Water Lane, Exeter

Air Quality Assessment

Project Ref: 332310057/8002 | Rev: Final| Date: September 2023

Registered Office: Buckingham Court Kingsmead Business Park, London Road, High Wycombe, Buckinghamshire, HP11 1JU
Office Address: 10 Queen Square, Bristol, BS1 4NT
T: +44 (0)117 332 7840 E: bristolqueensquare@stantec.com

Document Control Sheet

Project Name: Water Lane, Exeter

Project Ref: **332310057/8002**

Report Title: **Air Quality Assessment**

Doc Ref: **Final**

Date: **September 2023**

	Name	Position	Signature	Date
Prepared by:	Abbie O'Sullivan / Daniel Francis	Air Quality Consultant / Senior Air Quality Consultant	AO / DF	September 2023
Reviewed by:	Laura Smart	Principal Air Quality Consultant	LS	September 2023
Approved by:	Philip Branchflower	Technical Director – Air Quality	PB	September 2023
For and on behalf of Stantec UK Limited				

Revision	Date	Description	Prepared	Reviewed	Approved
Draft	Sept 2023	Draft for Client Comment	AO	LS	PB
Final	Sept 2023	Final document	AO	LS	PB

Contents

1 Introduction 1
1.1 Proposed Development 1
1.2 Scope of Assessment 1
1.3 Consultation 1
2 Legislation, Policy and Guidance 2
2.1 Air Quality Regulations 2
2.2 Air Quality Management 3
2.3 Planning Policy 4
2.4 Assessment Guidance 8
3 Methodology 10
3.1 Introduction 10
3.2 Baseline Air Quality 10
3.3 Construction Dust Impacts 10
3.4 Demolition and Construction Road Traffic Emission Impacts 11
3.5 Operational Road Traffic Emission Impacts 12
3.6 Site Suitability 13
3.7 Assumptions and Limitations 14
3.8 Air Quality Impacts Significance Criteria 14
4 Baseline Environment 17
4.1 Site Context 17
4.2 Study Area 17
4.3 Sensitive Receptor Locations 17
4.4 Ambient Air Quality 17
4.5 Predicted Background Concentrations 18
4.6 Predicted Baseline Concentrations 19
5 Predicted Impacts 21
5.1 Construction Dust Impacts 21
5.2 Site Suitability 22
5.3 Operational Phase Road Traffic Emission Impacts 24
5.4 Impact Significance 26
6 Mitigation 28
6.1 Site Suitability 28
6.2 Construction 28
7 Summary and Conclusions 31
References 32

Tables

Table 2-1 Relevant Air Quality Objectives / limit values 2
Table 2-2 Relevant Public Exposure 4
Table 3-1 Impact Significance Criteria 15
Table 4-1 Estimated Annual Mean Background Concentrations 19
Table 4-2 Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$ in 2019 and 2027 19
Table 5-1 Dust Emissions Magnitudes 21
Table 5-2 Risk of Construction Dust Impacts without Mitigation ..... **Error! Bookmark not defined.**
Table 5-3 Predicted Concentrations within the Site in 2027 23
Table 5-4 Predicted Concentrations of NO_2 (µg/m³), % Change and Impact at each Receptor 25
Table 5-5 Predicted Concentrations of PM_{10} (µg/m³), % Change and Impact at each Receptor 25
Table 5-6 Predicted Concentrations of $PM_{2.5}$ (µg/m³), % Change and Impact at each Receptor 26
Table B-1 Dust Emission Magnitude Classification 2
Table B-2 Receptor Sensitivity 3
Table B-3 Sensitivity of an Area to Dust Soiling Effects 4
Table B-4 Sensitivity of an Area to Human Health Impacts 4
Table B-5 Sensitivity of an Area to Ecological Impacts 5
Table B-6 Risk of Dust Impacts Calculation Matrix 5
Table D-1 Measured Annual Mean NO_2 Concentrations 2017 – 2021 7
Table D-2 Measured Exceedances of the Hourly Mean NO_2 Objective 2017 – 2021 8
Table D-3 Measured Annual Mean PM_{10} Concentrations 2017 – 2021 8
Table D-4 Measured Daily Mean PM_{10} Concentrations 2017 – 2021 8
Table D-5 Measured $PM_{2.5}$ Concentrations 2017 – 2021 8

Appendices

Appendix A Glossary
Appendix B IAQM Dust Guidance (2023) Approach
Appendix C EPUK IAQM Guidance (2017) Screening Criteria
Appendix D Monitoring Results
Appendix E Model Inputs and Results Processing
Appendix F Model Verification
Appendix G Figures

1 Introduction

1.1 Proposed Development

1.1.1 Cilldara Group (Exeter) (the 'Applicant') has commissioned Stantec to undertake an air quality assessment to support the outline planning application for the redevelopment of the land located at Water Lane, Exeter (the 'Site'). The Site is located within the administrative boundary of Exeter City Council (ECC).

1.1.2 The proposal is a residential-led mixed use development and the planning application is for outline planning permission for all elements with the exception of access that is applied for in full. The maximum proposed floorspace of the Proposed Development is 119,898 m^2 Gross External Area (GEA) and will include residential units, student accommodation, commercial and non-residential uses including a mobility hub, shared parking and energy centre (the 'Proposed Development').

1.2 Scope of Assessment

1.2.1 This report describes existing air quality within the study area and assesses the impact of the construction and operational phases of the Proposed Development on air quality in the study area.

1.2.2 The main air pollutants of concern during the construction phase are emissions of dust and fine particulate matter (PM_{10}) associated with on-site demolition and construction activities and off-site trackout. Additionally, there is the potential for emissions of nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) from construction related vehicles.

1.2.3 The main air pollutants of concern during the operational period are NO_2, PM_{10} and $PM_{2.5}$ emissions associated with proposed and existing road traffic and nearby industrial activities. Given the location of the Site and the limited study area applied, the potential for emissions from development related traffic to impact upon designated ecological sites has not been considered further.

1.2.4 At the time of writing, the energy strategy for the Proposed Development is not known, however, it intends to pursue a ‘Pathway to Net Zero Carbon’ (in operation) energy strategy and to target ‘Zero Fossil Fuel Emissions’ on-site. The Proposed Development is therefore unlikely to contain on-site combustion heating plant and as such, an assessment of the impact from related emissions has not been included in this air quality assessment at this stage.

1.2.5 The assessment has been prepared taking into account the requirements of relevant local and national guidance, policy and legislation.

1.3 Consultation

1.3.1 Consultation has been carried out between Stantec and ECC in the form of a telephone conversation and email correspondence with the Environmental Health Department in August 2023. The scope and methodology of the road’s modelling assessment was discussed and agreed with the Environmental Health Department at ECC. In addition, the Environmental Health Department highlighted that mitigation measures for the construction phase should include proposals for nuisance dust and PM monitoring at boundaries/ sensitive receptors.

2 Legislation, Policy and Guidance

2.1 Air Quality Regulations

2.1.1 The Air Quality (England) Regulations 2000 (AQR) defined National Air Quality Objectives (NAQOs, a combination of concentration-based thresholds, averaging periods and compliance dates) for a limited range of pollutants. Subsequent amendments were made to the AQR in 2001 and 2002 to incorporate 'limit values' and 'target values' for a wider range of pollutants as defined in European Union (EU) Directives.

2.1.2 These amendments were consolidated by the Air Quality Standards Regulations 2010 (AQSR) (with subsequent amendments most notably in 2016 and for the devolved administrations), which transposed the EU's Directive on ambient air quality and cleaner air for Europe (2008/50/EC).

2.1.3 Following the Transition Period after the UK's departure from the EU in January 2020, the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (and subsequent amendments for the devolved administrations) have amended the AQ Standards Regulations 2010 to reflect the fact that the UK has left the EU. The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 amended the $PM_{2.5}$ limit value in the AQSR to 20 $\mu g/m^3$.

2.1.4 The relevant NAQOs and limit values for this assessment are shown in **Table 2-1**.

Table 2-1 Relevant Air Quality Objectives / limit values

Pollutant	Time Period	Objectives	Source
NO_2	1-hour mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	NAQO and AQSR limit value
	Annual mean	40 $\mu g/m^3$	NAQO and AQSR limit value
PM_{10}	24-hour mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year	NAQO and AQSR limit value
	Annual mean	40 $\mu g/m^3$	NAQO and AQSR limit value
$PM_{2.5}$	Annual mean	20 $\mu g/m^3$	NAQO and AQSR limit value

2.1.5 The NAQOs for NO_2 and PM_{10} were to have been achieved by 2005 and 2004 respectively, but also continue to apply in all future years thereafter.

2.1.6 The 2019 Clean Air Strategy includes a commitment to set a "*new, ambitious, long-term target to reduce people's exposure to $PM_{2.5}$*" which the Environment Act 2021 commits the Secretary of State to setting. Two $PM_{2.5}$ targets were published via The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 and are set out below:

- an annual mean concentration target for $PM_{2.5}$ levels in England to be 10 $\mu g/m^3$ or below by 2040; and
- a population exposure reduction target for a reduction in $PM_{2.5}$ population exposure of 35% compared to 2019 to be achieved by 2040.

2.1.7 The Government has published an Environmental Improvement Plan 2023 (DEFRA, 2023) which sets out the following interim $PM_{2.5}$ targets to be met by the end of January 2028:

- the highest annual mean concentration in the most recent full calendar year must not exceed 12 µg/m^3 of $PM_{2.5}$; and
- compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.

2.1.8 The Plan also details how these targets will be met including reducing emissions at home, driving effective local action through local authorities, maintaining and improving the regulatory framework for industrial emissions, supporting farmers to reduce their impact on ammonia emissions and reducing emissions from cars and other forms of transport.

National Air Quality Plan for NO_2 in the UK

2.1.9 The national Air Quality Plan for NO_2 (DEFRA, 2018) sets out how the Government plans to deliver reductions in NO_2 throughout the UK, with a focus on reducing concentrations to below the EU limit values throughout the UK within the 'shortest possible time'.

2.1.10 The Plan requires all local authorities in England which DEFRA identified as having exceedances of the limit values in their areas past 2020 to develop local plans to improve air quality and identify measures to deliver reduced emissions, with the aim of meeting the limit values within their area within "*the shortest time possible*". Potential measures include changing road layouts, encouraging public and private ultra-low emission vehicle (ULEV) uptake, the use of retrofitting technologies and new fuels and encouraging public transport. In cases where these measures are not sufficient to bring about the required change within 'the shortest time possible' then local authorities may consider implementing access restrictions on more polluting vehicles (e.g. Clean Air Zones (CAZs)).

2.2 Air Quality Management

The Air Quality Strategy

2.2.1 Part IV of the Environment Act 1995 (Environment Act, 1995) required the Secretary of State to prepare and publish and 'strategy' regarding air quality.

2.2.2 The Air Quality Strategy (2023) establishes the policy framework for ambient air quality management and assessment in England. The Air Quality Strategy sets out six properties including boosting active travel and public transport. The Air Quality Strategy sets out the Government policy on achieving the NAQOs, including the new targets for $PM_{2.5}$.

2.2.3 The Clean Air Strategy (2019) aims to lower national emissions of pollutants, thereby reducing background pollution and minimising human exposure to harmful concentrations of pollution. The Strategy aims to create a stronger and more coherent framework for action to tackle air pollution (DEFRA, 2019).

Local Air Quality Management

2.2.4 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM) which requires local authorities to regularly and systematically review and assess air quality within their boundary and appraise development and transport plans against these assessments.

2.2.5 Where a NAQO is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the NAQO's within its AQMA.

2.2.6 The Local Air Quality Management Technical Guidance 2022 (LAQM.TG (22); DEFRA, 2022), issued by the Department for Environment, Food and Rural Affairs (DEFRA) for local authorities provides advice on where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year) as summarised in **Table 2-2**.

Table 2-2 Relevant Public Exposure

Averaging Period	NAQOs should apply at:	NAQOs don't apply at:
Annual mean	All locations where members of the public might be regularly exposed For example: Building façades of residential properties, schools, hospitals, care homes etc	Façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residences Kerbside sites Any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean NAQO would apply, together with hotels and gardens of residences	Kerbside sites Any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour mean NAQOs apply as well as: Kerbside sites Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside locations where the public would not be expected to have regular access
15-minute mean	All locations where members of the public might reasonably be regularly exposed for a period of 15 minutes or longer.	-

2.3 Planning Policy

National Planning Policy

2.3.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how they are expected to be applied (Ministry of Housing, Communities & Local Government (MHCLG), 2021). The following paragraphs are considered relevant from an air quality perspective.

2.3.2 Paragraph 104 on promoting sustainable transport states:

"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that: …

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; …"

2.3.3 Paragraph 105 goes on to state:

"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

2.3.4 Paragraph 174 on conserving and enhancing the natural environment states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by: …

e) 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 stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans, and…"

2.3.5 Paragraph 185 within ground conditions and pollution states:

"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."

2.3.6 Paragraph 186 states 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 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."

2.3.7 Paragraph 187 states that:

"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".

National Planning Practice Guidance

2.3.8 Paragraph 005, Reference 32-005-20191101 (revision date 01.11.2019), of the Planning Practice Guidance (PPG) (MHCLG, 2019) provides guidance on how considerations regarding air quality can be relevant to the development management process as follows:

"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity.

- *Where air quality is a relevant consideration the local planning authority may need to establish:*
- *The 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *Whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *Whether occupiers or users of the development could experience poor living conditions or health due to poor air quality."*

2.3.9 Paragraph 006, Reference 32-006-20191101 (revision date 01.11.2019), of the PPG identifies what specific air quality issues need to be considered in determining a planning application:

"Considerations that may be relevant to determining a planning application include whether the development would:

- *Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the proposed development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; and significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; biomass boilers or biomass-fuelled Combined Heat and Power plant; centralised boilers or plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area; or extraction systems (including chimneys) which require approval or permits under pollution control legislation;*
- *Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality;*
- *Give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations; and*
- *Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value."*

2.3.10 Paragraph 007, Reference 32-007-20191101 (revision date 01.11.2019), of the PPG provides guidance on how detailed an assessment needs to be:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

and

"The following could form part of assessments:

A description of baseline conditions and any air quality concerns affecting the area, and how these could change both with and without the proposed development;

- *Sensitive habitats (including designated sites of importance for biodiversity);*
- *The assessment methods to be adopted and any requirements for the verification of modelling air quality;*
- *The basis for assessing impacts and determining the significance of an impact;*
- *Where relevant, the cumulative or in-combination effects arising from several developments;*
- *Construction phase impacts;*
- *Acceptable mitigation measures to reduce or remove adverse effects; and*
- *Measures that could deliver improved air quality even when legally binding limits for concentrations of major air pollutants are not being breached."*

2.3.11 Paragraph 008, Reference 32-008-20140306 (revision date 01.11.2019), of the PPG provides guidance on how an impact on air quality can be mitigated:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met.

Examples of mitigation include:

- *Maintaining adequate separation distances between sources of air pollution and receptors;*
- *Using green infrastructure, trees, where this can create a barrier or maintain separation between sources of pollution and receptors;*
- *Appropriate means of filtration and ventilation;*
- *Including infrastructure to promote modes of transport with a low impact on air quality (such as electric vehicle charging points);*
- *Controlling dust and emissions from construction, operation and demolition; and*
- *Contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."*

Local Planning Policy

Exeter CC Core Strategy

2.3.12 The ECC Core Strategy was formally adopted in February 2012 and sets out the policies to guide future development in Exeter up until 2026 (ECC, 2012). The following policies relate to air quality:

2.3.13 Policy CP11:

"*Development should be located and designed so as to minimise and if necessary, mitigate against environmental impacts. Within the Air Quality Management Area…measures to reduce pollution and meet air quality objectives, that are proposed by the Local Transport Plan and Air Quality Action Plan, will be brought forward*."

2.3.14 ECC are currently progressing a New Exeter Local Plan which will replace the Core Strategy. The adoption of the emerging Local Plan is proposed for December 2025.

Local Plan First Review 1995 – 2011 Saved Policies

2.3.15 The following saved policy from the ECC Local Plan First Review 1995 – 2011 (ECC, 2005) is relevant to air quality:

EN3 – Air and Water Quality

"Development that would harm air or water quality will not be permitted unless mitigation measures are possible and are incorporated as part of the proposed".

Sustainable Transport Supplementary Planning Document (SPD)

2.3.16 ECC have adopted their Sustainable Transport SPD in March 2013 (ECC, 2013). The SPD provides guidance on how to provide sustainable travel outcomes for developments across Exeter.

Residential Design SPD

2.3.17 ECC SPD for Residential Design was adopted in September 2010 and provides information on standard designs for new residential developments (ECC, 2010). The document highlights that new development should submit information on constraints of existing pollution sources adjacent or adjoining the development including railway lines, commercial uses and busy roads.

Exeter Air Quality Action Plan 2019-2024

2.3.18 ECC declared an AQMA in 2010, covering major roads across the city, due to the exceedance of the annual mean NO_2 NAQO. In 2011, the AQMA Order was updated to include the one-hour mean NO_2 NAQO. The ECC Air Quality Action Plan (AQAP) 2019-2024 is implemented by the Council and includes measures aimed at improving air quality within the AQMA and wider area (ECC, 2019). The measures contained within the document are centred around the following themes:

- tackling congestion and accessibility;
- promoting active and healthy lifestyles; and
- building great neighbourhoods.

2.4 Assessment Guidance

2.4.1 The primary guidance documents used in undertaking this assessment are detailed in the section below.

DEFRA 'Local Air Quality Management Technical Guidance (LAQM.TG(22))'

2.4.2 DEFRA LAQM.TG (22) was published for use by local authorities in their LAQM review and assessment work (DEFRA, 2022). The document provides key guidance on aspects of air quality assessment, including screening, use of monitoring data, and use of background data that are applicable to all air quality assessments.

EPUK / IAQM 'Land-Use Planning & Development Control: Planning for Air Quality'

2.4.3 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have together published guidance to help ensure that air quality is properly accounted for in the development control process (EPUK / IAQM 2017). It clarifies when an air quality assessment should be undertaken, what it should contain, and how impacts should be described and assessed including guidelines for assessing the significance of impacts.

IAQM 'Guidance on the Assessment of Dust from Demolition and Construction'

2.4.4 Guidance on the assessment of dust from demolition and construction has been published by the IAQM (IAQM, 2023). The guidance provides a series of matrices to determine the risk magnitude of potential dust sources associated with construction activities in order to identify appropriate mitigation measures that are defined within further IAQM guidance.

3 Methodology

3.1 Introduction

3.1.1 The assessment methodology detailed in the following sections has been applied to ascertain the potential impacts of emissions to air in order to identify their significance and compliance with policy and regulatory requirements (outlined in **Section 2** of this report), and whether or not additional mitigation is required.

3.1.2 This assessment first defines the 'study area' and outlines the baseline air quality (for both 'existing'[1] and relevant future years i.e. development construction, first occupation or completion) within this study area. The suitability of the Site for the proposed end use is then assessed followed by the impact of construction and operational activities on existing sensitive receptors located within the study area.

3.2 Baseline Air Quality

3.2.1 Any exceedances of the limit values along roads within the study area have been identified using the 2020 NO_2 and PM Projections Data published by DEFRA (DEFRA, 2020a). Information on baseline air quality in the study area has been obtained by collating the results of monitoring carried out by ECC and their LAQM reports to identify potential AQMAs. A review of the planning portal has also been undertaken to identify any nearby existing air quality sources. Background concentrations for the study area have been defined using the national pollution maps published by DEFRA which cover the whole country on a 1x1 km grid (DEFRA, 2020b).

3.3 Construction Dust Impacts

3.3.1 During demolition and construction, dust from on-site activities and off-site trackout by construction vehicles has the potential to impact on sensitive human receptors within the study area. The main potential impacts are loss of amenity (as a result of dust soiling) and deterioration of human health (as a result of concentrations of PM_{10}).

3.3.2 The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source(s).

3.3.3 Separation distance is also an important factor. Large dust particles (greater than 30µm) can be potentially responsible for most dust annoyance, and will largely deposit within 100 m of sources. Intermediate particles (10-30 µm) can travel 200-500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10 µm), which are the predominant fraction that can be potentially responsible for human health impacts largely remain airborne. However, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance due to the rapid decrease in concentrations with distance from the source due to dispersion.

3.3.4 The assessment of the risk of potential construction dust impacts has been undertaken with reference to relevant guidance (IAQM, 2023).

[1] 2019 has been used as the 'existing' year as this is the latest year for which representative local monitoring data is available.

Screening Assessment

3.3.5 The first stage of the assessment involves screening to determine if there are sensitive receptors within threshold distances of the activities associated with the construction phase of the scheme; defined as the study area. No further assessment is required if there are no receptors within the study area.

3.3.6 The IAQM guidance outlines that an assessment is only required in cases where:

- A 'human receptor' is located within:
  - 250 m of the boundary of the Site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance(s).
- An 'ecological receptor' is located within:
  - 50 m of the boundary of the Site; or
  - 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance(s).

Further Assessment

3.3.7 The risk of impacts associated with dust soiling and PM_{10} caused by the Proposed Development has been determined (following the IAQM guidance (IAQM, 2023)) based on the dust emission class (or magnitude) for each activity arising from four activities in the absence of mitigation (demolition, earthworks, construction and trackout), the sensitivity of nearby receptors and the overall sensitivity of the area. The dust emission class, receptor sensitivity and the overall sensitivity of the area are determined using the criteria outlined in **Table B-1**, **Table B-2**, **Table B-3**, **Table B-4** and **Table B-5** of **Appendix B** (based on the IAQM guidance), indicative thresholds and professional judgement. The risk of dust impacts arising is a product of the relationship between the dust emission magnitude and the area sensitivity and is based on the criteria outlined in **Table B-6** (based on the IAQM guidance). The risk of impact is then used to determine the mitigation requirements.

3.3.8 The IAQM guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

3.3.9 With appropriate mitigation in place, the IAQM guidance indicates that the residual effect dust emissions associated with the demolition and construction can be classified as being 'not significant'.

3.4 Demolition and Construction Road Traffic Emission Impacts

3.4.1 The potential for a significant overall effect on existing sensitive receptors within the study area as a result of emissions from demolition and construction traffic generated by the Proposed Development has been determined qualitatively, taking into consideration the screening criteria outlined in the EPUK / IAQM guidance (EPUK / IAQM, 2017) (see **Appendix C**), the anticipated routing of the generated traffic and the anticipated duration of impacts associated with the generated traffic.

3.5 Operational Road Traffic Emission Impacts

Screening Assessment

Existing Sensitive Human Receptors

3.5.1 The potential for significant impacts on existing sensitive receptors within the study area as a result of emissions from traffic generated by the Proposed Development is determined based on the screening criteria outlined in the EPUK / IAQM guidance (see **Appendix C**) which includes consideration of the volume and composition of traffic generated by the Proposed Development and existing local air quality conditions (i.e. the presence of any declared AQMAs).

3.5.2 Where it is not possible to screen out the potential for significant effects, a detailed assessment is undertaken, which is the case for this air quality assessment report (see following section).

Detailed Assessment

Human Receptors

3.5.3 Concentrations of pollutants (NO_2, PM_{10} and $PM_{2.5}$) will be predicted for a range of worst-case locations of relevant human receptor exposure both at sensitive existing properties and within the Proposed Development itself to allow comparison with the NAQOs and (for existing receptors only) determination of the significance of impacts at each receptor.

3.5.4 Emissions from road vehicles and their resultant impact at receptor locations will be predicted using the ADMS-Roads dispersion model (v5.0.1.3). The model requires the user to provide various input data, including traffic flows (in AADT format), vehicle composition (i.e. the proportion of Heavy Duty Vehicles (HDVs)), road characteristics (including road width, gradient and street canyon dimensions, where applicable), and average vehicle speed. AADT flows and the proportions of HDVs, for roads within the study area will be provided by the Project's transport consultants, Stantec.

3.5.5 The following traffic scenarios have been modelled:

- 2019 'existing' baseline (for verification);
- 'Do Minimum' (DM) without the Proposed Development; and
- 'Do Something' (DS 1) with the full build-out traffic from the Proposed Development.

3.5.6 It should be noted that, both DM and DS 1 traffic scenarios include traffic growth up to the year 2033, as well as the traffic associated with committed developments on the study area. As the future traffic scenarios include committed development flows, the impacts of the committed developments are inherently assessed within this air quality assessment.

3.5.7 Moreover, DS 1 Scenario assumes that the section of Water Lane to the south of its junction with Tan Lane remains open to all traffic. This scenario is considered 'worst-case' as it represents the highest proportion of impact on the Proposed Development.

3.5.8 The model also requires meteorological data and will be run using 2019 meteorological data from the Exeter Airport meteorological station, which is considered the most suitable for this area due to the proximity of the meteorological station to the Proposed Development (approximately 8.4 km to the northeast).

3.5.9 Traffic emissions will be calculated using the Emission Factor Toolkit (EFT) v11 (DEFRA, 2021), which utilises NOx emission factors taken from the European Environment Agency (EEA) COPERT 5.3 emission tool. The traffic data will be entered into the EFT to provide emission

rates for each of the road links in the model. Road vehicular emissions are primarily associated with the exhaust emissions but also include particles generated from abrasion (of tyres, brakes and road). The EFT allows users to calculate road vehicle pollutant emission rates for NOx, PM_{10} and $PM_{2.5}$ (exhaust and brake, tyre and road wear) for a specified year, road type, vehicle speed and vehicle fleet composition.

3.5.10 The EFT provides pollutant emission rates for 2018 through to 2050 for England (not London), and 2018 to 2030 for Wales, Scotland, Northern Ireland and London and takes into consideration bespoke vehicle fleet information as well as the following information available from the National Atmospheric Emissions Inventory (NAEI):

- fleet composition data for motorways, urban and rural roads in the UK (excluding London);
- fleet composition based on European emission standards from pre-Euro I to Euro6/VI (including Euro 6 subcategories);
- scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting; and
- technology conversions in the national fleet.

3.5.11 As a result of this the road vehicle exhaust emissions of NOx are projected to decrease year-on-year due to technological advances and improvements to the fleet mix i.e. penetration of Euro VI HDVs, which recent research suggests are performing well. Whilst there has been uncertainty over NOx emissions from vehicle exhausts (particularly from Euro 5 and 6 LDVs it is important to note the EFT is not based on the Euro emission standards.

3.5.12 Generally, concentrations of air pollutants in the UK are anticipated to decrease in the coming years; as such, in most cases, the earlier the year that is assessed, the more worst-case the assessment is. The earliest year that the Proposed Development could potentially be occupied by is 2027. Therefore, the assessment has been carried out utilising 2027 emission factors and background concentrations combined with traffic data from 2033 (which includes full development flows).

3.6 Site Suitability

Road Traffic Emissions Sources

3.6.1 An initial qualitative assessment will be undertaken to determine whether there is a potential for exceedances of the relevant NAQOs at proposed sensitive locations within the Proposed Development, taking into account future baseline air quality conditions within and in close proximity to the Site, and the proximity of proposed sensitive locations within the Proposed Development to nearby sources of road traffic emissions. Where it is not possible to screen out the potential for significant impacts relating to road traffic emissions, a detailed assessment is undertaken, which is the case for this air quality assessment report.

Railway Emission Sources

3.6.2 A qualitative assessment (in accordance with LAQM.TG (22) (DEFRA, 2022)) will be undertaken to determine whether the existing railway is likely to cause exceedances of the relevant NAQOs at proposed sensitive locations within the Proposed Development. If the emission from the railway is likely to cause significant impacts and therefore can not be screened out, a detailed assessment will be undertaken.

Existing Industrial Emission Sources

3.6.3 There are a number of industrial facilities (including combustion-based power, waste processing and concrete manufacturing activities) within close proximity to the Proposed Development's southern boundary, which have the potential to impact air quality within the Site. Therefore, a desktop review of publicly available information relating to these activities has been undertaken to identify their likely air quality impact on future sensitive receptors within the Proposed Development.

3.7 Assumptions and Limitations

3.7.1 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

3.7.2 It has been assumed that traffic data provided for local roads in 2019 and the future years are appropriate, and the future trip generation and distribution is representative of the Proposed Development in operation. Moreover, the air quality study area has been limited to the study area used in the transport assessment. However, it is considered that the worst-case impacts have been assessed within the air quality assessment through selection of appropriate receptors. For more information on the traffic data assumptions please refer to the Transport Assessment and for the traffic data limitations please refer to Chapter 12 of the ES (Transportation and Access).

3.7.3 There has been an acknowledged disparity between national road transport emissions projections and measured annual mean concentrations of NOx and NO_2 for many years. Recent monitoring has shown that reductions in concentrations are now being measured in many parts of the country (Air Quality Consultants Ltd., 2022), however, there is still some uncertainty regarding the rate at which emissions will reduce in the future and therefore some consideration must be given to the accuracy of any projection and to appropriately respond to this.

3.7.4 The complete development modelling has been based on 2027 emission factors and background concentrations, whilst utilising traffic flows for 2033. The model has been verified against 2019 monitoring data. This is considered to provide an appropriate assessment taking into account the uncertainties regarding future vehicle emission factors.

3.7.5 The default fleet projections in the DEFRA's EFT v11.0 and 2018-based background maps are based on fleet growth assumptions which were current before the Covid-19 outbreak in the UK. As a result, default outputs from these tools do not reflect short or longer-term impacts on emissions in 2020 and potentially beyond resulting from behavioural change during lockdowns.

3.7.6 It has been assumed that meteorological conditions recorded at Exeter Airport in 2019 are representative of those at the Proposed Development in 2027, the anticipated first year of phased occupation.

3.8 Air Quality Impacts Significance Criteria

Existing Human Receptors

3.8.1 The relevant NAQOs are set out in **Table 2-1**. The predicted pollutant concentrations in the future year (2027) at each identified sensitive receptor have been compared to the relevant NAQOs and any exceedances identified.

3.8.2 Analysis of long-term monitoring data suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the 1-hour mean NO_2 NAQO is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment this concentration has been used to screen whether the one-hour mean objective is likely to be achieved (DEFRA,

2022). Analysis of long-term monitoring data also suggests that if the annual mean PM_{10} concentration is less than 32 µg/m^3 then the 24-hour mean PM_{10} NAQO is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment this concentration has been used to screen whether the 24-hour mean NAQO is likely to be achieved.

3.8.3 There is no official guidance in the UK on how to assess the significance of the air quality impacts of a new development on existing receptors. The approach developed by EPUK and the IAQM (EPUK / IAQM, 2017), which considers the change in air quality as a result of a Proposed Development on existing receptors in combination with baseline concentrations at the receptors, has therefore been used. The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective and is shown in **Table 3-1**.

Table 3-1 Impact Significance Criteria

Long term average concentration at receptor in assessment year	% Changes in concentration with development in relation to NAQO / limit value			
	1	2-5	6-10	>10
> 110 % [a]	Moderate	Substantial	Substantial	Substantial
>102% - ≤110% [b]	Moderate	Moderate	Substantial	Substantial
>95% - ≤102% [c]	Slight	Moderate	Moderate	Substantial
>75% - ≤95% [d]	Negligible	Slight	Moderate	Moderate
≤75% [e]	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse, and where it decreases as beneficial.
% change rounded to nearest whole number. Where the % change is 0 (i.e. less than 0.5%) the impact will be Negligible.
[a] NO_2 or PM_{10}: > 44 µg/m^3 annual mean; $PM_{2.5}$ >22 µg/m^3 annual mean; PM_{10} >35.2 µg/m^3 annual mean (days).
[b] NO_2 or PM_{10}: > 40.8 – ≤ 44 µg/m^3 annual mean; $PM_{2.5}$ > 20.4 – ≤22 µg/m^3 annual mean; PM_{10} >32.64 – ≤35.2 µg/m^3 annual mean (days).
[c] NO_2 or PM_{10}: > 38 – ≤40.8 µg/m^3 annual mean; $PM_{2.5}$ >19 – ≤20.4µg/m^3 of annual mean; PM_{10} >30.4 – ≤32.64 µg/m^3 annual mean (days).
[d] NO_2 or PM_{10}: >30 - ≤38 µg/m^3 annual mean; $PM_{2.5}$ >15 - ≤19 µg/m^3 annual mean; or <24 - ≤ 30.4 µg/m^3 annual mean (days).
[e] NO_2 or PM_{10}: ≤30 µg/m^3 annual mean; $PM_{2.5}$ ≤15 µg/m^3 annual mean; PM_{10} ≤24 µg/m^3 annual mean (days).

3.8.4 The guidance states that the overall assessment of significance should be based on professional judgement, taking into account factors including:

- the number of properties affected by ‘slight’, ‘moderate’ or ‘substantial’ adverse air quality impacts and a judgement on the overall balance;
- the magnitude of the changes and the descriptions of the impacts at the receptors;
- whether or not an exceedance of an NAQO or limit value is predicted to arise in the operational study area (where there are significant changes in traffic) where none existed before, or an exceedance area is substantially increased;
- the uncertainty, comprising the extent to which worst-case assumptions have been made; and
- the extent to which an NAQO or limit value is exceeded.

3.8.5 Therefore, where impacts at an individual receptor are classified as ‘negligible’ or ‘slight’, effects would typically be considered ‘not significant’. However, where ‘moderate’ or ‘substantial’ adverse impacts are identified at individual receptors, the overall effect needs to be considered

in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is 'significant' or not.

Site Suitability

3.8.6 There is no official guidance in the UK on how to assess the significance of the air quality impacts of existing air quality on a new development. The assessment of proposed receptors within the Site has therefore been limited to predicting pollutant concentrations at worst-case receptors within the Site and comparing these predicted concentrations to the relevant NAQOs, with the overall significance being based on whether the NAQOs for each pollutant are exceeded or not.

4 Baseline Environment

4.1 Site Context

The Site is bound to the north, east and south by a mixture of residential and industrial units. To the southeast, the Site is bound by the Exeter Ship Canal, and allotments and parkland are beyond the canal. To the west, the Site is bound by a railway line and beyond this lies industrial units including a number of industrial (including combustion-based power, waste processing and concrete manufacturing) facilities.

4.2 Study Area

4.2.1 For the construction dust risk assessment, the study area (based on IAQM, 2023 guidance) is defined as compromising the area up to 250 m from the site boundary and 50 m from the route used by construction vehicles (up to 250 m from the site entrance(s)), **Figure 03, Appendix G**.

4.2.2 For the operational phase road traffic emissions assessment, the study area has been limited to the study area used in the Transport Assessment which does not extend towards Exeter City Centre beyond the A377 and Haven Road junction. However, it is considered that the worst-case impacts have been assessed within the air quality assessment through selection of appropriate receptors along the A377 south of the Haven Road junction which are in close proximity to the road. Whilst greater development flows pass along the A377 to the north towards the city centre, these flows will be diluted through several junctions before passing in proximity to receptors. For more information on the traffic data assumptions please refer to the Transport Assessment and for the traffic data limitations please refer to Chapter 12 of the ES (Transportation and Access).

4.3 Sensitive Receptor Locations

4.3.1 Relevant sensitive human receptor locations are places where members of the public might be expected to be regularly present over the averaging period of the NAQOs. The NO_2, PM_{10} and $PM_{2.5}$ annual mean NAQO, and 1-hour mean NO_2 NAQO sensitive locations include existing and proposed residences. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, traffic lights and roundabouts where traffic may become congested, where there is a combined effect of several road links and routes along which substantial volumes of traffic generated by the Proposed Development will travel.

4.3.2 Based on these criteria, twenty existing residential properties within the study area and three locations representing proposed residential areas within the Proposed Development itself have been identified as worst-case receptors for the assessment. The locations of these receptors have been chosen to represent locations where impacts from road traffic generated by the Proposed Development are likely to be the greatest i.e. as a result of development traffic at junctions. The receptor locations are described in **Table E.2, Appendix E** and shown in **Figure 01, Appendix G.**

4.3.3 Concentrations have also been predicted at three of ECC's diffusion tube monitoring sites in order to verify the modelled results. **Appendix F** provides further details on the verification method.

4.4 Ambient Air Quality

Limit Values

4.4.1 The study area does not contain any predicted or measured exceedances of the limit values either in the existing year (2019) or in the future year (2027). The study area is not within a zone

where DEFRA have reported an exceedance of a limit value either in the 'existing' baseline year or in future years.

LAQM

4.4.2 ECC has investigated air quality within its administrative boundary as part of its responsibilities under the Local Air Quality Management (LAQM) regime. An Air Quality Management Area (AQMA) has been declared due to exceedances of the annual mean NO_2 NAQO. The Site is located approximately 325 m southeast of Exeter's AQMA, which covers a network of major roads in Exeter.

Local Monitoring Data

NO_2

4.4.3 ECC undertakes automatic monitoring of NO_2 concentrations at one monitoring station within the city, CM1 - Exeter Roadside, located approximately 1.2 km south of the Site. The Council also deploys NO_2 diffusion tubes at several locations, including twenty-seven locations within 1 km of the Site.

4.4.4 2019-2021 monitoring results for the most representative and closest monitoring locations to the Site are shown in **Table D-1** and **Table D-2**, **Appendix D** and their locations are shown in **Figure 02**, **Appendix G.** Whilst 2020 and 2021 monitoring results have been included in **Table D-1**, it should be noted that these are not considered to be representative of longer-term trends due to the impact of COVID-19 restrictions on travel patterns.

4.4.5 There have been no exceedances of the annual NO_2 NAQO at any of these monitoring sites since 2017, except for DT19 (located approximately 350 m northwest of the Site) and DT29 (located approximately 670 m north of the Site), which reported exceedances in 2017 – 2019 for DT19 and 2018 for DT29. Furthermore, measured concentrations at all diffusion tube monitoring sites are below 60 µg/m^3, indicating that it is unlikely that any exceedances of the 1-hour mean NAQO have occurred. There is no clear trend in concentrations over time.

PM_{10}

4.4.6 The results of the PM_{10} monitoring at the CM1 (Exeter Roadside) and CM2 (Alphington Street) automatic monitors are shown in **Table D-3** and **Table D-4**, **Appendix D**.

4.4.7 Measured PM_{10} concentrations have been below the relevant NAQOs for the duration of the monitoring period presented.

$PM_{2.5}$

4.4.8 The results of the $PM_{2.5}$ monitoring at the CM1 (Exeter Roadside) and CM2 (Alphington Street) automatic monitors are shown in **Table D-5, Appendix D**.

4.4.9 Measured $PM_{2.5}$ concentrations have been below the NAQO for the duration of the monitoring period presented.

4.5 Predicted Background Concentrations

4.5.1 Estimated background concentrations for the Site have been obtained from the latest 2018-based national maps provided by DEFRA (DEFRA, 2020b). The DEFRA background concentrations for the study area/identified receptors area are provided in **Table 4-1**.

4.5.2 The background concentrations are all well below the relevant NAQOs both in the 'existing' and future years.

Table 4-1 Estimated Annual Mean Background Concentrations

Year	Location	Annual Mean (µg/m^3)			Representative Human Receptors and Monitoring Locations
		NO_2	PM_{10}	$PM_{2.5}$	
2019	292_091	11.6	10.9	7.1	Receptors R01 – R16, R18 – R20, Proposed Receptors PR01 – PR03, Monitoring Locations DT22, DT19, DT20 and CM2
	291_091	11.1	12.0	8.2	Within the Development
	292_090	11.9	10.0	6.4	Receptor R17
2027	292_091	9.2	10.2	6.6	Receptors R01 – R16, R18 – R20, Proposed Receptors PR01 – PR03, Monitoring Locations DT22, DT19, DT20 and CM2
	291_091	8.6	11.3	7.7	Within the Development
	292_090	9.8	9.4	5.9	Receptor R17
NAQOs / limit value		**40**	**40**	**20**	**-**

Note: Projections in the 2018 reference year background maps and associated tools are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these tools do not reflect short- or longer-term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

4.6 Predicted Baseline Concentrations

Human Receptors

4.6.1 The ADMS-Roads model has been used to predict baseline NO_2, PM_{10} and $PM_{2.5}$ concentrations (excluding contributions from industrial sources) at each of the existing receptor locations identified in **Table E.2, Appendix E**. The results for the baseline scenarios are presented in **Table 4-2**.

Table 4-2 Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$ in 2019 and 2027

Receptor	Annual Mean (µg/m^3)					
	NO_2		PM_{10}		$PM_{2.5}$	
	2019	2027	2019	2027	2019	2027
R01	32.9	20.4	14.7	14.4	9.8	9.4
R02	38.1	23.3	15.5	15.3	10.2	9.9
R03	30.1	18.7	14.4	14.1	9.6	9.2
R04	29.1	18.2	14.3	13.9	9.5	9.1
R05	26.2	16.5	13.7	13.1	9.2	8.7
R06	29.4	18.3	14.5	14.2	9.7	9.3
R07	30.2	18.7	14.7	14.3	9.7	9.3
R08	35.7	21.7	15.3	15.0	10.1	9.7
R09	29.5	18.2	14.5	14.1	9.6	9.2
R10	30.7	18.9	14.7	14.4	9.8	9.4
R11	21.3	16.4	13.2	13.3	8.9	8.8
R12	19.9	15.5	13.0	13.1	8.8	8.7
R13	20.6	16.2	13.1	13.2	8.8	8.8
R14	20.2	15.9	13.1	13.2	8.8	8.7
R15	20.2	15.9	13.1	13.2	8.8	8.7
R16	21.5	17.0	13.1	13.2	8.8	8.7
R17	13.4	13.1	11.1	11.4	7.2	7.3
R18	24.6	18.0	13.4	13.4	9.0	8.9
R19	34.9	21.2	15.4	15.1	10.1	9.8

Receptor	Annual Mean (µg/m^3)					
	NO_2		PM_{10}		$PM_{2.5}$	
	2019	**2027**	**2019**	**2027**	**2019**	**2027**
R20	15.2	11.6	12.4	12.0	8.4	8.1
NAQOs	**40**		**40**		**20**	

Exceedances of the NAQOs are highlighted in bold.

4.6.2 The annual mean NO_2, PM_{10} and $PM_{2.5}$ NAQOs are not predicted to be exceeded at any of the existing receptor locations in 2019 and 2027. Furthermore, predicted concentrations of NO_2 are lower than 60 µg/m^3 during 2019 and 2027, indicating that exceedances of the 1-hour mean NAQO are unlikely, and predicted concentrations of PM_{10} are lower than 32 µg/m$_3$ during 2019 and 2027, indicating that exceedances of the 24-hour mean NAQO are also unlikely.

4.6.3 Overall, baseline concentrations of all of the pollutants considered are predicted to decrease between 2019 and 2027 as vehicle emission factors and background concentrations are assumed to improve, despite the traffic increase in the network.

5 Predicted Impacts

5.1 Construction Dust Impacts

Screening Assessment

5.1.1 There are a number of existing sensitive human receptors located within 250 m of the Site boundary and within 50 m of the routes that will be used by demolition and construction vehicles. As such, further assessment of the risk of dust soiling and PM_{10} emissions is required.

5.1.2 There are no sensitive ecological receptors located within 50 m of the Site boundary or within 50 m of the routes used by demolition and construction vehicles on the public highway. The closest designated ecological site to the Site is located >1 km from the Site boundary. As such, the potential for ecological impacts as a result of dust soiling can be screened out as being 'not significant'.

Further Assessment

Dust Emission Magnitude

5.1.3 The dust emissions magnitude of demolition, earthworks and construction activities and as a result of trackout have been determined in **Table 5-1** below based the criteria shown in **Table B-1, Appendix B**.

Table 5-1 Dust Emissions Magnitudes

Activity	Magnitude	Justification
Demolition	Large	Demolition activities include demolition of all existing buildings. Activities are not expected to occur more than 12 m above ground; however, the demolition of the existing boat building warehouse and vacant buildings on-site has the potential to exceed 75,000 m^3 of material and may utilise on-site crushing. Therefore, the dust emission magnitude of demolition activities is judged to be 'large' as a precautionary measure.
Earthworks	Large	Proposed earthworks activities comprise clearance of vegetation, soil preparation and landscaping across an area greater than 18,000 m^2. The Site also involves alteration of ground levels. The soil at the Site is largely classified as clay to sandy loam (British Geological Survey, 2023) which are considered to be moderately dusty, particularly during periods of dry weather. Based on this, the dust emission magnitude of earthworks activities is judged to be 'large'.
Construction	Large	The total building volume to be constructed is expected to be greater than 75,000 m^3 with over 1,500 dwellings. Construction materials will comprise a mixture of masonry material including those with a high potential for dust release, such as concrete, as well as those with a lower dust potential such as metals and timber. Based on this, the dust emission magnitude of construction activities is judged to be 'large'.
Trackout	Large	The number of HDVs that will exit the Site will vary depending upon the processes occurring at any one time. There are unlikely to be more than 50 outward HDV movements in any one day. Due to the nature of the Site, there could be an unpaved road length greater than 100 m in length comprising moderately dusty surface material. Based on this, the dust emission magnitude of trackout is judged to be 'large'.

Area Sensitivity

5.1.4 The area sensitivity to dust soiling and human health impacts has been determined based on the criteria shown in **Table B-3, Table B-4, Table B-5, Appendix B.** The IAQM demolition and construction band criteria used to determine the sensitivity of the local area is shown in **Figure 03, Appendix G**.

5.1.5 Residential properties are classed as being 'high sensitivity' receptors to dust soiling, based on the IAQM guidance (IAQM, 2023) (see **Table B-3 , Appendix B**). There are more than 20 residential properties located within 20 m of the Site boundary (at the north-west junction and north of Water Lane) and there is potential for future residential properties on-site in earlier phases to be occupied during later stages of construction. As such, the sensitivity of the area surrounding the Site to dust soiling is judged to be 'high'.

5.1.6 The IAQM guidance states that trackout may occur for distance of up to 500 m from 'large' sites. As the demolition and construction traffic routing is currently unknown, the worst-case assumption has been made that all main roads may potentially be used by HDVs leaving the Site entrances. There are more than 20 residential properties located within 20 m of roads extending up to 500 m of the Site. As such, the sensitivity to dust soiling of the area surrounding roads along which material may be tracked is judged to be 'high'.

5.1.7 The IAQM also defines residential properties as being 'high sensitivity' receptors to human health impacts (see **Table B-4, Appendix B**). Annual mean PM_{10} concentrations at existing residential properties within the study area are anticipated to be similar range to those predicted at existing receptor locations in 2019 (i.e. 11.1 - 15.5 µg/m^3). Based on the predicted existing PM_{10} concentrations and the number of sensitive receptors within 20 m of the Site boundary and roads along which material may be tracked, the sensitivity to human health impacts of the areas surrounding the Site and the area surrounding roads along which material may be tracked are judged to be 'low'.

Risk of Impacts

5.1.8 The risk of construction dust impacts, without mitigation, have been defined based on the criteria shown in **Table B-6, Appendix B** and are presented in **Table 5-2**.

Table 5-2 Risk of Construction Dust Impacts without Mitigation

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

5.2 Site Suitability

Road Traffic Emission Sources

5.2.1 A detailed assessment of site suitability in relation to road traffic emissions has been undertaken. Predicted concentrations at modelled proposed receptor locations are presented in **Table 5-3**. Details of the proposed receptors are provided in **Table E.2, Appendix E** and shown in **Figure 01, Appendix G.**

Table 5-1 Predicted Concentrations (excluding contribution from industrial sources) within the Site

Receptor	Annual Mean (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
PR01	11.9	12.1	8.1
PR02	10.1	11.7	7.9
PR03	12.6	12.2	8.2
NAQOs	**40**	**40**	**20**

5.2.2 The predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations associated with road traffic emissions are well below the relevant NAQOs at all proposed sensitive receptor locations.

Railway Emission Sources

5.2.3 Railway lines can be a source of stationary emissions of NO_2 and sulphur dioxide (SO_2) from idling locomotives in stations and depots, as well as mobile emissions on busy lines with a significant number of diesel or coal-fired trains. The Proposed Development is not near any stations or depots; however, the Site is bound to the west by the Riviera Line. This railway line does not have a significant number of diesel or coal-fired trains, according to DEFRA (2022). As such, in accordance with LAQM.TG (22) (DEFRA, 2022), the potential impact of railway emissions on proposed sensitive receptors is considered to be 'not significant' and has not been considered further in this assessment.

Existing Industrial Emission Sources

5.2.4 A ready-mix concrete manufacturing process plant is located approximately 110 m southwest of the Proposed Development (Glendinning Concrete Batching Plant). The concrete manufacturing process was granted planning permission in 2004 (reference 02/0689 and 04/1960). This site holds an Environmental Permit (reference 3.1/EP065/Var2) which ECC regulates (ECC, 2009). The Environmental Permit includes dust control measures to mitigate against dust generation and release. As a result of the activities at the Glendinning site and the implementation of dust control measures, the potential risk of impact due to dust and PM_{10} emissions on proposed sensitive receptors is considered to be 'not significant'.

5.2.5 An energy from waste (EfW) facility is located approximately 355 m south of the Proposed Development. As part of the planning application for the EfW facility, an air quality assessment was undertaken to assess the air quality impacts associated with the emissions from the facility and cumulative impacts from existing sources (RPS Consultancy, 2007). The assessment predicted concentrations of NOx, particulates, sulphur dioxide, carbon monoxide, hydrogen chloride, hydrogen fluoride, metals including cadmium, thallium, mercury, antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium, total organic carbon, polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, carbon dioxide. The closest modelled receptor is located approximately 320 m south of the Proposed Development. The Predicted Environmental Concentrations (PECs) from the EfW facility for all pollutants are below the relevant Environmental Assessment Levels (EALs) and the actual emissions associated with the EfW facility are expected to be below the Waste Incineration Directive emission limits. In addition, the EfW facility has a number of control measures to minimise emissions of air, including abatement techniques, monitoring and appropriate stack height (65 m). Therefore, the risk of potential impact of EfW facility emissions on proposed sensitive receptors is considered to be 'not significant'.

5.2.6 An existing gas turbine power station (Whitetower Energy Plant) is located approximately 45 m southwest of the Proposed Development. The power station was granted planning permission in 1997 (reference 97/0459 and 96/0060) and holds an Environmental Permit (reference EPR/PP3536TV) regulated by the Environment Agency and includes controls for the site for

emissions to air and odour. As part of their permit application, the power station completed dispersion modelling using AERMOD to predict annual and hourly NO_2 concentrations (PB Power, 2006). The maximum predicted annual mean NO_2 process contribution from the plant at ground level was 3.3 µg/m^3. Furthermore, the maximum predicted NO_2 hourly mean concentration from the plant at ground level was 56.62 µg/m^3. However, it is unclear what receptors were modelled as part of the air quality assessment. Therefore, the potential risk of impacts of emissions from the Whitetower Energy Plant on the Proposed Development cannot be quantified from the report and therefore it is recommended a planning condition is used to control delivery of development phases, linked to point source dispersion modelling and the delivery of any necessary related mitigation.

5.2.7 An existing gas fuelled plant (Conrad Energy Plant) is located approximately 20 m south of the Proposed Development. Planning permission was granted for the plant in 2014 (reference 14/1822) and included a condition for an air quality assessment to be submitted. As part of the subsequent planning application 15/0761, an air quality assessment was undertaken to assess the impacts of NOx, NO_2 and carbon monoxide (CO) concentrations on air quality from the plant using dispersion modelling (ADMS 5). However, the report does not consider the Proposed Development as a receptor and thus we are unable to quantify the potential risk of impacts from Conrad Energy Plant on the Proposed Development at this time. It is therefore recommended that a planning condition is used to control delivery of development phases, linked to any necessary point source dispersion modelling and the delivery of any related mitigation.

Odour

5.2.8 There is a Sewage Pumping Station located approximately 60 m to the west of the Proposed Development which is operated by South West Water. As highlighted by the Sewage Sector Guidance Appendix C (Water UK, 2021), the minimum distance of a pumping station to any habitable buildings should be at least 15 m to minimise the risk of odour and nuisance. As the pumping station is located approximately 60 m from the site boundary, the impact of odour from the pumping station on the proposed residential receptors is considered to be 'not significant' and has not been considered further in this assessment.

5.2.9 An existing Wastewater Treatment Works is located 3 km south of the Proposed Development (South West Water's Countess Wear Water Treatment Works). Water Treatment Works can be a source of offensive odour emissions. However, given the distance between the Water Treatment Works and the Proposed Development, the potential impact of odour emissions from the treatment works on proposed sensitive receptors is not considered to be significant and has been scoped out of this assessment.

5.3 Operational Phase Road Traffic Emission Impacts

Human Receptors

Screening Assessment

5.3.1 The Proposed Development will generate additional traffic during the operational phase, which will result in an increase of over 100 AADT along several roads located within an AQMA, thus exceeding the EPUK / IAQM screening criteria (see **Appendix C**). As such, it is not possible to screen out the potential for significant impacts from operational traffic generated by the Proposed Development on existing sensitive properties and, therefore a detailed assessment has been undertaken as presented in the following section.

Detailed Assessment

5.3.2 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors, both without and with the Proposed Development in place, are presented in **Table 5-4, Table 5-5** and **Table 5-6**. The 'without development' scenario predicted concentrations include background concentrations and emissions from existing traffic, and the 'with development' scenario predicted

concentrations include background concentrations, emissions from existing traffic and traffic generated by the Proposed Development.

Table 5-2 Predicted Concentrations of NO_2 (µg/m³), % Change and Impact at each Receptor

Receptor	Without Development	With Development	Change (as % of NAQO)	Impact Descriptor
R01	20.4	21.2	2%	Negligible
R02	23.3	24.4	3%	Negligible
R03	18.7	19.4	2%	Negligible
R04	18.2	18.8	2%	Negligible
R05	16.5	16.9	1%	Negligible
R06	18.3	18.8	1%	Negligible
R07	18.7	19.2	1%	Negligible
R08	21.7	22.3	2%	Negligible
R09	18.2	18.7	1%	Negligible
R10	18.9	19.4	1%	Negligible
R11	16.4	18.7	6%	Slight adverse
R12	15.5	17.8	6%	Slight adverse
R13	16.2	18.7	6%	Slight adverse
R14	15.9	18.3	6%	Slight adverse
R15	15.9	18.4	6%	Slight adverse
R16	17.0	20.0	7%	Slight adverse
R17	13.1	14.7	4%	Negligible
R18	18.0	20.4	6%	Slight adverse
R19	21.2	21.8	2%	Negligible
R20	11.6	13.2	4%	Negligible
NAQO	**40**		-	

Table 5-3 Predicted Concentrations of PM_{10} (µg/m³), % Change and Impact at each Receptor

Receptor	Without Development	With Development	Change (as % of NAQO)	Impact Descriptor
R01	14.4	14.7	1%	Negligible
R02	15.3	15.6	1%	Negligible
R03	14.1	14.2	0%	Negligible
R04	13.9	14.1	0%	Negligible
R05	13.1	13.3	0%	Negligible
R06	14.2	14.3	0%	Negligible
R07	14.3	14.5	0%	Negligible
R08	15.0	15.2	0%	Negligible
R09	14.1	14.2	0%	Negligible
R10	14.4	14.5	0%	Negligible
R11	13.3	13.9	2%	Negligible
R12	13.1	13.7	1%	Negligible
R13	13.2	13.9	2%	Negligible
R14	13.2	13.8	2%	Negligible
R15	13.2	13.8	2%	Negligible
R16	13.2	13.9	2%	Negligible
R17	11.4	11.8	1%	Negligible
R18	13.4	14.0	1%	Negligible

Receptor	Without Development	With Development	Change (as % of NAQO)	Impact Descriptor
R19	15.1	15.3	0%	Negligible
R20	12.0	12.4	1%	Negligible
NAQO	**40**		-	

Table 5-4 Predicted Concentrations of $PM_{2.5}$ (µg/m³), % Change and Impact at each Receptor

Receptor	Without Development	With Development	Change (as % of NAQO)	Impact Descriptor
R01	9.4	9.5	1%	Negligible
R02	9.9	10.0	1%	Negligible
R03	9.2	9.3	0%	Negligible
R04	9.1	9.2	0%	Negligible
R05	8.7	8.8	0%	Negligible
R06	9.3	9.4	0%	Negligible
R07	9.3	9.4	0%	Negligible
R08	9.7	9.8	1%	Negligible
R09	9.2	9.3	0%	Negligible
R10	9.4	9.4	0%	Negligible
R11	8.8	9.1	2%	Negligible
R12	8.7	9.0	2%	Negligible
R13	8.8	9.1	2%	Negligible
R14	8.7	9.1	2%	Negligible
R15	8.7	9.1	2%	Negligible
R16	8.7	9.1	2%	Negligible
R17	7.3	7.5	1%	Negligible
R18	8.9	9.2	2%	Negligible
R19	9.8	9.9	1%	Negligible
R20	8.1	8.3	1%	Negligible
NAQO	**20**		-	

5.3.3 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations both without and with the Proposed Development in place, are below the relevant NAQOs at all existing receptors. Furthermore, predicted annual mean NO_2 concentrations are below 60 µg/m³ at all receptors, indicating that exceedances of the 1-hour mean NO_2 NAQO are not likely, and the predicted annual mean PM_{10} concentrations are below 32 µg/m³ at all receptors, indicating that exceedances of the 24-hour mean PM_{10} NAQO are not likely.

5.3.4 The changes in annual mean NO_2 concentrations (when rounded to the nearest whole number) range from 1-4% at thirteen receptors and are 6-7% at seven receptors. Using the criteria set out in **Table 3-1,** these impacts are described as being '**slight adverse'** at seven receptors (R11-16,18) and '**negligible**' at all remaining receptors.

5.3.5 The changes in annual mean PM_{10} and $PM_{2.5}$ concentrations (when rounded to the nearest whole number) are 0-2% at all receptors. Using the criteria set out in **Table 3-1**, the PM_{10} and $PM_{2.5}$ impacts are described as being '**negligible**' at all receptors.

5.4 Impact Significance

5.4.1 The IAQM guidance recommends that no judgement of the significance of effects of construction dust without mitigation is made, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations (IAQM, 2023). Following the implementation of

appropriate mitigation measures (as described in **Section 6**) the residual effects will be 'not significant'.

5.4.2 Overall, taking into account the conservative nature of the assessment, and the criteria set out in **Section 3.8**, the operational roads air quality effects of the Proposed Development are considered to be 'not significant' on the basis that:

- Emissions associated with the Proposed Development (i.e. from traffic generated by the Proposed Development) will not cause any exceedances of the NAQOs.
- Impacts as a result of emissions associated with the operation of the Proposed Development will be '**negligible**' at all receptors.
- Predicted concentrations of road traffic emissions (NO_2, PM_{10} and $PM_{2.5}$) at worst-case sensitive locations within the Proposed Development will be well below the relevant NAQOs.

6 Mitigation

6.1 Site Suitability

6.1.1 As summarised in **Section 5.2**, there are two nearby industrial activities whose impact on the air quality within the Site cannot currently be clarified. Therefore, it is recommended that a planning condition is used to control delivery of development phases, linked to point source dispersion modelling and the delivery of any necessary mitigation (for both industrial activities).

6.2 Construction

6.2.1 The following standard mitigation measures from the IAQM guidance (IAQM, 2023) are recommended, taking into account the outcomes of the construction dust risk assessment (presented in **Table 5-2**).

Table 6-1 Construction Phase Mitigation Measures

Category	Mitigation Measure
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary.
	Display the head or regional office contact information.
Management	Develop and implement a Dust Management Plan (DMP).
	Record all dust and air quality complaints, identify causes and take measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- of off-site, and the action taken to resolve the situation in the log book.
	Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Monitoring	Undertake daily on-site and off-site inspections, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked.
	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
	Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the local authority. Where possible, commence baseline monitoring at least three months before work on a phase commences.
Preparing and maintaining the site	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as a high as any stockpiles on site.
	Fully enclose site or specific operations where there is a high potential for dust productions and the site is active for an extensive period.
	Avoid site runoff of water of mud.

Category	Mitigation Measure
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.
	Cover, seed or fence stockpiles to prevent wind whipping.
Operating vehicle/machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
	Impose and signpost a maximum speed limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car sharing).
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste management	Avoid bonfires and burning of waste materials.
Demolition	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.
	Avoid explosive blasting, using appropriate manual or mechanical alternatives.
	Bag and remove any biological debris or damp down such material before demolition.
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
	Only remove the cover in small areas during work and not all at once.
Construction	Avoid scabbling (roughening of concrete surfaces) if possible.
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	Use water assisted dust sweepers on the site access and local roads.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving the site are covered to prevent escape of materials.

Category	Mitigation Measure
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Record all inspections of haul routes and any subsequent action in a site log book.
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
	Access gates to be located at least 10 m from receptors where possible.

7 Summary and Conclusions

7.1.1 The air quality impacts associated with the Proposed Development of the Site at Water Lane, Exeter, located within the boundary of the ECC have been assessed.

7.1.2 To date ECC has declared one AQMA due to exceedances of the annual and hourly mean NO_2 objective. The Site is not located within an AQMA; the closest AQMA to the Site is the Exeter AQMA located at the A377, approximately 260 m northwest of the Site.

7.1.3 At the time of writing, the energy strategy for the Proposed Development is not known, however, it intends to pursue a 'Pathway to Net Zero Carbon' (in operation) energy strategy and to target 'Zero Fossil Fuel Emissions' on-site. The Proposed Development is therefore unlikely to contain on-site combustion heating plant and as such, an assessment of the impacts from related emission has not been included in this air quality assessment at this stage.

7.1.4 The construction works have the potential to create dust. During construction it is recommended that in accordance with the IAQM guidance a package of mitigation measures is put in place to minimise the risk of elevated PM_{10} concentrations and dust nuisance in the surrounding area. With mitigation in place the construction impacts are judged as 'not significant'.

7.1.5 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ associated with road traffic emissions have been predicted for a number of worst-case locations representing existing properties adjacent to the road network, as well as future receptor locations within the Site. Predicted concentrations are well below the relevant NAQOs at all of the existing and proposed receptor locations with the Proposed Development in place. The operational effects of the Proposed Development on human receptors are judged to be 'not significant'.

7.1.6 There are a number of existing industrial emission sources within close proximity of the Site. For the majority of these sources, this report highlights that emissions are not considered to have a significant impact on the Proposed Development. However, the impacts of emissions associated with Conrad Energy Plant and Whitetower Energy Plant could not be evaluated at the time of writing this report due to insufficient publicly accessible information available. It is therefore recommended that a planning condition is used to control delivery of development phases, linked to any necessary point source dispersion modelling and the delivery of any related mitigation.

References

Amec Foster Wheeler (2015). '*Air Quality Impact Assessment for Emissions to Atmophere from Water Lane Capacity Mechanism Power Plant'*.

British Geological Survey (2022). '*UK Soil Observatory (UKSO)*'. Available at: http://mapapps2.bgs.ac.uk/ukso/home.html

Department for Environment, Food and Rural Affairs (DEFRA) (2018). '*UK Plan for tackling Roadside Nitrogen Dioxide Concentrations: Detailed Plan'.* Available at: https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

Department for Environment, Food and Rural Affairs (DEFRA) (2019). '*Clean Air Strategy 2019*'.

Department for Environment, Food and Rural Affairs (DEFRA) (2020a) '*2020 NO_2 and PM Projections Data (2018 Reference Year)*' [online] Available at: https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data

Department for Environment, Food and Rural Affairs (DEFRA) (2020b). '*2018 Based Background Maps*

Department for Environment, Food and Rural Affairs (DEFRA) (2020c). '*NO_x to NO_2 Conversion* Spreadsheet' [online] Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

Department for Environment, Food and Rural Affairs (DEFRA) (2022). '*Local Air Quality Management Technical Guidance (TG22)*'. August 2022.

Department for Environment, Food and Rural Affairs (DEFRA) (2021). '*Emissions Factor Toolkit (Version 11.0)*' Online, available at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

Department for Environment, Food and Rural Affairs (DEFRA) (2023). '*Environmental Improvement Plan 2023*'.

Department for Environment, Food and Rural Affairs (DEFRA) (2023). '*The Air Quality Strategy for England*'. Available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Environment Act 1995, Part IV.

Environment Agency (2020). '*Environmental Permit for Whitetower Energy Limited'*.

Environmental Protection UK and the Institute of Air Quality Management (EPUK / IAQM) (2017). '*Land-use Planning & Development Control: Planning for Air Quality*'. V1.2. The Institute for Air Quality Management, London.

Exeter City Council (2005). 'Local Plan First Review 1995 – 2011'. Available at: https://exeter.gov.uk/planning-services/current-planning-policy/current-local-plan/local-plan-first-review-1995-2011/

Exeter City Council (2009). '*Environmental Permit for Glendinning Ltd'*.

Exeter City Council (2010). *'Residential Design: Supplementary Planning Document*'.

Exeter City Council (2012). *'Exeter Core Strategy'*. Available at: https://exeter.gov.uk/planning-

services/planning-policy/local-plan/core-strategy-development-plan-document/

Exeter City Council (2013). '*Sustainable Transport Supplementary Planning Document*'.

Exeter City Council (2016). '*Riverside & Ludwell Valley Parks Masterplan 2016 – 2026*'.

Exeter City Council (2019). *'Exeter Air Quality Action Plan 2019-2024'*. Available at: https://exeter.gov.uk/clean-safe-city/environmental-health/pollution-control/air-quality-action-plan/

Exeter City Council (2022). '*2022 Air Quality Annual Status Report (ASR).*'

Institute of Air Quality Management (2023). '*Assessment of Dust from Demolition and Construction*', IAQM, London. Available at: https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-dust-2023-BG-v6-amendments.pdf

Ministry of Housing, Communities & Local Government (2021). '*National Planning Policy Framework'*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2#history

National Atmospheric Emissions Inventory (2018). The NAEI London fleet projection dataset. Available at https://naei.beis.gov.uk/data/ef-transport

PB Power (2006) '*Exeter OCGT Power Station Application for IPPC Permit Volume II'*.

Planning Practice Guidance (2014). '*Air Quality'*.

RPS Consultancy (2007). '*Air Quality Assessment'*.

Statutory Instrument 2000, No 921, '*The Air Quality (England) Regulations 2000'* HMSO, London.

Statutory Instrument 2002, No 3034, '*The Air Quality (England) (Amendment) Regulations 2002'* HMSO, London.

Statutory Instrument 2010, No. 1001, '*The Air Quality Standards Regulations 2010'* HMSO, London.

Statutory Instrument 2016, No. 1184, '*The Air Quality Standards (Amendment) Regulations 2016*' HMSO, London.

Statutory Instruments 2019, No. 74, 'The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019' HMSO, London

Statutory Instruments 2020, No. 131, 'The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020' HMSO, London

Statutory Instruments 2021, c. 30, 'Environment Act 2021' HMSO, London

Statutory Instruments 2023 No. 96. 'The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023' HMSO, London

Water UK (2021) '*Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code")*'. Available at: https://www.water.org.uk/wp-content/uploads/2021/07/SSG-App-C-Des-Con-Guide.pdf

Appendix A Glossary

Abbreviations	Meaning
AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQR	Air Quality Regulations
AQMA	Air Quality Management Area
CAZ	Clean Air Zone
CEMP	Construction Environmental Management Plan
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
ECC	Exeter City Council
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes. Includes Heavy Goods Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAEI	National Atmospheric Emission Inventory
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen Dioxide
NOx	Oxides of nitrogen generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
NPPF	National Planning Policy Framework
$PM_{10}/PM_{2.5}$	Small airborne particles less than 10/2.5 µm in diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
SPG	Supplementary Planning Guidance
UNECE	United Nations Economic Commission for Europe

Appendix B IAQM Dust Guidance (2023) Approach

Table B-1 Dust Emission Magnitude Classification

Activity	Dust Emission Magnitude		
	Large	**Medium**	**Small**
Demolition	Total building volume of >75,000 m^3, potentially dusty construction material, on-site crushing and screening, demolition activities >12 m above ground	Total building volume of 12,000 – 75,000 m^3, potentially dusty construction material, demolition activities 6 – 12 m above ground level	Total building volume of <12,000 m^3, construction material with low potential for dust release, demolition activities <6 m above ground, demolition during wetter months
Earthworks	Total site area of >110,000 m^2, potentially dusty soil type, >10 heavy earth moving vehicles active at any one time, formation of bunds >6 m in height	Total site area of 18,000 – 110,000m^2, moderately dusty soil type, 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 3 - 6 m in height	Total site area of <18,000 m^2, soil type with large grain size, <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height
Construction	Total building volume >75,000 m^2, on-site concrete batching, sandblasting	Total building volume 12,000 - 75,000 m^2, potentially dusty construction material, on-site concrete batching	Total building volume <12,000 m^2, construction material with low potential for dust release
Trackout	>50 HDV outwards movements in any one day, potentially dusty surface material, unpaved road length >100 m	20 - 50 HDV outwards movements in any one day, moderately dusty surface material, unpaved road length 50 - 100 m	<20 HDV outwards movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

Table B-2 Receptor Sensitivity

Receptor Sensitivity	Impact		
	Dust Soiling	**Health Effects of PM_{10}**	**Ecological Impacts**
High	An area where: • Users can reasonably expect enjoyment of a high level of amenity; • The appearance, aesthetics of value of their property would be diminished by soiling; • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.	Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objective, a relevant location would be one where individuals may be exposed for eight hours or more per day). Examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	Locations with an international or national designation and the designated features may be affected by dust soiling; OR Locations where there is a community of particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain. Indicative examples include a SAC designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	An area where: • Users would expect to enjoy of a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; • The appearance, aesthetics of value of their property could be diminished by soiling; • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods, as part of the normal pattern of use of the land. Examples include parks and places of work.	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objective, a relevant location would be one where individuals may be exposed for eight hours or more per day). Examples include office and shop workers, but will generally not include workers occupationally exposed to for PM_{10}, as protection is covered by Health and Safety at Work legislation.	Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; OR Locations with a national designation where the features may be affected by dust deposition. Indicative example is a SSSI with dust sensitive features.

Low	An area where: • The enjoyment of amenity would not reasonably be expected; • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short-term car parks and roads.	Locations where human exposure is transient. Examples include public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be affected by dust deposition. Indicative example is a LNR with dust sensitive features.

Table B-3 Sensitivity of an Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Low	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 B-4 Sensitivity of an Area to Human Health Impacts

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

Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28 µg/m^3	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table B-5 Sensitivity of an Area to Ecological Impacts

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

Table B-6 Risk of Dust Impacts Calculation Matrix

Sensitivity of Area		**Dust Emission Magnitude**		
		Large	**Medium**	**Small**
Demolition	High	High Risk	Medium Risk	Medium Risk
	Medium	High Risk	Medium Risk	Low Risk
	Low	Medium Risk	Low Risk	Negligible Risk
Earthworks	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible Risk
Construction	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible Risk
Trackout	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Negligible Risk
	Low	Low Risk	Low Risk	Negligible Risk

Appendix C EPUK IAQM Guidance (2017) Screening Criteria

The Development Will:	Indicative Criteria to Proceed to an Air Quality Assessment
Cause a significant change in LDV traffic flows on local roads with relevant receptors.	A change of LDV flow of: • >100 AADT within or adjacent to an AQMA; and • >500 AADT elsewhere.
Cause a significant change in HDV flows on local roads with relevant receptors.	A change of HDV flow of: • >25 AADT within or adjacent to an AQMA; and • >100 AADT elsewhere.
Realign roads i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5 m or more and the road is within an AQMA.
Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle acceleration / deceleration, e.g. traffic lights, or roundabouts.
Introduce or change a bus station.	A change of bus flows of: • >25 AADT within or adjacent to an AQMA; and • >100 AADT elsewhere.
Have an underground car park with extraction system.	The ventilation extract for the car park will be located within 20 m of a relevant receptor; and The car park will have >100 movements per day (total in and out).

The screening criteria presented is amended from Table 6.2 of the EPUK / IAQM guidance (EPUK / IAQM, 2017). Only the screening criteria relevant to changes in transport (including both traffic and the transport network) are outlined.

Appendix D Monitoring Results

Table D-1 Measured Annual Mean NO_2 Concentrations 2017 – 2021

Site ID	Site Type	Within AQMA	Annual Mean (µg/m^3)				
			2017	2018	2019	2020	2021
Automatic Monitoring Sites							
CM1 – Exeter Roadside	Kerbside	Yes, Exeter AQMA	27.7	29.1	29.0	18.8	19.2
Diffusion Tube Sites							
DT8 - North Street	Kerbside	Yes, Exeter AQMA	35.7	33.9	35.7	22.6	27.9
DT9 - South Street	Roadside	Yes, Exeter AQMA	31.5	29.1	28.5	18.7	24.2
DT10 - Market Street	Kerbside	Yes, Exeter AQMA	31.0	30.8	29.5	18.6	23.4
DT11 - Magdalen Street	Kerbside	Yes, Exeter AQMA	29.2	29.4	28.9	19.5	24.7
DT12 - Magdalen Street façade	Kerbside	Yes (AQMA No1 Trent Bridge)	31.8	31.1	29.3	20.0	23.8
DT16 - Holloway Street	Kerbside	Yes, Exeter AQMA	31.3	34.2	29.3	21.3	26.6
DT17 - Carder's Court, Shilhay	Roadside	No	22.0	22.4	21.4	15.5	18.3
DT18 - Rear of Gervase Avenue	Roadside	Yes, Exeter AQMA	23.4	22.3	22.7	15.8	19.2
DT19 - Alphington Street [a]	Kerbside	Yes, Exeter AQMA	**40.8**	**47.0**	**42.0**	28.5	35.7
DT20 - Alphington Road inbound [a]	Roadside	Yes, Exeter AQMA	33.9	33.6	31.3	22.4	27.4
DT21 - Queen's Road	Urban Background	No	13.7	15.3	12.7	9.1	11.7
DT22 - Alphington Road outbound [a]	Roadside	Yes, Exeter AQMA	26.8	29.0	26.2	17.7	21.2
DT23 - Alphington Road outer	Roadside	Yes, Exeter AQMA	23.4	27.3	23.4	15.3	20.6
DT24 - Church Road Alphington	Roadside	Yes, Exeter AQMA	29.1	28.0	23.4	18.3	24.3
DT25 - Church Road II	Kerbside	Yes, Exeter AQMA	25.6	26.1	23.5	16.2	19.8
DT26 - Alphington Cross	Roadside	Yes, Exeter AQMA	32.7	31.3	30.2	20.4	25.6
DT28 - Cowick Street (inbound)	Roadside	Yes, Exeter AQMA	20.7	23.9	21.1	15.6	19.9
DT29 - Cowick Street (outbound)	Roadside	Yes, Exeter AQMA	33.6	**43.4**	34.4	24.3	29.8
DT30 - Cowick Street (Exe Bridges)	Roadside	Yes, Exeter AQMA	32.0	33.2	30.1	22.1	28.2
DT31 - Okehampton Street	Roadside	Yes, Exeter AQMA	24.6	25.2	24.3	17.3	20.6
DT67 - Topsham Road (Barrack Road)	Roadside	Yes, Exeter AQMA	23.4	25.6	21.5	15.9	19.1
DT68 - Riverside Valley Park	Urban Background	No	-	13.7	13.8	9.4	11.7
DT69 - Cowick Barton Playing Fields	Urban Background	No	-	11.5	11.2	7.6	9.3
DT76 - Mill Lane	Urban Background	No	-	-	14.7	9.6	12.3

Site ID	Site Type	Within AQMA	Annual Mean (µg/m^3)				
			2017	2018	2019	2020	2021
DT81 - St. Leonards Road	Roadside	No	-	-	15.6	11.2	13.9
DT83 - New Bridge St	Roadside	Yes, Exeter AQMA	-	-	-	19.5	24
DT84 - Lower Coombe St	Roadside	No	-	-	-	15.5	18.6
NAQO		**40**					

Exceedances of the NAQO are highlighted in bold.
[a] Monitoing Locations used for verification.
2017 – 2021 data taken from the ECC 2022 Air Quality Annual Status Report (2022)

Table D-2 Measured Exceedances of the Hourly Mean NO_2 Objective 2017 – 2021

Site ID	Number of Hours >200µg/m^3				
	2017	2018	2019	2020	2021
Automatic Monitoring Sites					
CM1 – Exeter Roadside	0	0	0	0	0
NAQO		**18 (hours >200µg/m^3)**			

Exceedances highlighted in bold.
2017 – 2021 data taken from the ECC 2022 Air Quality Annual Status Report (2022).

Table D-3 Measured Annual Mean PM_{10} Concentrations 2017 – 2021

Site ID	Annual Mean PM_{10} (µg/m^3)				
	2017	2018	2019	2020	2021
CM1 – Exeter Roadside	18.0	17.7	15.8	14.1	13.9
CM2 – Alphington Street	19.0	16.7	15.1	11.5	12.0
NAQO	**40**				

2017 – 2021 data taken from the ECC 2022 Air Quality Annual Status Report (2022).

Table D-4 Measured Daily Mean PM_{10} Concentrations 2017 – 2021

Site ID	Number of Days >50µg/m^3				
	2017	2018	2019	2020	2021
CM1 – Exeter Roadside	1	0 (28.8)	0 (21.2)	1	1
CM2 - Alphington Street	2	1	4	0 (19.2)	0
NAQO	**35 (days >50 µg/m^3)**				

2017 – 2021 data taken from the ECC 2022 Air Quality Annual Status Report (2022).

Table D-5 Measured $PM_{2.5}$ Concentrations 2017 – 2021

Site ID	Annual Mean $PM_{2.5}$ (µg/m^3)				
	2017	2018	2019	2020	2021
CM1 – Exeter Roadside	-	-	10.0	8.6	8.4
CM2 - Alphington Street	-	9.0	9.5	6.8	7.5
limit value	**20**				

2017 – 2021 data taken from the ECC 2022 Air Quality Annual Status Report (2022).

Appendix E Model Inputs and Results Processing

E.1 Summary of Model Inputs

Meteorological Data	2019 hourly meteorological data from Exeter station has been used in the model. The wind rose is shown in Figure D.1.
ADMS	Version 5.0.1.3
Time Varying Emission Factors	Based on Department for Transport statistics. Table TRA0307. Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2019
Latitude	50.7°
Minimum Monin-Obukhov length	A value of 30 for 'cities and large towns' was used to represent the modelled area. A value of 10 for 'small towns <50,000' was used to represent the meteorological station site.
Surface Roughness	A value of 0.5 m for 'parkland, open suburbia' was used to represent the modelled area. A value of 0.3 m for 'agricultural area (max)' was used to represent the meteorological station site.
Emission Factor Toolkit (EFT)	V11 (DEFRA, 2021)
NOx to NO_2 Conversion	NOx to NO_2 calculator version 8.1, August 2020 (DEFRA, 2020c)
Background Maps	2018 reference year background maps (DEFRA, 2020b)

E.2 Receptor Locations

Receptor	Description	X Coordinate	Y Coordinate	Height (m)
Existing Receptors				
R01	Rosebank	291652	91866	1.5
R02	3BC Alphington St	291667	91869	1.5
R03	Apartment complex on A377	291652	91806	1.5
R04	Homeclyst House	291675	91784	1.5
R05	St Nicholas House	291595	91582	1.5
R06	55 Alphington St	291563	91392	1.5
R07	85 Alphington St	291542	91322	1.5
R08	105 Alphington St	291522	91253	1.5
R09	82 Alphington St	291501	91237	1.5
R10	147 Alphington St	291505	91110	1.5

Receptor	Description	X Coordinate	Y Coordinate	Height (m)
Existing Receptors				
R11	Apartment block on Haven Rd (1)	291788	91878	1.5
R12	Apartment block on Haven Rd (2)	291863	91851	1.5
R13	35 Water Lane	291948	91727	1.5
R14	Apartment block on Haven Cl	291929	91733	1.5
R15	40 Water Lane	291961	91675	1.5
R16	Willeys Ct Flats 1 - 12	291946	91604	1.5
R17	1 Cotfield St	292261	91389	1.5
R18	7 Shooting Marsh Stile	291690	91948	1.5
R19	54 Alphington St	291537	91363	1.5
R20	Apartment block on Tan Lane	291945	91566	1.5
Proposed Receptors				
PR01	Proposed Receptor	291965	91558	4.5
PR02	Proposed Receptor	291972	91463	4.5
PR03	Proposed Receptor	291970	91575	4.5

E.3 Traffic Data

Location	ID	2019 Baseline		2033 without Development		2033 with Development*	
		AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
Water Lane South	1	794	7.3	5148	5.3	7238	5.2
Willeys Avenue	2	83	0.0	94	0.0	94	0.0
Haven Road	3	6057	3.1	11644	3.7	15824	4.1
Tan Lane	4	646	27.1	742	12.7	2833	7.0
A377 / Haven Road Junction	5	24520	3.3	32670	3.3	36850	3.5
A377 Alphington Road North	6	20525	3.3	24780	3.1	26017	3.2
A377 Alphington Road South	7	20525	3.3	24779	3.1	26017	3.2
A377 Alphington Road (Marsh Barton Junction)	8	20929	3.1	23040	3.1	23240	3.2

E.4 Windrose

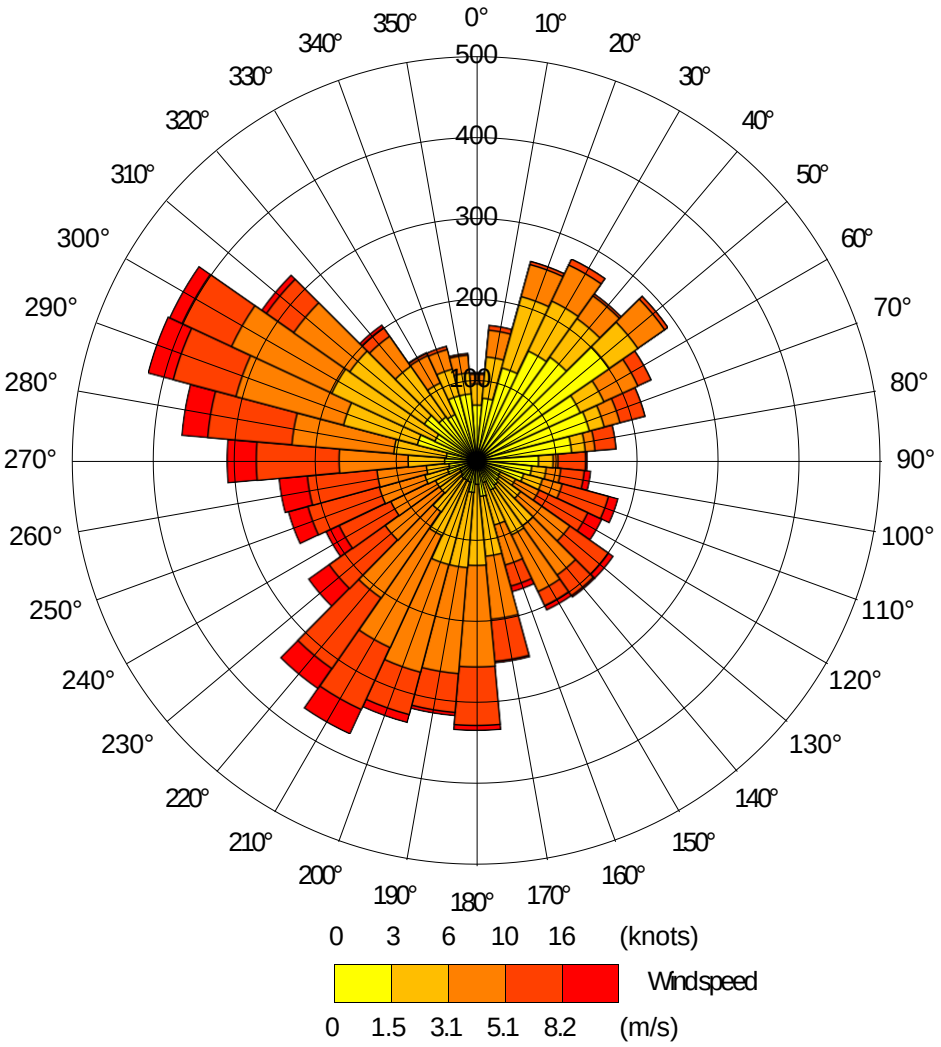


Figure E-1: 2019 windrose for Exeter

Appendix F Model Verification

NO_2

Most NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the 2019 annual mean road-NOx contribution at three monitoring locations (identified in **Table D-1**). 2019 was the latest year of representative data available at the time of the assessment. Concentrations have been modelled at a height of 2 m for Alphington Street (DT19), 1.7 m for Alphington Road inbound (DT20) and 1.7 m for Alphington Road outbound (DT22).

A primary adjustment factor of **3.6222** has been determined as the slope of the best fit line between the modelled road NOx contribution and the 'measured' road-NO_x (which is calculated from the measured and background NO_2 concentrations within DEFRA's NO_x from NO_2 calculator (DEFRA, 2020c)), forced through zero (**Figure F-1**). This factor has then been applied to the raw modelled road-NO_x concentration to provide adjusted modelled road-NO_x concentrations.

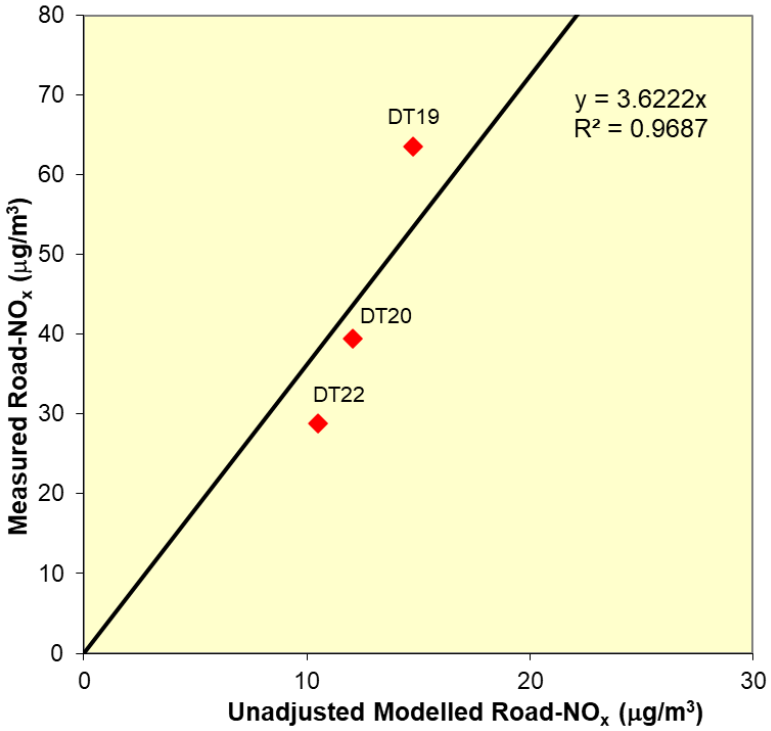


Figure F-1 Measured and Unadjusted Road-NO_x Comparison

The total NO_2 concentrations have then been determined by combining the adjusted modelled road-NO_x concentrations with the background NO_2 concentration within DEFRA's NO_x from NO_2 calculator (DEFRA, 2020c). A secondary adjustment factor of **0.9892** has then been calculated as the slope of the best fit line applied to the adjusted data and forced through zero (**Figure F-2**).

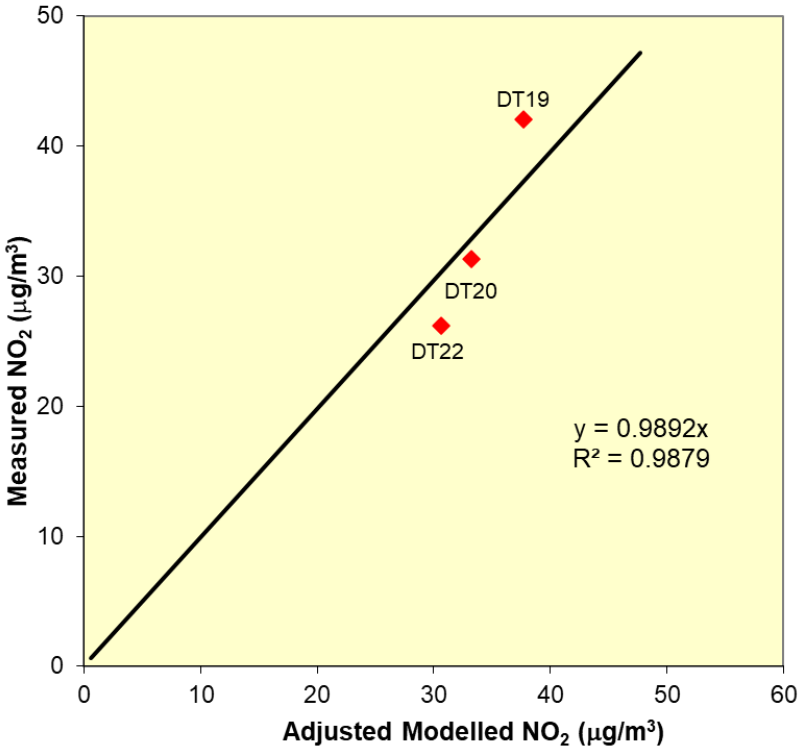


Figure F-2 Measured and Primary Adjusted Modelled NO_2 Comparison

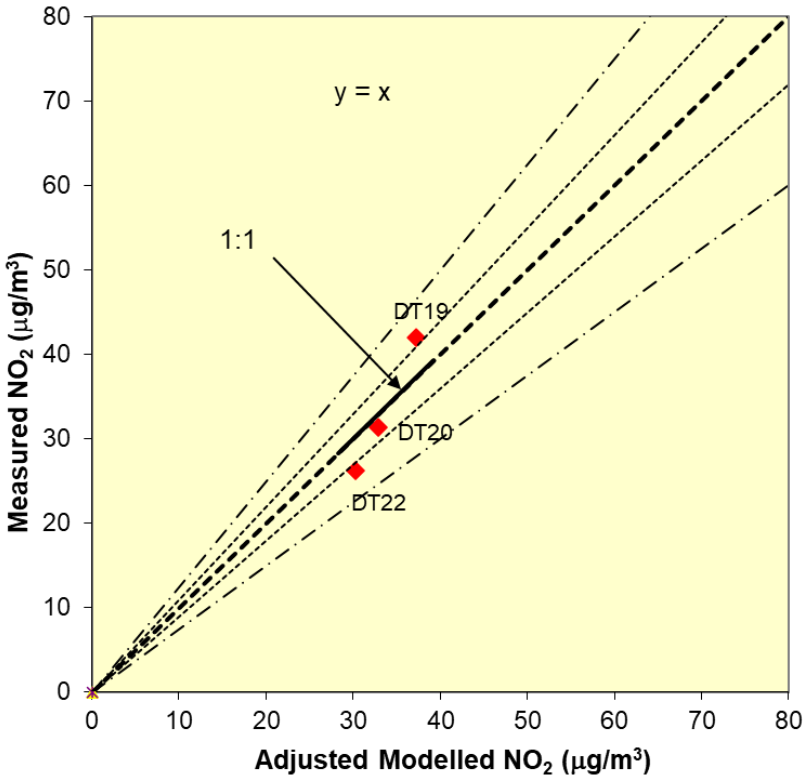


Figure F-3 Measured and Final Adjusted Modelled NO_2 Comparison

Figure F-3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NOx and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line.

The calculated adjustment factors imply that overall, the model has under-predicted the road-NO_x contribution. This is a common experience with this and most other models. The calculated Root Mean Square Error (RMSE) for this verification (3.7 µg/m^3) lies within the range considered to be acceptable by DEFRA (DEFRA, 2022) (0 – 10).

PM_{10} and $PM_{2.5}$

The Alphington Street (CM2) automatic monitoring station is the only roadside location within the study area that monitors PM_{10}. This has therefore been used to calculate a verification factor for $PM_{2.5}$ following a similar methodology as that used for NO_2.

Road-PM_{10} (calculated from measured PM_{10} at the CM2 monitoring site and calibrated background PM_{10} for the appropriate grid-square) is divided by the modelled road-PM_{10} to produce a factor which can be applied to PM_{10} model outputs.

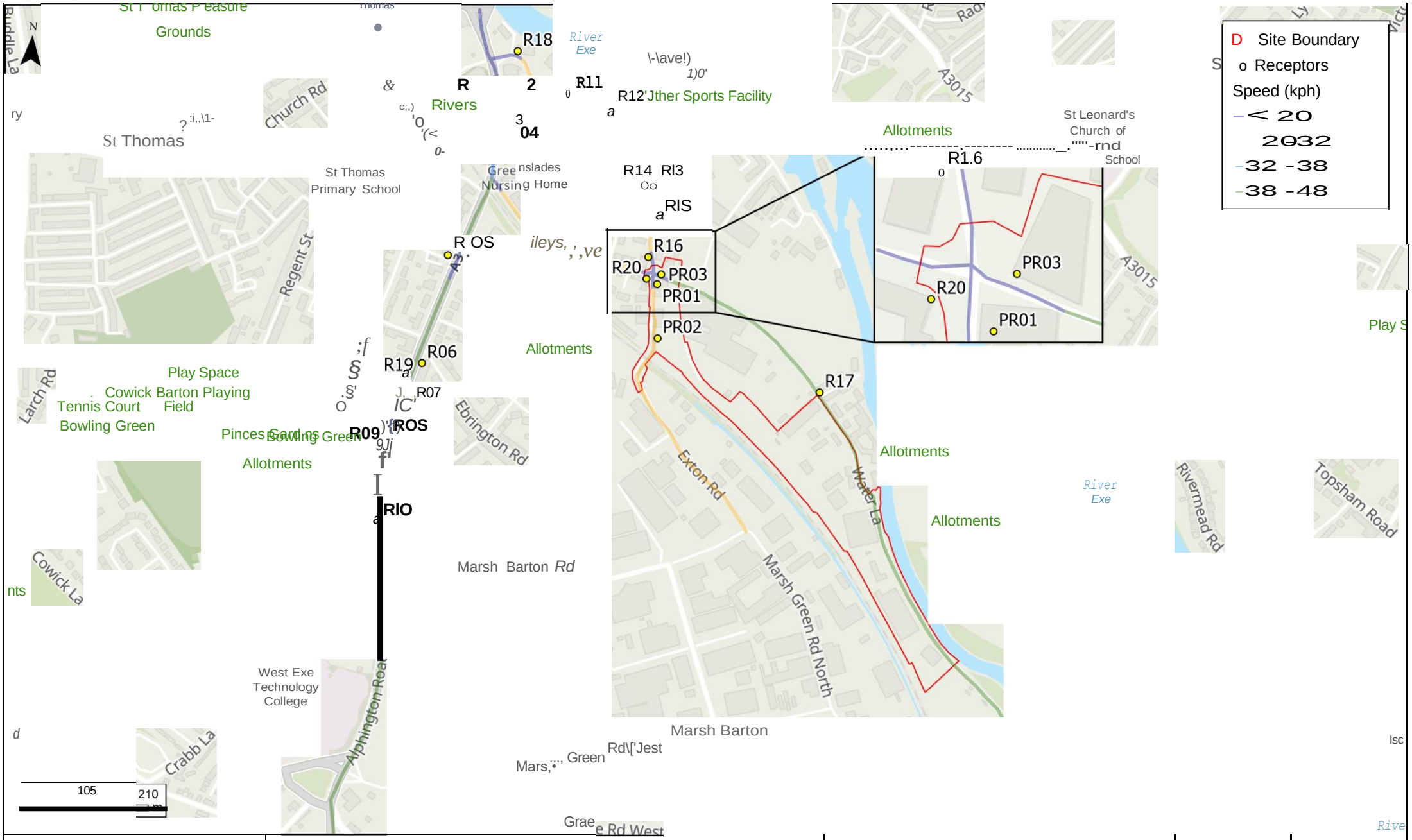
Measured PM_{10} (15.1 µg/m^3) - calibrated background PM_{10} (12.0 µg/m^3) = measured road PM_{10} (3.1 µg/m^3)

Measured road-PM_{10} / modelled road-PM_{10} (1.29 µg/m^3) = PM_{10} verification factor (**2.3878**).

The adjusted factor calculated for PM_{10} has been applied to the modelled road-PM_{10} and road-$PM_{2.5}$ concentrations.

Appendix G Figures

Document Path: \\Tnt-vfps-001\tnt\Projects\332310057\Air Quality\Plans and Figures\ArcGIS\Water Lane\Water Lane.aprx



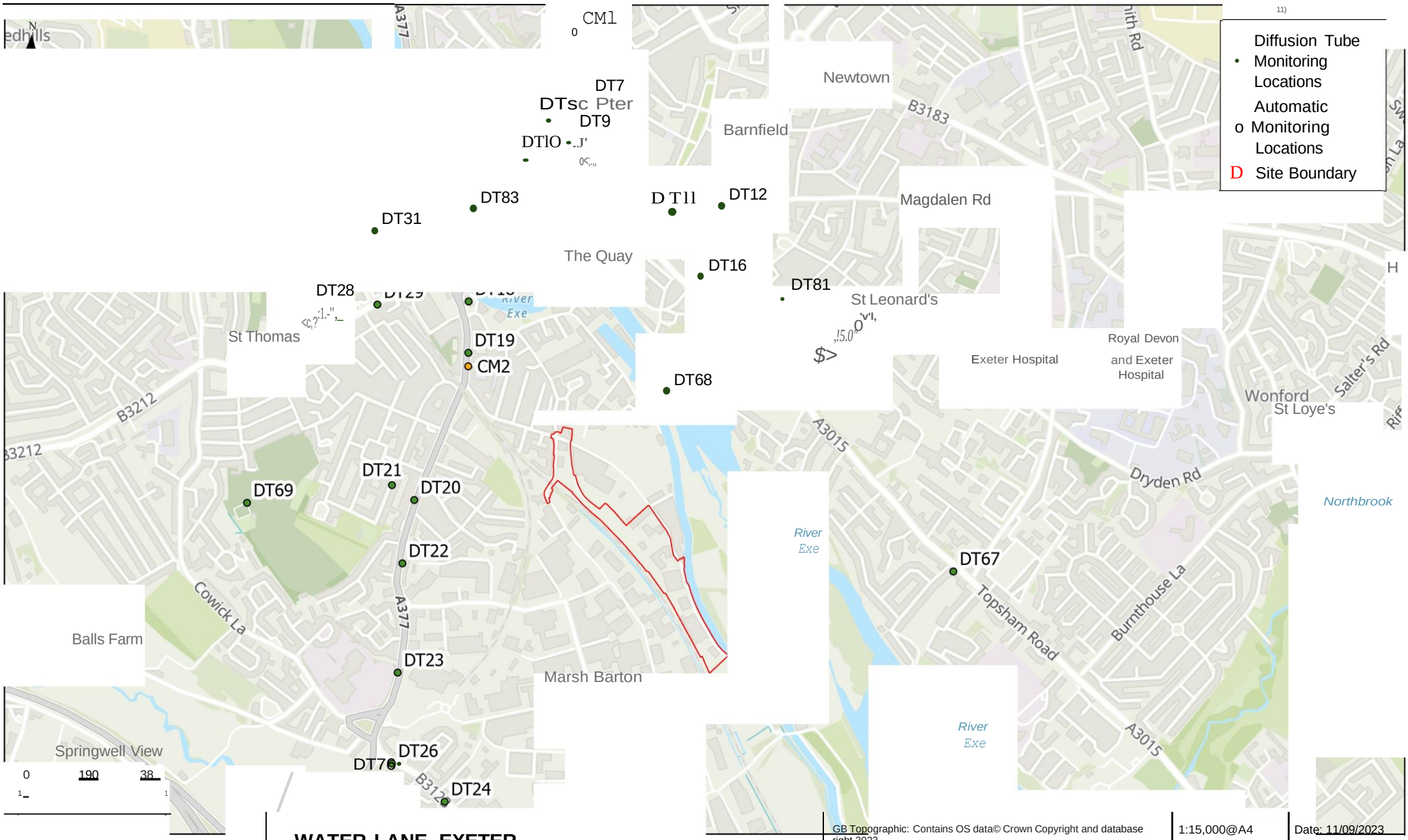
Stantec

WATER LANE, EXETER

Modelled Existing and Proposed Receptors including Site Boundary and Modelled Roads

1:8,500@A4	Date: 25/08/2023
Drawn: AO	Checked: LS
Figure 01	Rev A

Document Path: \\Tnt-vfps-001\tnt\Projects\332310057\Air Quality\Plans and Figures\ArcGIS\Water Lane\Water Lane.aprx



WATER LANE, EXETER

Exeter City Council Monitoring Locations

1:15,000@A4	Date: 11/09/2023
Drawn: AO	Checked: LS
Figure 02	Rev A

Document Path: \\Tnt-vfps-001\tnt\Projects\332310057\Air Quality\Plans and Figures\ArcGIS\Water Lane\Water Lane.aprx

Stantec

WATER LANE, EXETER

IAQM Demolition and Construction Dust Distance Criteria

1:9,000@A4	Date: 12/09/2023
Drawn: AO	Checked: LS
Figure 03	Rev A