Appendix G Air Quality Assessment

Chichester District Council – Local Plan

Transport Study of Strategic Development Environmental Impacts

Air Quality Assessment

On behalf of **Chichester District Council**

Project Ref: 43682/5505 | Rev: Draft | Date: October 2018

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Contents

Tables

Appendices

1 Introduction

1.1 Proposed Development

1.1.1 Peter Brett Associates (PBA) has been commissioned to undertake an air quality assessment to inform the preparation of the Chichester Local Plan Review: 2016-2035. Although the Council adopted the Chichester Local Plan 2014-2029 in July 2015, the examination concluded that the Plan fell short of meeting the full housing needs of the District outside of the South Downs National Park (the 'Plan Area'). The Inspector required that the Council commit to a review of the Local Plan within 5 years with the objective to ensure that housing needs are fully met.

1.1.2 The transport study assesses the impact of potential strategic site allocations, both individually and cumulatively, on the local and strategic highway networks in the District and wider area. For the Local Plan evidence base, an assessment of the air quality impacts of the plan proposals is required where the increase in traffic is above 30% compared to the 2035 reference case, or on routes which pass through or adjacent to a designated Air Quality Management Areas (AQMA), if an increase of at least 50 Passenger Car Unit (PCU)/hr is forecast in these areas.

1.2 Scope of Assessment

1.2.1 This report describes the existing air quality within the District, presents a qualitative assessment of all areas where there is a net increase in traffic over 30%, and a quantitative modelling assessment when a significant increase in traffic is predicted within an AQMA, road links with sensitive receptors or within a designated environmentally protected site (i.e. a site subject to Habitats Regulations). The qualitative assessment considers the change in traffic numbers and the likely change in vehicle emissions to ascertain if an adverse impact on air quality will result. The main air pollutants of concern related to road traffic are nitrogen dioxide (NO_2), and particulate matter and dust (PM_{10} and $PM_{2.5}$).

1.2.2 Within St. Pancras AQMA, the predicted net increase in traffic for all scenarios is below 30% and 50 PCU/hour, and therefore the need to consider impacts on St Pancras AQMA have been scoped out of this assessment.

1.2.3 Further to the criteria set above in paragraph 1.1.2, only links with relevant sensitive receptors were modelled based on the proximity to the kerb of existing properties and total vehicle flows on the road network. Road links with total Annual Average Daily Traffic (AADT) below 10,000 and no existing properties close to the kerb were scoped out of this assessment, since road traffic impacts would not be significant.

1.2.4 Where a net increase in traffic of more than 30% was identified on roads within 200 m of a designated environmentally protected site, the potential effects of air quality have been assessed (Natural England, 2018). The Pagham Harbour Special Protection Area (SPA) and Wetland of International Importance (Ramsar Site), located adjacent to the B2145 Chichester Road; and Chichester and Langstone Harbours SPA and Ramsar Site and Solent Maritime Special Area of Conservation (SAC), located south of the A259 Main Road, meet the criteria for an assessment to be undertaken.

1.2.5 The Habitats Regulations Assessment (HRA) for CDC Local Plan Review report considered the potential for effects of reduced air quality on Chichester and Langstone Harbours SPA and Ramsar sites; Ebernoe Common SAC; The Mens SAC; and Duncton to Bignor Escarpment SAC (AECOM, 2017). The transport modelling informing this assessment, determined that the predicted traffic increase on the road network within 200 m of Ebernoe Common SAC and The Mens SAC is below 1000 AADT threshold determined by Natural England (Natural England, 2018). The predicted increase in traffic at the A285 south of Duncton, which passes through northwest corner of Duncton to Bignor Escarpment SAC, is above 1000 AADT. However, Duncton to Bignor Escarpment SAC lies wholly within South Downs National Park Authority area, who is preparing a single local plan for the entire National Park and has commissioned a separate evidence base. The air quality impacts on Ebernoe Common SAC, The Mens SAC and Duncton to Bignor Escarpment SAC have therefore been scope out of this assessment.

2 Legislation and Policy

2.1 The Air Quality Strategy

2.1.1 The Air Quality Strategy (2007) establishes the policy framework for ambient air quality management and assessment in the UK (DETR, 2007). The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

2.1.2 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000 (Statutory Instrument, 2000) and the Air Quality (Amendment) (England) Regulations 2002 (Statutory Instrument, 2002).

2.1.3 Where an objective 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 objectives within its AQMA.

2.1.4 The Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16); Defra, 2016), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to 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). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

2.2.1 The Air Quality Standards Regulations 2010 (Statutory Instrument, 2010) implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO_2. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

2.2.2 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

2.2.3 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

Habitats

2.2.4 European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) requires member states to introduce a range of measures for the protection of habitats and species. The Conservation of Habitats and Species Regulations (2017) (Statutory Instrument, 2017), transposes the Directive into law in England and Wales. Sites as Special Areas of Conservation (SACs) are designated under these regulations, as are Special Protection Areas (SPAs); with these classified under the Council Directive 2009/147/EC on the Conservation of Wild Birds. These Sites form a network termed "Natura 2000."

2.2.5 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

2.2.6 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to any significant effects on European sites. Where this is the case, it has to carry out an 'appropriate assessment' of the implications for any European site likely to be significantly affected in view of that site's conservation objectives.

Air Quality Objectives

Human Health

2.2.7 The NAQOs for NO_2 and PM_{10} set out in the Air Quality Regulations (England) 2000 (Statutory Instrument, 2000) and the Air Quality (England) (Amendment) Regulations 2002 (Statutory Instrument, 2002), are shown in **Table 2.1**.

Table 2.1: NO_2 and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO_2)	1-hour mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40 µg/m^3
Particulate Matter (PM_{10})	24-hour mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40 µg/m^3

2.2.8 The objectives 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. Analysis of long-term monitoring data suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective 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, 2016).

2.2.9 The Air Quality Strategy 2007 (DETR, 2007) includes an exposure reduction target for smaller particles known as $PM_{2.5}$. These are an annual mean target of 25 µg/m^3 by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

2.2.10 The Ambient Air Quality and Cleaner Air for Europe directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for

$PM_{2.5}$, shown in **Table 2.2**. The UK Government transposed this new directive into national legislation in June 2010.

Table 2.2: $PM_{2.5}$ Objectives

	Time Period	Objective	To be Achieved by
UK Objectives	Annual mean	25 µg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background sites	Between 2010 and 2020
European Obligations	Annual mean	Target value of 25 µg/m^3	2010
	Annual mean	Limit value of 25 µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20 µg/m^3	2020
	3 year Average Exposure Indicator (AEI) (a)	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20 µg/m^3	2015

(a) The 3 year annual or AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

Sensitive Ecological Receptors

2.2.11 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and were to have been achieved by 2000. They are summarised in **Table 2.3** and are the same as the EU limit values. The objectives only strictly apply (a) more than 20 km from an agglomeration (about 250,000 people), and (b) more than 5 km from Part A industrial sources, motorways and built up areas of more than 5,000 people. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally and nationally designated nature conservation sites (SPAs and SACs). For the assessment of road schemes, the Highways Agency follows this approach and requires an assessment of the impacts of roads traffic emissions on nature conservation Sites (Designated Sites) within 200 m of a road. When pollutant concentrations exceed a critical level it is considered that there is a risk of harmful effects.

Table 2.3: Vegetation and Ecosystem Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual mean	30 µg/m^3

Critical Loads

2.2.12 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by United Nations Economic Commission for Europe (UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Exceedance of a critical load is used as an indication of the potential for harmful effects to occur.

2.3 Planning Policy

National 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, 2018). In relation to achieving sustainable development, paragraph 8 states that:

"*Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):*
…
c) ***an environmental objective*** *– to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."*

2.3.2 So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development. Paragraph 11 states that plans and decisions should apply a presumption in favour of sustainable development, which for decision-taking means:

"… d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:
…
ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."

2.3.3 Paragraph 54 on planning conditions and obligations states:

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

2.3.4 Paragraph 102 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; …"

2.3.5 Paragraph 103 continues 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."

2.3.6 Paragraph 170 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…"

2.3.7 Paragraph 180 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."

2.3.8 Paragraph 181, also 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."

Planning Practice Guidance

2.3.9 Planning Practice Guidance (PPG) (Planning Practice Guidance, 2014) was first published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-007-20140306 (revision date 06.03.2014) of the PPG provides a summary as to why air quality is a consideration for planning:

"… Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit… The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives

have been, or will be, achieved at relevant locations, by an applicable date… If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan… Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive… Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

2.3.10 Paragraph 002 of the PPG concerns the role of Local Plans with regard to air quality;

"… Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider;

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution…; and*
- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

2.3.11 Paragraph 005 of the PPG identifies when air quality could be relevant for a planning decision;

"… When deciding whether air quality is relevant to a planning application, considerations could include whether the development would;

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in 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; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Areas;*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality;*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations; and*
- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.3.12 Paragraph 007 of the PPG provides guidance on how detailed an assessment needs to be;

"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific."

2.3.13 Paragraph 008 of the PPG provides guidance on how an impact on air quality can be mitigated;

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact… Examples of mitigation include;

- *the design and layout of development to increase separation distances from sources of air pollution;*
- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*
- *means of ventilation;*
- *promoting infrastructure to promote modes of transport with low impact on air quality;*
- *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."*

2.3.14 Paragraph 009 of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment;

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."

Local Policy

2.3.15 CDC Local Plan Key Policies 2014-2029 includes development management policies and was designed to provide the vision and framework that will shape the future of Chichester District outside the South Downs National Park area (CDC, 2014). Policy 39 on Transport, Accessibility and Parking states:

"*Planning permission will be granted for development where it can be demonstrated that all the following criteria have been considered:*

2. Development is located and designed to minimise additional traffic generation and movement, and should not create or add to problems of safety, congestion, air pollution, or other damage to the environment; ...

Where development is likely to have an impact on an Air Quality Management Area, an air quality assessment will be required."

Chichester District Council Air Quality Action Plan

2.3.16 CDC AQAP "*builds on what has been achieved through the previous document and includes some ambitious actions for tackling local air quality issues. It sets out the basis for our understanding of air quality and its impacts through monitoring and reporting, encourages the use of fiscal measures to tackle vehicle related pollution and recommends a partnership approach to bring more resource to bear in continuing times of austerity*" (CDC, 2015).

2.3.17 The AQAP five priorities for action comprise the strategic approach for tackling air pollution across Chichester District:

- Priority 1: Measure, model, and report on air quality
- Priority 2: Strengthen partnerships, seek funds, pool resources and exploit synergies
- Priority 3: Encourage low emission technology
- Priority 4: Encourage and foster behavioural change/modal shift
- Priority 5: Be innovative, capitalise on opportunities and celebrate our successes, reduce emissions by 1%.

3 Methodology

3.1 Existing Conditions

3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by CDC. Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2018).

3.2 Road Traffic Impacts

Human Health Receptors

3.2.1 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

3.2.2 Based on the above criteria, eighteen existing properties have been identified as residential receptors for the assessment. The locations of existing residential receptors were chosen to represent locations where impacts from road traffic related to the Local Plan are likely to be the greatest, i.e. as a result of development traffic at junctions. These locations are described in **Table 3.1**. Receptors were modelled at a height of 1.5 m representing ground floor exposure (shown in **Figure 1**).

3.2.3 Concentrations have also been predicted at two automatic sites and four diffusion tube locations in order to verify the modelled results (see **Appendix C** for further details on the verification method).

Table 3.1: Receptor Locations Description

Receptor	Location	x	y	Height (m)
Existing Receptor				
R1	Funtington Hall	480020	108332	1.5
R2	Christmas Cottage	480065	108334	1.5
R3	Snowdens	480207	108405	1.5
R4	Swallow Cottage	480237	108452	1.5
R5	1 Salthill Road	483485	104717	1.5
R6	118 Fishbourne Road W	483509	104710	1.5
R7	52 Stockbridge Road	485704	103792	1.5
R8	51 Stockbridge Road	485742	103790	1.5
R9	1 to 9 Claremont Court	485773	103845	1.5
R10	Citadel House	485858	105180	1.5
R11	152 Orcha Road St	485873	105174	1.5
R12	190 Orcha Road St	485956	105196	1.5

Receptor	Location	x	y	Height (m)
R13	193 Orcha Road St	485970	105217	1.5
R14	5 St Pauls's Road	485995	105237	1.5
R15	The Old Mill	486020	105221	1.5
R16	213 Oving Road,	487277	104881	1.5
R17	Musgrove House, 63 Oving Road	487295	104897	1.5
R18	2 St James' Road	487307	104899	1.5

Ecological Receptors

3.2.4 For each of the Natura 200 designated sites (Pagham Harbour SPA and Ramsar Site, Chichester and Langstone Harbours SPA and Ramsar, and Solent Maritime SAC), concentrations of nitrogen oxides have been predicted, and deposition calculated, at a range of transects at increasing distances from the adjacent road network in order to indicate whether or not the critical level and critical loads are being exceeded in the habitats. These locations are shown in **Figure 1** and in **Table 3.2**.

3.2.5 The assessment has been undertaken against criteria for the most sensitive habitat present at each location following APIS information.

Table 3.2: Receptor Location Descriptions

Receptor	Location	X	y	Height (m)
	Ecological Receptors			
CH 0m	Chichester and Langstone Harbours SPA, Ramsar and SAC/ Solent Maritime SAC (Unit 29)	483518*	104672	0.0
PH Un18	Pagham Harbour SPA, Ramsar, and SAC (Unit 18)	485628*	96464	0.0
PH Un5	Pagham Harbour SPA, Ramsar, and SAC (Unit 5)	485701*	97758	0.0

* 0 metres coordinate

Impact Predictions

3.2.6 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2017 meteorological data from the Thorney Island meteorological station, which are considered suitable for this area (see **Appendix C** for further details on the model inputs).

3.2.7 AADT flows and the proportions of HDVs, for roads within 250 m of the road network modelled, existing receptors and monitoring sites have been provided by Peter Brett Associates. Traffic data used in this assessment are summarised in **Appendix D**.

3.2.8 The Local Plan of Strategic Development Options and Sustainable Transport Measures report includes a detailed explanation of the assessed scenarios (PBA, 2018). The three strategic sites development quanta for Local Plan scenarios were assessed:

- Scenario 1 with 600 dwellings per annum (dpa)
- Scenario 2 with 800 dwellings per annum
- Scenario 3 with 1,000 dwellings per annum

3.2.9 Scenario 3, with 1,000 dpa, has the highest increase in traffic flows on the road network. This scenario as therefore been assessed as representative of the worst-case scenario.

3.2.10 Furthermore, the network impacts of the Local Plan with proposed mitigation in place for Scenario 1 compared to the reference case (2035 future baseline) were assessed. Mitigation in the form of junction improvements is proposed in the local plan to accommodate the proposed scale of development (PBA, 2018).

3.2.11 The following scenarios have been modelled to assess the air quality impacts:

- 2017 existing baseline and model verification;
- 2035 Future baseline (with 2025 emission factors and background);
- 2035 Scenario 3 (with 2025 emission factors and background);
- 2035 Scenario 1 with mitigation measures (with 2025 emission factors and background).

3.2.12 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v8.0, which utilises NO_x emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model.

3.2.13 In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been carried out utilising 2025 emission factors and background concentrations combined with traffic data from 2035, this is considered a conservative assumption of emissions in the future. **Appendix E** provides a justification for the selection of future year vehicle emission factors.

Assessment Criteria

Human Health Impacts

3.2.14 The relevant objectives for human health are set out in **Table 2.1** and **Table 2.2**. There is no official guidance in the UK on how to assess the significance of air quality impacts of a new development. The approach developed by the IAQM and Environmental Protection UK (EPUK), which considers the change in air quality as a result of a proposed development on existing receptors, has therefore been used (Moorcroft and Barrowcliffe *et al.*, 2017).

3.2.15 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.

3.2.16 **Table 3.3** sets out the impact magnitude descriptors, whilst **Table 3.4** sets out the impact descriptors.

Table 3.3: Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (Change in Concentration)	Annual Mean NO_2 and PM_{10} (40 µg/m³)	Annual Mean $PM_{2.5}$ (25 µg/m³)	Annual Mean of 32 µg/m³ equating to 35 days above 50 µg/m³ for PM_{10}
Very Large (>9.5%)	≥3.8 µg/m³	≥2.375 µg/m³	≥3.04 µg/m³
Large (>5.5% - ≤9.5%)	>2.2 – ≤3.8 µg/m³	>1.375 – ≤2.375 µg/m³	>1.76 - ≤3.04 µg/m³
Medium (>1.5% - ≤5.5%)	>0.6 – ≤2.2 µg/m³	>0.375 – ≤1.375 µg/m³	>0.48 - ≤1.76 µg/m³
Small (>0.5% - ≤1.5%)	>0.2 – ≤0.6 µg/m³	>0.125 – ≤0.375 µg/m³	>0.16 - ≤0.48 µg/m³
Imperceptible (≤0.5%)	≤0.2 µg/m³	≤0.125 µg/m³	≤0.16 µg/m³

Table 3.4: Impact Descriptor for Changes in Concentration at a Receptor

Concentration with the development in place in relation to Objective / Limit Value	Change in Concentration				
	Imperceptible	Small	Medium	Large	Very Large
> 109.5 % (a)	Negligible	Moderate	Major	Major	Major
>102.5% - ≤109.5% (b)	Negligible	Moderate	Moderate	Major	Major
>94.5% - ≤102.5% (c)	Negligible	Minor	Moderate	Moderate	Major
>75.5% - ≤94.5% (d)	Negligible	Negligible	Minor	Moderate	Moderate
≤75.5% (e)	Negligible	Negligible	Negligible	Minor	Moderate

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.
(a) NO_2 or PM_{10}: > 44 µg/m³ annual mean; $PM_{2.5}$ >27.5 µg/m³ annual mean; PM_{10} >35.2 µg/m³ annual mean (days)
(b) NO_2 or PM_{10}: > 40.8 – ≤ 44 µg/m³ annual mean; $PM_{2.5}$ > 25.5 – ≤27.5 µg/m³ annual mean; PM_{10} >32.6 – ≤35.2 µg/m³ annual mean (days)
(c) NO_2 or PM_{10}: > 38 – ≤40.8 µg/m³ annual mean; $PM_{2.5}$ >23.75 – ≤25.5 µg/m³ of annual mean; PM_{10} >30.4 – ≤32.6 µg/m³ annual mean (days)
(d) NO_2 or PM_{10}: >30 - ≤38 µg/m³ annual mean; $PM_{2.5}$ >18.75 - ≤23.6 µg/m³ annual mean; PM_{10} <24 - ≤ 30.4 µg/m³ annual mean (days)
(e) NO_2 or PM_{10}: ≤30 µg/m³ annual mean; $PM_{2.5}$ ≤18.75 µg/m³; annual mean; PM_{10} ≤24 µg/m³ annual mean (days)

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

- the number of properties affected by minor, moderate or major air quality impacts and a judgement on the overall balance;
- the magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 3.3** and **3.4** findings;
- whether or not an exceedance of an objective 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 objective or limit value is exceeded.

3.2.18 Where impacts can be considered in isolation at an individual receptor, moderate or major impacts (i.e. per **Table 3.4**) may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, 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.

Ecological Receptors

3.2.19 The critical loads for the ecological receptors are presented in **Table 3.5** below.

Table 3.5: Deposition and Site Relevant Critical Loads

Habitat(s)	Total Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		Nitrogen (keqN/ha/yr)	Sulphur (keqS/ha/yr)
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)			
Critical Load/Level	20 – 30	Not Sensitive	Not Sensitive
Pagham Harbour SPA and Ramsar - Neutral Grassland (Unit 18)			
Critical Load/Level	20 – 30	5.071	4.0
Pagham Harbour SPA and Ramsar - Broadleaved, Mixed and Yew Woodland (Unit 5)			
Critical Load/Level	10 – 20	0.357	1.82

3.2.20 Where critical loads are already exceeded, an increase of more than 1% of the critical load is an indication of potentially significant effects which would trigger the need for further, more detailed assessment. It should be noted that an increase in deposition of more than 1% is not, per se, an indication that a significant effect exists, only the possibility of one. Depending on a more detailed assessment which would take account of the actual ecological conditions at the location under consideration, an increase of more than 1% may be acceptable.

3.2.21 The same approach applies for the NO_x critical level of 30 µg/m^3 shown in **Table 2.3**.

Assumptions and Limitations

3.2.22 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data 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.

3.2.23 A disparity between national road transport emissions projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean nitrogen oxides and NO_2 concentrations from road traffic emissions should have fallen significantly over the past 6 – 8 years, at many monitoring sites levels have remained relatively stable, or have shown a slight increase (Carslaw, 2011).

3.2.24 The complete development modelling has been based on 2025 emission factors and background concentrations, whilst utilising traffic flows for 2035. The model has been verified against 2017 monitoring data. This is considered to provide an appropriately conservative assessment, taking into account the uncertainties regarding future vehicle emission factors.

4 Baseline Conditions

4.1 LAQM

4.1.1 CDC has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, three AQMAs have been declared due to exceedances of the annual mean NO_2 objective (**Figure 2**):

- Chichester St Pancras AQMA - an area along St Pancras Road between Eastgate Square and New Park Road;
- Chichester (Orchard St) AQMA - an area along Orchard Street at the eastern end of the street where it meets Northgate; and
- Chichester (Stockbridge Roundabout) AQMA - an area encompassing the Stockbridge Roundabout at the junction of the Chichester bypass and Stockbridge Road.

4.2 Monitoring

Nitrogen Dioxide

4.2.1 CDC carries out automatic monitoring and deploys NO_2 diffusion tubes at a number of locations (**Figure 2**). The monitoring locations within Chichester City are described in **Table 4.1** below.

Table 4.1: Measured NO_2 Concentrations

Site ID	Location	Site Type	Within AQMA	Annual Mean (µg/m³)				
				2013	2014	2015	2016	2017
Automatic Site								
CI1*	Stockbridge	S	N	32	33	34	34	33
CI4*	Orchard Street	R	Y	27	34	x	29	23
Diffusion Tubes								
1	Kings Ave/ Southbank Jct	R	N	30	32	30	33	29
2*	Claremont Court	R	Y	**42**	**42**	**42**	**42**	39
3*	Cabin	S	N	30	33	34	34	33
4*	Cabin	S	N	33	33	34	33	32
5*	Cabin	S	N	33	33	34	35	34
6*	Stockbridge Road South	R	N	**45**	**41**	**41**	**43**	36
7	Cleveland Rd	UB	N	20	16	17	18	16
8	Westhampnett Road	R	N	36	31	30	31	30
9	Hornet	R	N	**42**	38	**40**	**41**	38
10	St Pancras	R	Y	**53**	**52**	**46**	**51**	**44**
11	Arthur Purchase	UB	N	20	18	18	20	18
12*	174 Orchard St	R	Y	38	39	33	38	33
	Objective			**40**				

Exceedances of the objective highlighted in bold. R= Roadside; S = Suburban; UB = Urban Background.
2013 – 2017 data taken from 2018 Air Quality Annual Status Report.
*Used for model verification

Table 4.2: Measured Exceedances of the Hourly Mean NO_2 Objective

Site ID	Number of Hours >200µg/m^3				
	2013	2014	2015	2016	2017
CI1	0	0	0	0	0
Objective	**18 (200)**				

4.2.2 Measured concentrations have been below the relevant objective at all monitoring locations except at 2, 6, 9 and 10. Monitoring locations 6 and 9 are not within an AQMA and the measured concentration in 2017 were below the objective. At the majority of locations, pollutant concentrations were lower in 2017 than in 2013.

PM_{10}

4.2.3 The results of the PM_{10} monitoring are shown in **Table 4.3** below.

Table 4.3: Measured PM_{10} and $PM_{2.5}$ Concentrations

Site ID	Location	2013	2014	2015	2016	2017
Annual Mean PM_{10} (µg/m^3)						
CI1	Stockbridge	20	20	21	20	19
Objective		**40**				
Number of days > 50µg/m^3						
CI1	Stockbridge	1	2	3	2	1
Objective		**35**				

4.2.4 Measured PM_{10} concentrations have well been below the relevant objectives and limit values for the past five years.

4.3 Baseline Deposition – Ecological Receptors

4.3.1 The three-year average (2013 – 2015) nitrogen and acid deposition rates for each of the Designated Sites sensitive habitats to either nitrogen or acid deposition are presented in **Table 4.4**; data have been taken from the APIS website. The APIS data does not include future year predictions and therefore on a conservative basis, the APIS baseline is assumed constant for the future year assessments.

Table 4.4: Baseline Deposition Rates

Habitat(s)	Total Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		Nitrogen (keqN/ha/yr)	Sulphur (keqS/ha/yr)
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)			
2016	**12.04**	Not Sensitive	Not Sensitive
Critical Load/Level	**20 – 30**		
Pagham Harbour SPA and Ramsar - Neutral Grassland (Unit 18)			
2016	12.04	0.86	0.16
Critical Load/Level	**20 – 30**	**5.071**	**4.00**
Pagham Harbour SPA and Ramsar - Broadleaved, Mixed and Yew Woodland (Unit 5)			

Habitat(s)	Total Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		Nitrogen (keqN/ha/yr)	Sulphur (keqS/ha/yr)
2016	**19.6**	1.4	0.19
Critical Load/Level	**10 – 20**	**2.173**	**1.82**

4.3.2 The total nitrogen deposition exceeds the relevant critical load for Pagham Harbour SPA within the Broadleaved, Mixed and Yew Woodland habitat. The acid deposition background deposition rates do not exceed the relevant critical loads for the remaining ecological receptors with neutral grassland habitats. Coastal and Floodplain Grazing Marsh habitats are not sensitive to acid deposition.

4.4 Background Concentrations

4.4.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (Defra, 2018) (shown in **Table 4.5**). The mapped background concentrations were calibrated against background concentrations measured at two urban background monitoring sites (see **Appendix G** for more details).

Table 4.5: Estimated Annual Mean Background Concentrations

Year	Location	Annual Mean (µg/m³)			
		NO_x	NO_2	PM_{10}	$PM_{2.5}$
2017	486_104	24.7	17.9	15.0	14.6
	486_105	22.1	16.2	14.4	14.0
	485_103	19.2	14.4	13.8	13.4
	480_108	13.8	10.5	13.7	13.4
	487_104	26.4	19.1	15.5	15.3
	483_104	15.0	11.4	13.3	13.0
	485_096	13.7	10.4	11.5	7.3
	485_097	12.5	9.6	11.9	7.7
2025	486_104	18.0	13.4	10.2	9.7
	486_105	16.3	12.2	9.6	9.3
	485_103	13.8	10.5	8.9	8.6
	480_108	10.5	8.1	8.8	8.5
	487_104	19.5	14.5	10.2	10.0
	483_104	11.2	8.6	8.7	8.4
	485_096	11.2	8.6	11.2	7.1
	485_097	9.8	7.6	11.6	7.4
Objectives		**-**	**40**	**40**	**25**

4.4.2 The background concentrations are all well below the relevant objectives.

4.5 Predicted Baseline Concentrations

Human Health Receptors

4.5.1 The ADMS-Roads model has been run to predict baseline NO_2, PM_{10} and $PM_{2.5}$ concentrations at each of the existing receptor locations identified in **Table 3.1**. The results for the baseline scenarios are presented in **Table 4.6** below.

Table 4.6: Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$

Receptor	Annual Mean (µg/m³)					
	NO_2		PM_{10}		$PM_{2.5}$	
	2017	2035	2017	2035	2017	2035
R1	20.7	15.2	16.7	17.0	10.7	10.6
R2	21.5	15.9	17.0	17.4	10.8	10.8
R3	24.6	17.9	18.0	18.4	11.4	11.4
R4	25.7	18.8	18.4	18.9	11.7	11.7
R5	19.1	13.6	15.6	15.5	10.1	9.8
R6	21.8	15.3	16.3	16.2	10.5	10.3
R7	38.1	21.1	22.2	20.0	14.0	12.2
R8	**47.3**	25.5	26.0	22.9	16.2	13.8
R9	**49.7**	23.6	26.9	21.5	16.8	13.0
R10	26.4	17.2	19.4	18.6	12.6	11.8
R11	29.6	19.0	20.9	20.0	13.5	12.6
R12	29.0	18.7	20.5	19.6	13.2	12.4
R13	27.4	17.8	19.4	18.6	12.6	11.8
R14	27.9	18.2	19.1	18.4	12.5	11.7
R15	33.6	21.6	20.7	19.9	13.4	12.5
R16	24.6	17.1	17.4	16.8	11.3	10.9
R17	27.0	18.3	18.3	17.6	11.9	11.3
R18	30.0	19.6	19.4	18.4	12.6	11.8
Objectives	**40**		**40**		**25**	

Exceedances highlighted in bold

4.5.2 The annual mean NO_2 objectives are not predicted to be exceeded at any of the existing receptor locations in 2017, except for receptors R7 and R8 at Stockbridge Road. The annual mean PM_{10} and $PM_{2.5}$ objectives are not predicted to be exceeded at any of the existing receptor locations in 2017.

4.5.3 The annual mean NO_2, PM_{10} and $PM_{2.5}$ objectives are not predicted to be exceeded at any of the existing receptor locations in 2035. Baseline concentrations are predicted to decrease between 2017 and 2035 as vehicle emission factors and background concentrations are assumed to improve.

4.5.4 None of the predicted annual mean NO_2 concentrations exceed 60 µg/m³ and therefore exceedance of the 1-hour mean NO_2 objective is unlikely.

4.5.5 None of the predicted annual mean PM_{10} concentrations exceed 32 µg/m³ and therefore the 24-hour mean PM_{10} objective is not predicted to be exceeded.

Ecological Receptors

4.5.6 Predicted concentrations and deposition rates for the baseline scenarios are presented in **Appendix G**.

4.5.7 The background nitrogen deposition rate does not exceed the relevant critical load at Chichester and Langstone Harbours/Solent Maritime SPA (Unit 29) and at Pagham Harbour SPA (Unit 18) both in 2017 and 2035. The background nitrogen deposition rate exceeds the relevant critical load at Pagham Harbour SPA (Unit 5) and therefore the nitrogen critical load is exceeded in both 2017 and 2035. The NO_x critical level is predicted to be exceeded up to 10 m from the road for Pagham Harbour (Unit 5 and Unit 18).

4.5.8 The acid deposition critical load is not predicted to be exceeded at Pagham Harbour (Unit 5 and Unit 18). Chichester and the habitats supported by Langstone Harbours/Solent Maritime SPA (Unit 29) is not sensitive to acid deposition.

5 Impact Assessment

5.1 Roads Qualitative Assessment

5.1.1 The qualitative assessment considers the change in traffic numbers and the likely change in vehicle emissions to ascertain if an adverse impact on air quality will result. **Appendix E** provides an explanation of the predicted changes and relative decline in vehicle NO_x emission factors expected in the future with the reinforcement of emissions standards and introduction of new technologies.

5.1.2 **Appendix E** graph shows the relative decline in vehicle NO_x emissions predicted for a road in England (not London) with 5% Heavy Duty Vehicle traffic travelling at 50 kph. The relative decline in NO_x emissions is likely to lie between the green and red curves, which represents a decline in more than 50% by 2030 when compared with 2017. With the expected reductions in both vehicle emissions and emissions from other sources (such as power stations), air quality is not expected to decline at locations that currently meet the objectives.

5.1.3 The areas that currently experience exceedances of the air quality objectives or that will have a significant increase in traffic in close proximity to sensitive receptors have been modelled and the results are presented in **section 5.2** below. Apart for the assessed road network, no new areas that might experience exceedances of the air quality objectives are expected in the future within CDC as the predicted decline in NO_x emissions will counteract the road traffic increase.

5.2 Modelled Road Traffic Impacts

Scenario 3 Human Health Receptors

5.2.1 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2035 for Local Plan scenario 3 are presented in **Table 5.1** below.

Table 5.1: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Existing Receptors

Receptor	2035 Annual Mean (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	Base	SCN 3	Change	Base	SCN 3	Change	Base	SCN 3	Change
R1	15.2	17.6	2.32	17.0	18.3	1.25	10.6	11.3	0.72
R2	15.9	18.4	2.49	17.4	18.7	1.35	10.8	11.6	0.78
R3	17.9	20.7	2.80	18.4	19.9	1.53	11.4	12.2	0.89
R4	18.8	21.8	3.06	18.9	20.6	1.70	11.7	12.7	0.98
R5	13.6	15.7	2.13	15.5	16.6	1.09	9.8	10.5	0.63
R6	15.3	18.0	2.62	16.2	17.5	1.25	10.3	11.0	0.73
R7	21.1	23.2	2.11	20.0	21.4	1.42	12.2	13.0	0.78
R8	25.5	27.9	2.35	22.9	24.5	1.64	13.8	14.7	0.91
R9	23.6	24.7	1.04	21.5	22.2	0.70	13.0	13.4	0.39
R10	17.2	18.5	1.24	18.6	19.6	0.97	11.8	12.3	0.53
R11	19.0	20.6	1.59	20.0	21.3	1.25	12.6	13.3	0.69
R12	18.7	20.1	1.39	19.6	20.7	1.08	12.4	13.0	0.59
R13	17.8	18.9	1.14	18.6	19.5	0.83	11.8	12.3	0.46
R14	18.2	19.1	0.84	18.4	19.0	0.56	11.7	12.0	0.31
R15	21.6	23.0	1.32	19.9	20.7	0.87	12.5	13.0	0.48
R16	17.1	17.8	0.70	16.8	17.3	0.44	10.9	11.1	0.24

Receptor	2035 Annual Mean (µg/m^3)								
	NO_2			PM_{10}			$PM_{2.5}$		
	Base	SCN 3	Change	Base	SCN 3	Change	Base	SCN 3	Change
R17	18.3	19.2	0.87	17.6	18.1	0.54	11.3	11.6	0.30
R18	19.6	20.8	1.17	18.4	19.1	0.74	11.8	12.2	0.41
Objective	**40**		**-**	**40**		**-**	**25**		**-**

5.2.2 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations in 2035 for both baseline and scenario 3 are below the relevant objectives at all existing receptor locations.

5.2.3 The impact magnitude and descriptors are presented in **Table 5.2**.

Table 5.2: Impact Magnitude and Descriptors for Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Receptor	Impact Magnitude			Impact Descriptor		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R2	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R3	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R4	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R5	Medium	Medium	Medium	Negligible	Negligible	Negligible
R6	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R7	Medium	Medium	Medium	Negligible	Negligible	Negligible
R8	Large	Medium	Medium	Minor Adverse	Negligible	Negligible
R9	Medium	Medium	Medium	Negligible	Negligible	Negligible
R10	Medium	Medium	Medium	Negligible	Negligible	Negligible
R11	Medium	Medium	Medium	Negligible	Negligible	Negligible
R12	Medium	Medium	Medium	Negligible	Negligible	Negligible
R13	Medium	Medium	Medium	Negligible	Negligible	Negligible
R14	Medium	Small	Small	Negligible	Negligible	Negligible
R15	Medium	Medium	Medium	Negligible	Negligible	Negligible
R16	Medium	Small	Small	Negligible	Negligible	Negligible
R17	Medium	Small	Small	Negligible	Negligible	Negligible

Receptor	Impact Magnitude			Impact Descriptor		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R18	Medium	Medium	Medium	Negligible	Negligible	Negligible

5.2.4 Based on the impact magnitude descriptors presented in **Table 3.3**, the changes in annual mean NO_2 concentrations range from medium to large. Large changes occur at receptors R1 to R4 (Funtington), R6 (Fishbourne) and R8 (Stockbridge roundabout). The changes in PM_{10} and $PM_{2.5}$ concentrations range from small to medium.

5.2.5 Using the criteria set out in **Table 3.4**, the impact on annual mean NO_2 concentrations is described as minor adverse at receptors with large changes, i.e. R1 to R4, R6 and R8. Large changes result in minor adverse impacts because the predicted concentration is below 75% of the objective (i.e. below 30 µg/m^3). All other receptors experience negligible impacts.

5.2.6 The impact on PM_{10} and $PM_{2.5}$ concentrations is described as negligible. The annual mean of 32 µg/m^3 equating to 35 days above 50 µg/m^3 for PM_{10} is described as being negligible at all receptor locations.

Scenario 3 Ecological Receptors

5.2.7 Predicted concentrations and deposition rates for 2035 baseline and Scenario 3 are presented in **Appendix F.** Scenario 3 NO_x contribution, nitrogen and acid deposition contributions are presented in **Appendix G.**

5.2.8 The critical load at Chichester and Langstone Harbours/Solent Maritime SPA (Unit 29) and at Pagham Harbour SPA (Unit 18) is not exceeded in both the 2035 baseline and Scenario 3. The baseline nitrogen deposition rate exceeds the relevant critical load at Pagham Harbour SPA (Unit 5) and therefore the nitrogen critical load is exceeded in both the 2035 baseline and Scenario 3. The NO_x critical level is predicted to be exceeded adjacent to the road (at 0 m) at Pagham Harbour (Unit 5 and Unit 18) in 2035. The NO_x critical level exceedance increases to 5 m in scenario 3.

5.2.9 The acid deposition critical load is not predicted to be exceeded at Pagham Harbour (Unit 5 and Unit 18).

5.2.10 The NO_x concentration at Chichester and Langstone Harbours/Solent Maritime SPA (Unit 29) does not exceed the critical level in Scenario 3, and the increase in nitrogen deposition is a maximum of 0.5% of the critical load and therefore not significant.

5.2.11 The NO_x critical level is exceeded at Pagham Harbour SPA (Unit 18) up to less than 10 m from the road, and therefore the road traffic impacts are considered not significant given the limited extent of the impact. The nitrogen deposition critical load is not exceeded.

5.2.12 The NO_x critical level at Pagham Harbour SPA (Unit 5) is exceeded up to 5 m from the road and therefore considered not significant over this short distance. The nitrogen deposition is above 1% of the critical load up to 75 m (with a maximum of 12.2% adjacent to the road), therefore, potentially significant over this distance. The area of the habitat subject to increases above 1% is 0.3% of the total area of the designated site, and only related with the western section adjacent to the B2145 Selsey Road. Moreover, the woodland is not important for the SPA and Ramsar interest features.

5.2.13 The assessment has been undertaken assuming that there will be no reduction in background deposition in the future, as this is not accounted for within the APIS website predictions, and using 2025 backgrounds and emissions factors. For Pagham Harbour SPA (Unit 5), where the nitrogen deposition critical load is exceeded, the increase in deposition is 5.2% or less of the future baseline deposition rates.

5.2.14 Reductions in baseline deposition will occur as a result of improvements in background pollutant concentrations in the future, from reductions in both vehicle emissions and emissions from other sources such as power stations. Such reductions in nitrogen deposition are likely to outweigh the predicted increases in deposition as a result of the Local Plan.

Scenario 1 With Mitigation Human Health Receptors

5.2.15 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2035 for Scenario 1 with mitigation are presented in **Table 5.3** below.

Table 5.3: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Existing Receptors

Receptor	2035 Annual Mean (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	Base	SCN 1 Mit	Change	Base	SCN 1 Mit	Change	Base	SCN 1 Mit	Change
R1	15.2	15.9	0.63	17.0	17.3	0.31	10.6	10.8	0.18
R2	15.9	16.6	0.68	17.4	17.7	0.34	10.8	11.0	0.19
R3	17.9	18.6	0.76	18.4	18.8	0.37	11.4	11.6	0.22
R4	18.8	19.5	0.73	18.9	19.3	0.36	11.7	11.9	0.21
R5	13.6	14.6	1.07	15.5	16.0	0.57	9.8	10.2	0.33
R6	15.3	16.4	1.06	16.2	16.8	0.56	10.3	10.6	0.32
R7	21.1	19.8	-1.28	20.0	19.1	-0.85	12.2	11.7	-0.47
R8	25.5	24.6	-0.93	22.9	22.2	-0.65	13.8	13.4	-0.36
R9	23.6	23.0	-0.65	21.5	21.1	-0.44	13.0	12.8	-0.24
R10	17.2	18.3	1.05	18.6	19.4	0.83	11.8	12.3	0.46
R11	19.0	20.4	1.35	20.0	21.1	1.09	12.6	13.2	0.60
R12	18.7	19.9	1.15	19.6	20.5	0.90	12.4	12.9	0.49
R13	17.8	18.7	0.93	18.6	19.3	0.68	11.8	12.2	0.37
R14	18.2	18.9	0.65	18.4	18.9	0.43	11.7	12.0	0.24
R15	21.6	22.7	1.08	19.9	20.6	0.71	12.5	12.9	0.40
R16	17.1	17.6	0.48	16.8	17.1	0.30	10.9	11.0	0.17
R17	18.3	18.9	0.61	17.6	18.0	0.37	11.3	11.5	0.21
R18	19.6	20.1	0.49	18.4	18.7	0.31	11.8	11.9	0.17
Objective	**40**		-	**40**		-	**25**		-

Mit = Mitigation

5.2.16 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations in 2035 for both baseline and scenario 1 with mitigation are below the relevant objectives at all existing receptor locations.

5.2.17 The impact magnitude and descriptors are presented in **Table 5.4**.

Table 5.4: Impact Magnitude and Descriptors for Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Receptor	Impact Magnitude			Impact Descriptor		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	Medium	Small	Small	Negligible	Negligible	Negligible

Receptor	Impact Magnitude			Impact Descriptor		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R2	Medium	Small	Small	Negligible	Negligible	Negligible
R3	Medium	Small	Small	Negligible	Negligible	Negligible
R4	Medium	Small	Small	Negligible	Negligible	Negligible
R5	Medium	Small	Small	Negligible	Negligible	Negligible
R6	Medium	Small	Medium	Negligible	Negligible	Negligible
R7	Medium	Medium	Small	Negligible	Negligible	Negligible
R8	Medium	Medium	Small	Negligible	Negligible	Negligible
R9	Medium	Small	Medium	Negligible	Negligible	Negligible
R10	Medium	Medium	Medium	Negligible	Negligible	Negligible
R11	Medium	Medium	Medium	Negligible	Negligible	Negligible
R12	Medium	Medium	Small	Negligible	Negligible	Negligible
R13	Medium	Medium	Small	Negligible	Negligible	Negligible
R14	Medium	Small	Medium	Negligible	Negligible	Negligible
R15	Medium	Medium	Small	Negligible	Negligible	Negligible
R16	Small	Small	Small	Negligible	Negligible	Negligible
R17	Medium	Small	Small	Negligible	Negligible	Negligible
R18	Small	Small	Small	Negligible	Negligible	Negligible

5.2.18 Based on the impact magnitude descriptors presented in **Table 3.3**, the changes in annual mean NO_2 concentrations range from small to medium. Medium changes occur at all receptors, except for receptors R16 and R18 at Portfield. The changes in PM_{10} and $PM_{2.5}$ concentrations range from small to medium.

5.2.19 Using the criteria set out in **Table 3.4**, the impact on annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations is described as negligible at all receptors. Medium changes result in negligible impacts because the predicted concentration is below 75% of the objective (i.e. below 30 $\mu g/m^3$).

5.2.20 The annual mean of 32 $\mu g/m^3$ equating to 35 days above 50 $\mu g/m^3$ for PM_{10} is described as negligible at all receptor locations.

Scenario 1 With Mitigation Ecological Receptors

5.2.21 Predicted concentrations and deposition rates for 2035 baseline and Scenario 1 with mitigation are presented in **Appendix H.** Scenario 1 with mitigation NO_x contribution, nitrogen and acid deposition contributions are also presented in **Appendix I.**

5.2.22 The critical load at Chichester and Langstone Harbours/Solent Maritime SPA (Unit 29) and at Pagham Harbour SPA (Unit 18) is not exceeded in both the 2035 baseline and Scenario 1 with mitigation. The baseline nitrogen deposition rate exceeds the relevant critical load at Pagham Harbour SPA (Unit 5) and therefore the nitrogen critical load is exceeded in both the 2035 baseline and Scenario 1 with mitigation. The NO_x critical level is predicted to be exceeded adjacent to the road (at 0 m) at Pagham Harbour (Unit 5 and Unit 18) in 2035. The NO_x critical level exceedance increases to 5 m in scenario 1 with mitigation for Pagham Harbour (Unit 18).

5.2.23 The acid deposition critical load is not predicted to be exceeded at Pagham Harbour (Unit 5 and Unit 18).

5.2.24 The NO_x concentration at Chichester and Langstone Harbours/Solent Maritime SPA (Unit 29) does not exceed the critical level in Scenario 1 with mitigation, and the increase in nitrogen deposition is a maximum of 0.6% of the critical load and therefore not significant.

5.2.25 The NO_x critical level is exceeded at Pagham Harbour SPA (Unit 18) up to less than 10 m from the road, and therefore the road traffic impacts are considered not significant given the limited extent of the impact. The nitrogen deposition critical load is not exceeded.

5.2.26 The NO_x critical level at Pagham Harbour SPA (Unit 5) is exceeded up to 5 m from the road and therefore considered not significant over this short distance. The nitrogen deposition is above 1% of the critical load up to 20 m (with a maximum of 4.7% adjacent to the road), therefore, potentially significant over this distance. The area of the habitat subject to increases above 1% is less than 0.3% of the total area of the designated site, and only related with the western section adjacent to the B2145 Selsey Road. Moreover, the woodland is not important for the SPA and Ramsar interest features.

5.2.27 The assessment has been undertaken assuming that there will be no reduction in background deposition in the future, as this is not accounted for within the APIS website predictions, and using 2025 backgrounds and emissions factors. For Pagham Harbour SPA (Unit 5), where the nitrogen deposition critical load is exceeded, the increase in deposition is 2.0% or less of the future baseline deposition rates.

5.2.28 Reductions in baseline deposition will occur as a result of improvements in background pollutant concentrations in the future, from reductions in both vehicle emissions and emissions from other sources such as power stations. Such reductions in nitrogen deposition are likely to outweigh the predicted increases in deposition as a result of the Local Plan.

Impact Significance

5.2.29 Overall, considering the conservative nature of the assessment, and the criteria set out in **Section 2.2.8,** the air quality effects on human health receptors of road traffic generated by the Local Plan, for both scenario 3 and scenario 1 with mitigation, is considered to be not significant as there are no predicted exceedances of the relevant air quality strategy objectives at any of the existing receptor locations (refer to **Table 3.1**).

5.2.30 Overall, given the extent and location of the road traffic impacts on designated sites, the Local Plan impacts on ecological receptors is deemed to be not significant.

6 Conclusions

6.1.1 The air quality impacts associated with the Chichester Local Plan Review: 2016-2035, have been assessed.

6.1.2 For the Local Plan evidence base, an assessment of the air quality impacts of the plan proposals was undertaken where the increase in traffic is above 30% compared to the 2035 reference case, or on routes which pass through or adjacent to designated Air Quality Management Areas (AQMA), if an increase of at least 50 Passenger Car Unit (PCU)/hr is forecast in these areas. Further to these criteria, only links with relevant sensitive receptors based on the proximity to the kerb of existing properties and total vehicle flows on the road network were modelled. Road links with total AADT below 10,000 vehicles and no existing properties close to the kerb were scoped out of this assessment since road traffic impacts are considered to be not significant.

6.1.3 To date, three AQMAs have been declared due to exceedances of the annual mean NO_2 objective: Chichester St Pancras AQMA, Chichester (Orchard St) AQMA and Chichester (Stockbridge Roundabout) AQMA. Chichester St Pancras AQMA was scoped out of this assessment because the predicted net increase in traffic for all scenarios is below 30% and 50 PCU/hour.

6.1.4 Where a net increase in traffic by more than 30% was identified on roads within 200 m of a designated environmentally protected sites, the potential effects of air quality have been assessed (Natural England, 2018). The Pagham Harbour Special Protection Area (SPA) and Wetland of International Importance (Ramsar Site), located adjacent to B2145 Chichester Road; and Chichester and Langstone Harbours SPA and Ramsar Site and Solent Maritime Special Area of Conservation (SAC), were assessed.

6.1.5 The air quality effects on human health receptors of road traffic generated by the adopted Local Plan are considered to be not significant as there are no predicted exceedances of the relevant air quality strategy objectives at any of the existing receptor locations, for both scenario 1 with 600 dwellings per annum with mitigation measures and the worst case scenario 3 with 1,000 dwellings per annum. With the expected reductions in both vehicle emissions and emissions from other sources (such as power stations), air quality is not expected to decline at locations that currently meet the objectives, and therefore, no future exceedances of the air quality objectives are expected within Chichester District Council.

6.1.6 Reductions in baseline deposition will occur as a result of improvements in background pollutant concentrations in the future. Such reductions in nitrogen deposition are likely to outweigh the predicted increases in deposition as a result of the Local Plan. Given the extent and location of the road traffic impacts on designated sites, the Local Plan impact on ecological receptors in relation to air quality is deemed to be not significant.

6.1.7 Overall, it is concluded that there are no air quality constraints to the Chichester Local Plan Review: 2016-2035.

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Statutory Instrument 2017, No. 1012, 'The Conservation of Habitats and Species Regulations 2017' HMSO, London.

Appendix A Glossary

Abbreviations	Meaning
AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling System
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CDC	Chichester District Council
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
EA	Environmental Agency
EFT	Emission Factor Toolkit
EHO	Environmental Health Officer
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
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides, 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
PBA	Peter Brett Associates LLP
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
SAC	Special Areas of Conservation
SPA	Special Protection Areas
SPG	Supplementary Planning Guidance
TEA	Triethanolamine
UNECE	United Nations Economic Commission for Europe
TEMPRO	Trip End Model Presentation Programme

Appendix B Model Verification

Nitrogen Dioxide

Most nitrogen dioxide 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 (NO_x = NO + NO_2). The model has been run to predict the 2017 annual mean road-NO_x contribution at two automatic stations and four monitoring locations (identified in **Table 4.1**). Concentrations have been modelled at a height of reported within the 2018 Air Quality Annual Status report (CDC, 2018).

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure C.1). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure C.2).

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Primary adjustment factor: 2.3598

Secondary adjustment factor: 1.0098

The results imply that overall, the model was under-predicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

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

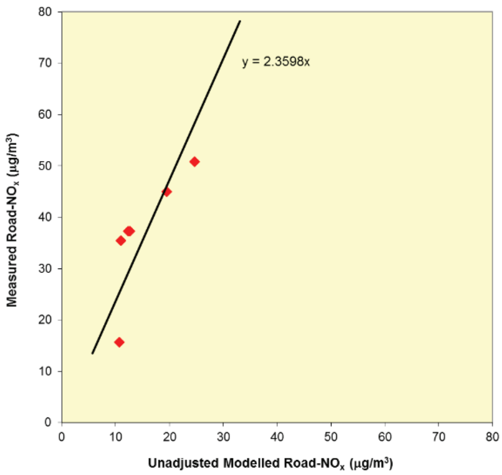


Figure C.1: Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x Concentrations

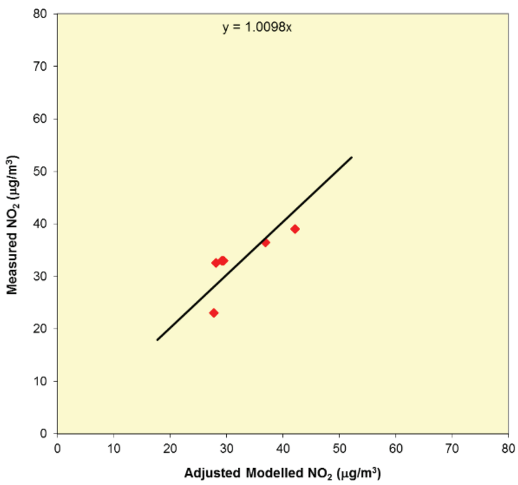


Figure C.2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO_2 Concentrations

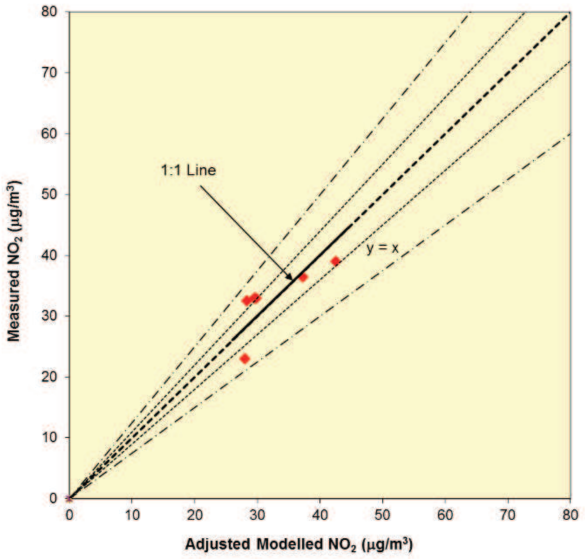


Figure C.3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO_2 Concentrations

Particulates (PM_{10} and $PM_{2.5}$)

CI1 Stockbridge Automatic monitoring station monitors PM_{10}. This station has been used to calculate a verification factor for Particulates.

Measured PM_{10} is divided by the modelled road PM_{10} to produce a factor which can be applied to PM_{10} model outputs.

Measured PM_{10} (19.0 $\mu g/m^3$) - Background PM_{10} (13.8 $\mu g/m^3$) = Measured Road PM_{10} (5.2 $\mu g/m^3$)
Measured Road PM_{10} / Modelled Road PM_{10} (0.89 $\mu g/m^3$) = PM_{10} verification factor (5.8831).

No monitoring of $PM_{2.5}$ is carried out in proximity to the development site. The primary adjustment factor calculated for PM_{10} concentrations has therefore been applied to the modelled road-$PM_{2.5}$ concentrations.

Appendix C Model Inputs and Results Processing Tools

Meteorological Data	2017 Hourly meteorological data from Thorney Island Station (with missing cloud from Southampton) has been used in the model. The wind rose is shown in figure C1.
ADMS	Version 4.1.1
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: 2017.
Latitude	51º
Surface Roughness	A value of 0.5 for Parkland Open suburbia was used to represent the modelled area. A value of 0.3 for agricultural areas was used to represent the meteorological station site.
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 was used to represent the meteorological station site.
Emission Factor Toolkit (EFT)	V8.0, November 2017.
NO_x to NO_2 Conversion	NO_x to NO_2 calculator version 6.1, 17 October 2017
Background Maps	2015 reference year background maps

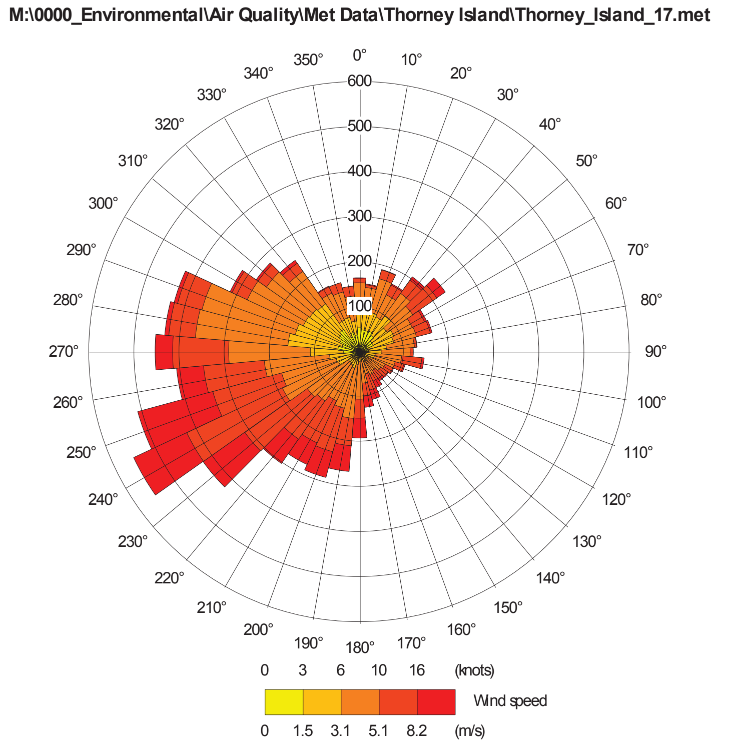


Figure C.1: 2017 Thorney Island Wind rose

Appendix D Traffic Data and Road Network

Link ID	Location	Speed (kph)	2017 Baseline		2035 Baseline		2035 SCN 3		2035 SCN1 with mitigation	
			AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
1182352	Keynor Ln	48	2678	2.2	3177	2.2	4347	2.6	3736	2.2
1183623	Hares Ln	48	7104	1.9	8239	2.0	9342	2.2	8717	2.0
1183680	B2146 Funtington	48	6551	3.1	10238	3.2	15902	3.0	11677	2.7
1184536	Chichester Road	48	15033	2.4	17615	2.7	23486	2.6	19819	2.7
1186282	B2146 Funtington	48	13427	2.5	18215	2.7	24481	2.7	19931	2.4
1188489	Main Road West Salthill	48	12424	2.7	15293	3.0	22352	3.1	19489	3.1
1202533	Stockbridge Rd	48	11297	2.5	13724	2.4	15408	1.9	8204	3.5
1202885	Stockbridge Rd	48	11459	2.5	13916	2.5	15611	2.0	11458	3.1
1203797	Orchard Street	48	15646	1.6	15193	2.4	18800	2.1	18196	2.3
1205171	Orchard Street	48	15193	2.4	18800	2.1	18196	2.3	15193	2.4
1205969	Orchard Street	48	16211	1.6	15830	2.4	19411	2.1	18196	2.3
1206200	St Pauls Rd	48	14081	1.3	14914	1.6	18281	1.6	18877	2.3
1206361	Orchard Street	48	17108	1.6	16673	2.4	20253	2.1	19561	2.3
1206370	St Pauls Rd	24	18720	1.6	20438	1.9	21321	2.1	21020	1.9
1206535	St Pauls Rd	24	18719	1.6	20438	1.9	21321	2.1	21020	1.9
1206948	Churchside	24	18999	1.6	20612	1.9	22035	1.9	20264	1.9
1207016	Northgate	24	21133	1.2	21619	1.6	23762	1.7	23649	1.7
1207500	Northgate	24	20161	1.4	21878	1.8	23867	1.8	23811	1.8
1207628	Broyle Rd	48	13275	1.7	13718	1.8	12953	2.0	13107	1.9
1212542	Oving Rd	32	3244	1.4	2465	6.6	3552	2.8	3625	1.5
1213463	Florence Rd	32	5603	0.9	5617	1.5	7104	1.5	5884	1.0
1213728_J	Florence Rd	24	5986	0.9	5610	1.1	7494	2.8	6131	0.9
1213787	Pound Farm Rd	32	966	2.4	1256	4.0	1695	9.2	1160	2.1
1213885	St James' Rd	32	6594	0.0	6286	1.0	7302	0.9	7780	0.3

1214438	Oving Rd	32	5799	1.2	3322	3.2	4370	3.9	2472	1.6
1214785	Pound Farm Rd	32	827	1.8	1101	3.5	1504	9.5	899	1.1
1217086	Northgate	24	19908	1.0	20031	1.5	21711	1.5	21597	1.5
1217177	Northgate	24	17937	1.4	18935	1.9	20964	1.8	21444	1.8
1218617	Chichester by Pass	112	52150	3.6	57711	4.0	63842	3.8	58272	4.1
1223281 J	Chichester by Pass	24	50400	3.7	63139	3.6	67274	3.4	65251	3.7
1227005	Oaklands Rd	48	26081	1.2	28206	1.5	29918	1.4	28422	1.7
1243935	Main Road East Salthill	48	16331	2.2	21317	2.4	22510	2.6	25180	2.6
1253413_A	Chichester Rd	80	17966	2.4	21097	2.6	28247	2.6	23884	2.6
1262307	Water In	48	2173	2.1	2355	2.5	2609	3.0	2730	2.7
1262628	B2146 Funtington	48	14318	2.3	19022	2.5	24948	2.5	20412	2.2
1264139	Salthill Rd	48	4626	3.2	5592	3.4	9961	3.5	5990	2.8
1289803	Stockbridge Rd	48	25270	2.0	30316	2.3	39769	2.4	23757	2.5
1338260	B2146 Funtington	48	14318	2.3	19022	2.5	24708	2.4	20412	2.2
1338858	B2146 Funtington	97	14318	2.3	19022	2.5	24312	2.4	20412	2.2
1359540 JA	Stockbridge Rd	24	25271	2.0	30316	2.3	39446	2.4	23757	2.5
1212574	Stockbridge Jct	24	-	-	47954	4.3	47989	4.3	52128	4.2
1212844	Stockbridge Jct	24	-	-	605	4.0	1103	2.5	2062	2.4
1281431	Stockbridge Jct	24	-	-	9152	2.0	14751	2.1	4083	2.8
1270923	Stockbridge Jct	24	-	-	12373	2.7	12555	2.9	11986	2.6
1202337	Stockbridge Jct	24	-	-	8883	3.2	8674	2.8	8204	3.5
121880	Stockbridge Jct	24	-	-	4568	0.8	5940	0.5	1184	1.2
1212609	Stockbridge Jct	24	-	-	49781	4.1	49194	4.1	56017	4.0
1281467	Stockbridge Jct	24	-	-	8790	2.1	12140	2.0	23757	2.5

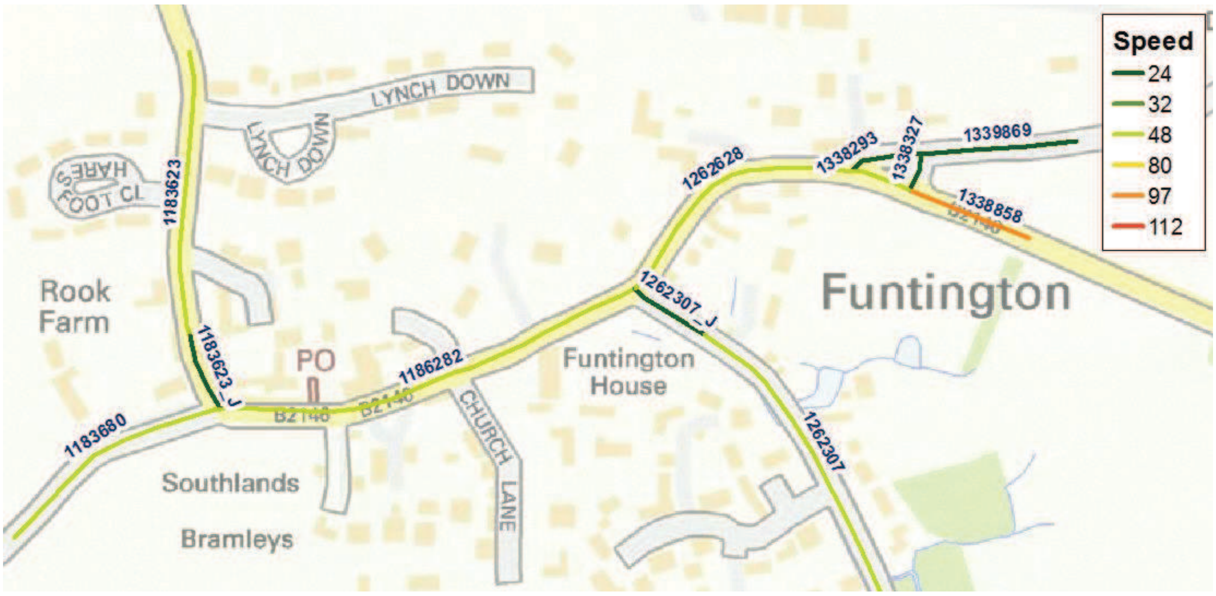


Figure D.1: 2017 and 2035 Funtington Modelled Road Network Sources

Figure D.2: 2017 and 2035 Fishbourne Modelled Road Network Sources

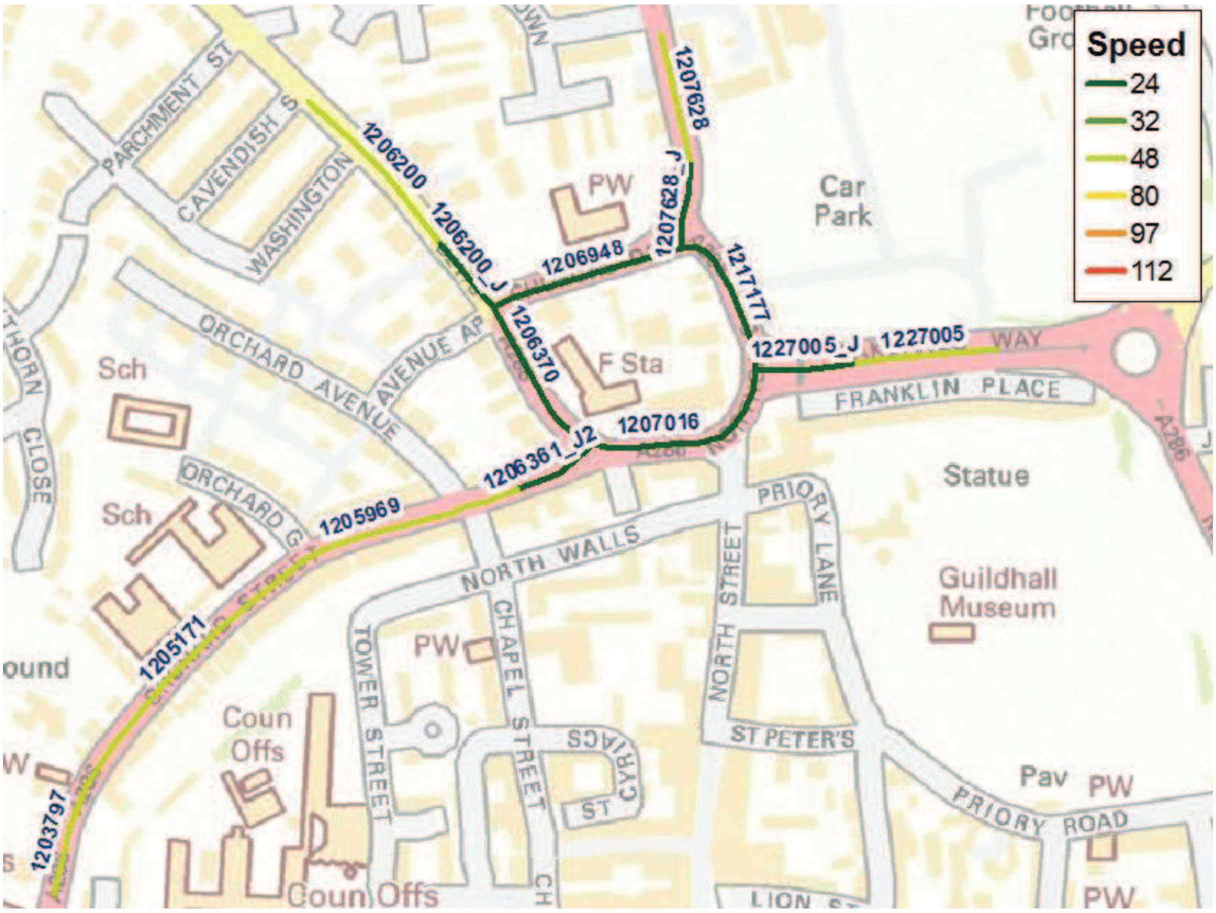


Figure D.3: 2017 and 2035 Oaklands Modelled Road Network Sources

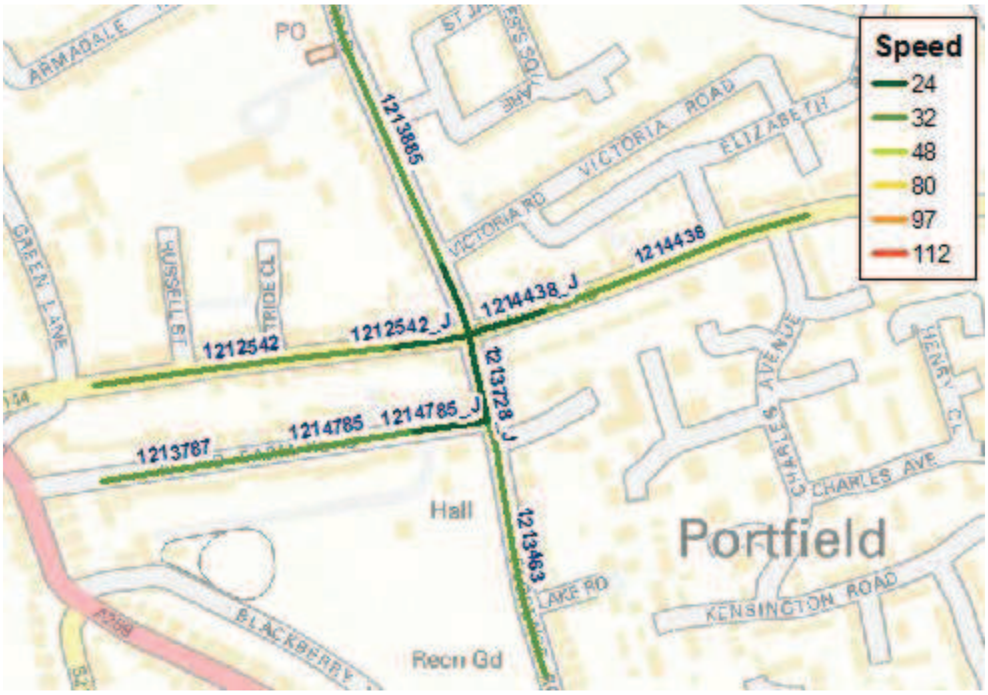


Figure D.4: 2017 and 2035 Portfield Modelled Road Network Sources

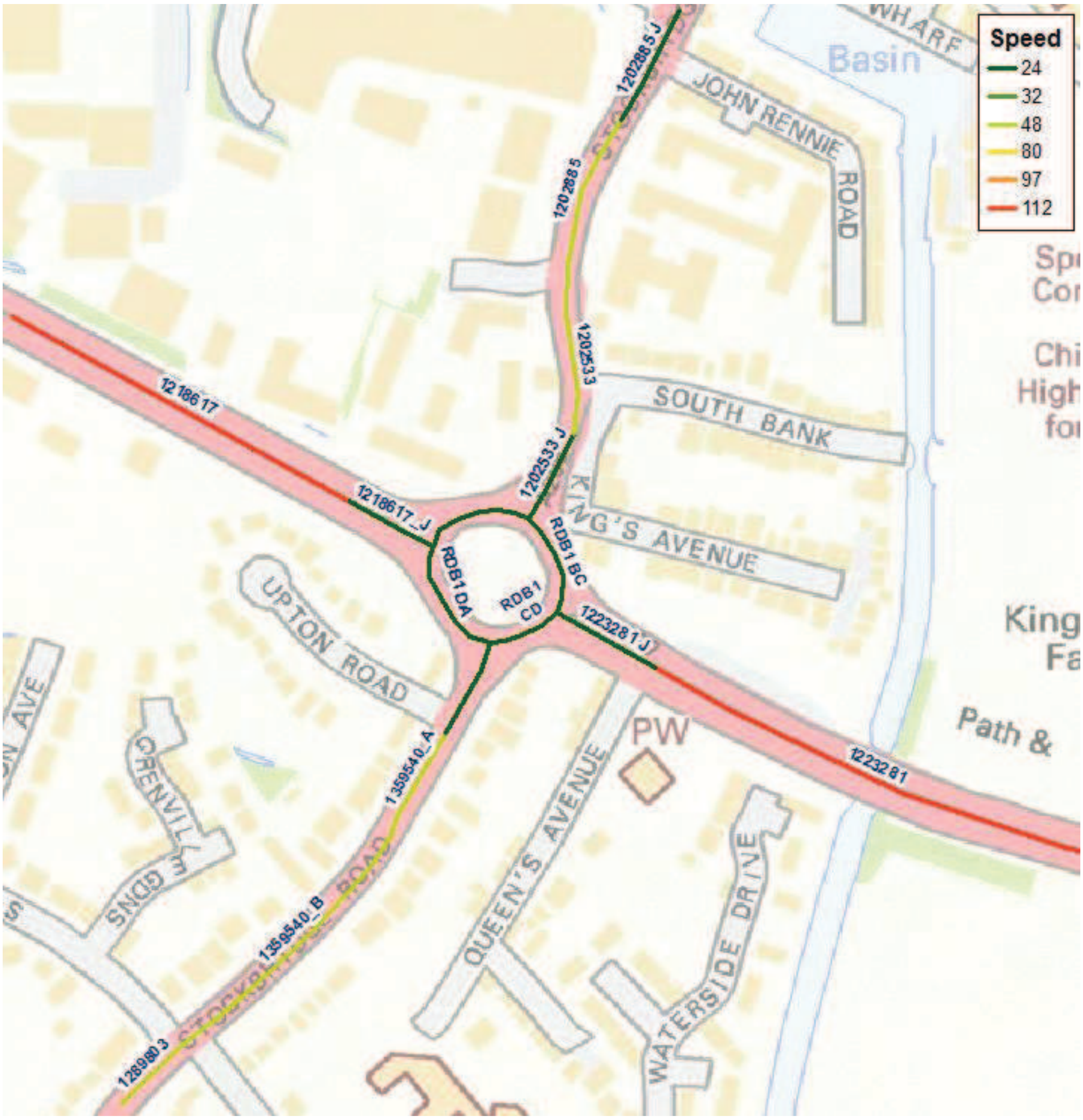


Figure D.5: 2017 Stockbridge roundabout Modelled Road Network Sources

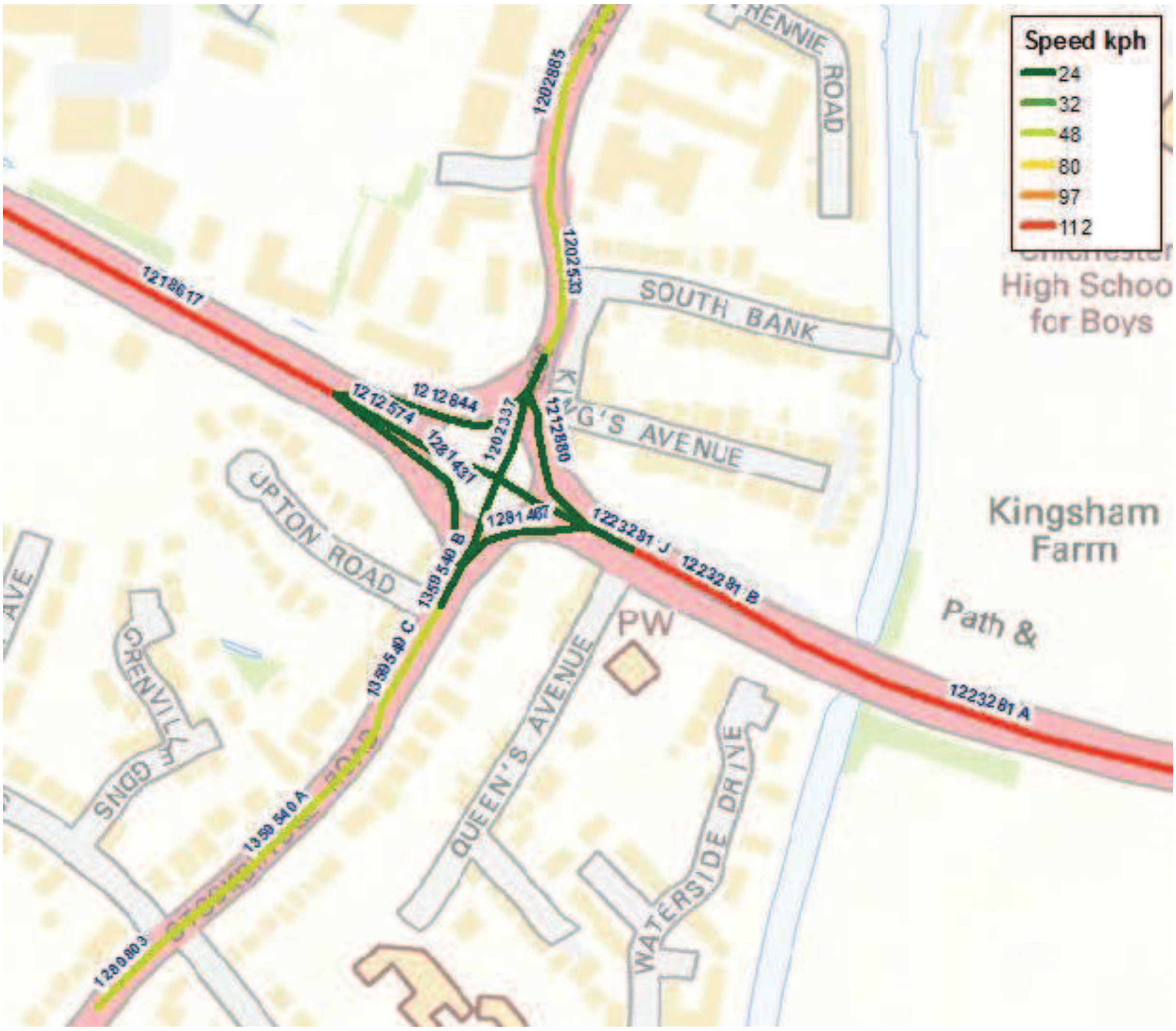


Figure D.6: 2035 Stockbridge roundabout Modelled Road Network Sources

Figure D.7: 2017 and 2035 Sidlesham and Ferry Field Modelled Road Network Sources

Appendix E Future Year Modelling – Road Transport Emissions Factors

Introduction

Atmospheric dispersion modelling is used to determine the effect of future development traffic on local air quality. The modelling utilises predictions of the composition and emissions profile of the vehicle fleet which are produced by Defra in the emissions factor toolkit (EFT). The composition and emissions profiles are provided on a year by year basis from 2013 to 2030, with the database being periodically updated.

The main issue with regard to the modelling of future traffic impacts is the choice of emission factors to use given that there is a degree of uncertainty as to the accuracy of the emission factors, as well as uncertainty introduced by the modelling process and the traffic data on which the predictions are based. This has become more important in recent years as it has been realised that previous versions of the EFT were likely to have significantly underestimated the real world emissions of the vehicle fleet, as well as the more recent revelations concerning the use of 'defeat devices' on VW group vehicles.

This note therefore sets out PBAs approach to the choice of vehicle emission factors for future year assessments. The note has been revised following updating of the Defra Emissions Factor Toolkit in November 2017.

Modelling Methodology

As a prelude to the discussion of emission factors, it is useful to recap on the general methodology that is used for dispersion modelling of road traffic emissions:

- Traffic data is entered into the dispersion model to represent the baseline situation and the model is used to predict how NO_x emissions are dispersed in the environment.
- The dispersion modelling predictions are compared to monitoring data to obtain a verification factor; the factor by which the predicted road traffic concentration must be multiplied by to agree with the monitored concentration.
- The modelling is repeated for the future year situation; with traffic data representing the situation without the development in place (the 'without' scheme scenario) and with the development in place ('with' scheme). In both cases, the verification factor obtained from the baseline modelling is used to multiply the model results by, in essence assuming that the model is equally as accurate in the future as it was for the baseline scenario.

The verification factor is one of the key elements in the discussion regarding vehicle emission factors. One element of uncertainty in the modelling is the degree to which the emission factors in the EFT are different to actual emissions of the vehicle fleet on the local road network. The use of the verification factor for the future year predictions essentially assumes that the difference between the EFT emission factors and real world emissions is the same in the future as it was in the baseline year. In other words, unless there is some reason to believe that the future year emission factors are less accurate than the baseline year emission factors, the degree to which the EFT emission factors and real world emission factors differ is taken into account in the modelling by the use of the verification factor. This is discussed further in the following sections.

Emission Factor Toolkit

The EFT contains estimates of the future composition of the vehicle fleet in terms of the age and type of vehicles. The composition of the vehicle fleet is primarily related to the age of the vehicles (in terms of their emissions class) and the fuel that they use (i.e. petrol or diesel). In general terms, the majority of new vehicles replace much older vehicles, and as the emissions performance of vehicles is generally taken to improve over time, both current and historical versions of the EFT predict very large reductions in NO_x emissions in the future. It is also obvious that the further one looks into the future, the more uncertain the predictions become as they depend on the rate of vehicle renewal and the size and fuel mix of the vehicles bought; which are all estimates.

The emissions performance of the vehicles is classified in terms of Euro type approval testing; Euro 1 to 6 concerning light duty vehicles and Euro I to VI heavy duty vehicles. Whilst the introduction of each Euro class has generally seen a tightening of emission standards, the standards up until now have been based on laboratory testing of vehicles. The emissions performance of the vehicles in real world driving conditions has been higher than the laboratory testing results, especially for diesel vehicles. This factor was not recognised in earlier versions of the EFT, and combined with the fact that diesel vehicles have much higher NO_x emissions than petrol vehicles and there has been a very large increase in the number of diesel vehicles on the road, has meant that the NO_x emissions and NO_2 concentrations have not reduced as previously predicted.

The trends in NO_x emissions in the vehicle fleet, especially diesel vehicles and the accuracy of the current version of the EFT, is therefore critical in terms of the choice of emission factors in modelling.

Trends in NO_x emissions

For light duty vehicles, the latest Euro standard is Euro 6, which was introduced from September 2015 (with a derogation in the UK for the registration of new vehicles until September 2016).

The emissions standards currently relate to a laboratory test whereby the average emission rate is calculated over an idealised drive cycle. The cycle used is the New European Drive Cycle (NEDC) and there has been extensive criticism that the drive cycle does not represent real world driving conditions. It has therefore been agreed that a new drive cycle will be introduced, the World Light-duty Test Cycle (WLDTC), as well as an on-road test termed Real Driving Emissions (RDE).

Up until September 2017, Euro 6 vehicles were only tested in the laboratory against the NEDC, and these vehicles are termed Euro 6ab. However, from September 2017, new models are tested against the WLDTC and will also have a RDE test. The initial introduction of the RDE test will allow vehicles to have average RDE test emissions of 2.1 times the WLDTC test standard (termed Euro 6c vehicles). The 2.1 factor is termed the conformity factor and will apply to new vehicle models from September 2017 and all new vehicles from September 2019. From January 2020, the conformity factor will reduce to 1.5 for new vehicle models (January 2021 for all new vehicles) and these are termed Euro 6d vehicles.

Air Quality Consultants undertook some research into the performance of diesel vehicles to support a methodology that they adopted for undertaking air quality assessments[1]. As part of the analysis, they compared the real word test results of current Euro 6ab diesel vehicles and calculated an average conformity factor of 3.9 from the tests that were assessed. This work led to AQC publishing the CURED v2A calculator which attempted to take account of the real world emissions performance of diesel vehicles. The approach using CURED v2A was generally accepted to be conservative when considering developments a long time in the future.

Subsequently, the Department for Transport have undertaken testing of Euro 5 and 6ab diesel vehicles and found that the average NO_x emissions were 1135 mg/km for Euro 5 vehicles and 500 mg/km for Euro 6ab vehicles[2]. These work out to be a conformity factor of 6.30 and 6.25 for Euro 5 and Euro 6ab respectively. Adding in the DfTr results to the AQC results gives an overall average conformity factor for Euro 6ab vehicles tested of 4.1.

A paper presented by Dr Marc Stettler at the recent Westminster Energy, Environment & Transport Forum[3] included results of RDE testing of existing Euro 6ab vehicles. Whilst there was wide range in the results, a number of the vehicles tested did already comply with the Euro 6c standard.

[1] Emissions of Nitrogen Oxides from Modern Diesel Vehicles. AQC January 2016

[2] Vehicle Emissions Testing Programme DfTr Cm 9259 April 2016

[3] Priorities for reducing air quality impacts of road vehicles. Dr Marc Stettler 17th May 2016

Similar results have been reported in a study led by Rosalind O'Drscoll of Imperial College[4]. This showed that the average NO_x emissions were 4.5 times higher than the Euro 6 limit, with an average NO_2 percentage of 44%.

From the emissions testing work undertaken to date on Euro 6ab vehicles it is clear that the NO_x emissions performance of Euro 6ab vehicles is significantly better than Euro 5 vehicles, although not in line with the laboratory standards. The introduction of Euro 6 should therefore see a significant reduction in NO_x emissions in the future, as outlined in the following table.

Emission Standard	Real Driving Emissions NO_x mg/km
Euro 5, DfTr testing	1135
Euro 6ab, DfTr testing	500
Euro 6c, September 2017 models	168
Euro 6d, January 2020 models	120

Further testing of vehicles is ongoing, with Emissions Analytics regularly publishing the results of real world emissions testing on vehicles[5]. Also, in the November 2017 budget, the government announced a one-off tax on new diesel cars not meeting Euro 6c standards. Both of these factors should help put pressure on vehicle manufacturers to meet the RDE standards. In the longer term, there is also the move to electric vehicles which will gather pace. Recent evidence in terms of vehicle procurement also suggests a decline in diesel vehicle sales due to negative publicity. These factors may mean that the vehicle fleet predictions in the EFT v8.0 are pessimistic with regard to vehicle NO_x emissions.

Emissions in the EFT

As noted in Section 3, the EFT contains estimates of vehicle emissions by Euro Class. The database was updated in November 2017 from v7.0 to v8.0. It now uses NO_x emissions factors for the vehicles taken from the European Environment Agency's COPERT 5 database, compared to the previous COPERT 4 version v11.

The EFT now takes account of the real world performance of Euro 6ab diesel cars, applying a high conformity factor to these vehicles. For Euro 6c and Euro 6d vehicles, it assumes that the RDE will be effective in bringing down vehicle emissions, but does not assume that vehicle emissions will be as low as the conformity factors in the RDE testing. The EFT therefore incorporates an assumption that diesel car NO_x emissions will be higher in real world driving conditions than the testing standards allow.

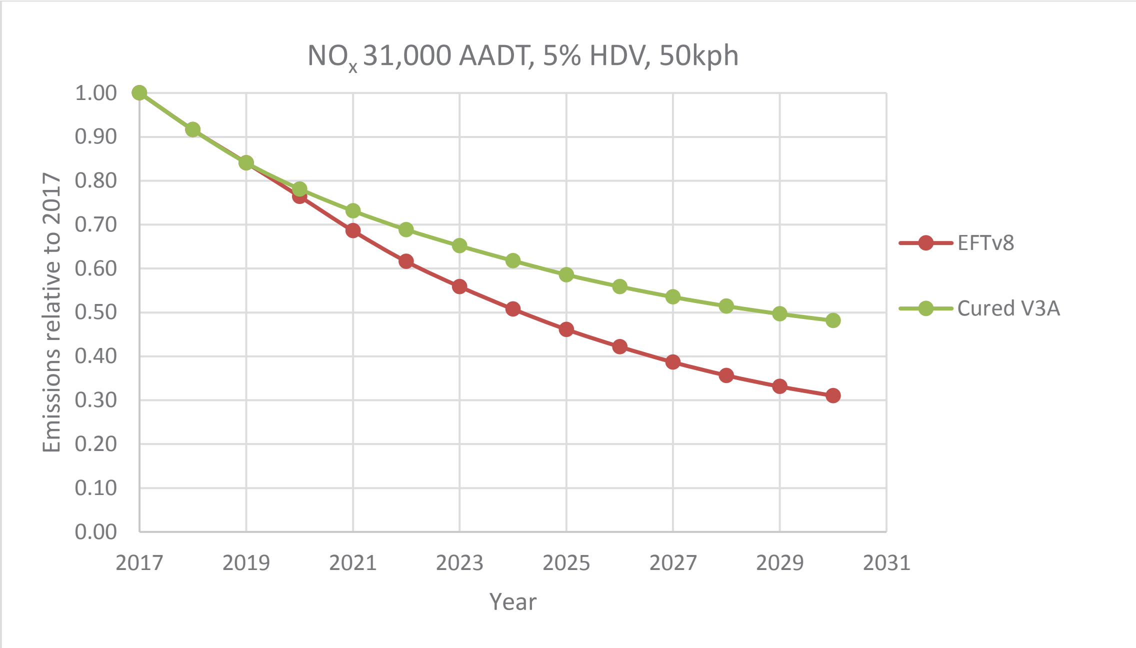
AQC have reviewed their approach to vehicle emissions[6] following publication of EFT v8.0. CURED v3A has been formulated assuming that light duty vehicle emissions are as per EFT v8.0 up until Euro 6c. Euro 6d vehicles are assumed to have the same emissions as Euro 6c. Emissions from HDVs are assumed to be as per the EFT v8.0. Vehicle emissions using CURED v3A can be considered to be a worst-case sensitivity test post 2020.

The following graph shows the relative decline in vehicle NO_x emissions predicted for a road in England (not London) with 5% Heavy Duty Vehicle traffic travelling at 50kph. As air quality models are verified against historic data, the relative decline in emissions is shown.

[4] A Portable Emissions Measurement System (PEMS) study of NO_x and primary NO_2 emissions from Euro 6 diesel passenger cars and comparison with COPERT emission factors. Rosalind O'Driscoll. September 2016

[5] http://equaindex.com/equa-air-quality-index/

[6] Development of the CURED V3A Emissions Model



For emission years prior to 2020, the CURED v3A methodology is likely to give similar results to using the EFT v8.0 data. Post 2020, when the introduction of Euro 6d begins to take effect, then CURED v3A and the EFT v8.0 begin to diverge. By 2030, CURED v3A emissions are approximately equivalent to EFT v8.0 for 2025.

Future Year Assessment Methodology

The selection of emission factors for a future year assessment depends partly on the situation regarding the assessment to be undertaken. Where pollutant concentrations are low and are unlikely to exceed threshold levels, then one may take a conservative approach and keep emission factors at current levels. This will produce a conservative result, but as the result will be 'acceptable' in terms of leading to no exceedances of National Air Quality Strategy Objectives, then it is a reasonable approach to adopt as it avoids uncertainty as to whether there will be exceedances in the future.

In contrast, where pollutant concentrations are high, then a different approach to uncertainty is required. In addition, for a formal Environmental Impact Assessment the legal requirement is to assess 'likely significant effects'. This is not 'worst case' significant effects, but 'likely' significant effects and therefore must allow for a degree of uncertainty in the predictions.

As discussed in Section 2, the use of the verification factor in the modelling takes account, amongst other things, of the difference in the real world emissions performance of vehicles in the fleet. For developments up until 2020, the current EFT should be reasonably accurate as to NO_x emissions as the problem with the performance of diesel vehicles has been recognised. As such, one is justified in using the emission factors for the year of the assessment as the uncertainty in the emission factors is taken account of by using the verification factor.

Developments post 2020 will increasingly be influenced by the assumption that the RDE testing of diesel vehicles is effective, which may or may not turn out to be the case. In essence, the result is likely to lie between the green and red curves of the previous graph. This is likely to become less important as the actual levels of emissions is significantly reduced in the future. If a conservative approach is warranted, one could follow the green curve, the effect of which is outlined in the table below.

Traffic Data year	EFT v8 year
2017	2017
2018	2018
2019	2019

Traffic Data year	EFT v8 year
2020	2020
2021	2020
2022	2020
2023	2021
2024	2021
2025	2022
2026	2022
2027	2023
2028	2023
2029	2024
2030	2025
Beyond 2030	2025

Appendix F Background Concentrations

Introduction

Defra publish details of estimated background concentrations of pollutants for each 1km grid square across the country. CDC runs two urban background monitoring sites at Cleveland Road (DT7) and Arthur purchase (DT11). In order to more accurately reflect background concentrations across the study area, Defra mapped background concentrations have been compared against concentrations measured at both sites to produce a calibration factor which is applied to background concentrations across the study area.

Nitrogen Dioxide

DT 7
Defra mapped NO_2 = 14.2 µg/m^3
Measured NO_2 = 16 µg/m^3
Calibration factor = 1.13

DT11
Defra mapped NO_2 = 12.8 µg/m^3
Measured NO_2 = 18 µg/m^3
Calibration factor = 1.40

An average factor of 1.27 has been applied to the mapped NO_2 and NO_x background for both baseline and future year scenarios across the study area.

Appendix G Ecological Receptors Results Baseline and Scenario 3

Predicted Baseline Concentrations and Deposition

Receptor and Distance in Habitat	2017 Baseline			2035 Baseline		
	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)						
CH 0m	26.4	12.9	Not sensitive	18.7	12.6	Not sensitive
CH 5m	24.0	12.8		17.1	12.5	
CH 10m	22.3	12.6		16.0	12.4	
CH 15m	21.2	12.5		15.2	12.4	
CH 20m	20.3	12.5		14.7	12.3	
CH 30m	19.1	12.4		13.9	12.3	
CH 40m	18.3	12.3		13.4	12.2	
CH 50m	17.8	12.3		13.0	12.2	
CH 75m	16.9	12.2		12.5	12.2	
Critical Level / Load	**30**	**20**		**30**	**20**	
Pagham Harbour SPA - Neutral Grassland (Unit 18)						
PH Un18 0m	**69.9**	16.0	1.31	**45.5**	14.6	1.20
PH Un18 5m	**43.6**	14.3	1.18	29.4	13.5	1.12
PH Un18 10m	**34.1**	13.6	1.13	23.6	13.0	1.09
PH Un18 15m	29.1	13.3	1.11	20.5	12.8	1.07
PH Un18 20m	26.1	13.0	1.09	18.7	12.6	1.06
PH Un18 30m	22.5	12.7	1.07	16.5	12.5	1.05
PH Un18 40m	20.5	12.6	1.06	15.3	12.4	1.04
PH Un18 50m	19.2	12.5	1.05	14.5	12.3	1.04
PH Un18 75m	17.4	12.3	1.04	13.4	12.2	1.03
PH Un18 100m	16.4	12.3	1.04	12.8	12.2	1.03
PH Un18 125m	15.8	12.2	1.03	12.4	12.2	1.03
PH Un18 150m	15.4	12.2	1.03	12.2	12.1	1.03
PH Un18 175m	15.1	12.2	1.03	12.0	12.1	1.03
PH Un18 200m	14.9	12.2	1.03	11.9	12.1	1.03
Critical Level / Load	**30**	**20**	**1.07-5.07**	**30**	**20**	**1.07-5.07**
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)						
PH Un5 0m	**56.5**	**26.1**	2.05	**36.4**	**23.6**	1.88
PH Un5 5m	**37.9**	**23.5**	1.87	25.1	**22.0**	1.76
PH Un5 10m	**30.4**	**22.4**	1.79	20.6	**21.3**	1.71
PH Un5 15m	26.4	**21.8**	1.75	18.1	**20.9**	1.69
PH Un5 20m	23.8	**21.4**	1.72	16.6	**20.7**	1.67
PH Un5 30m	20.7	**20.9**	1.68	14.8	**20.4**	1.65
PH Un5 40m	19.0	**20.7**	1.67	13.7	**20.2**	1.64

Receptor and Distance in Habitat	2017 Baseline			2035 Baseline		
	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
PH Un5 50m	17.8	**20.5**	1.65	13.0	**20.1**	1.63
PH Un5 75m	16.1	**20.2**	1.63	12.0	**20.0**	1.62
PH Un5 100m	15.2	**20.1**	1.62	11.4	**19.9**	1.61
PH Un5 110m	15.0	**20.0**	1.62	11.3	**19.9**	1.61
Critical Level / Load	**30**	**10**	**0.36-2.18**	**30**	**10**	**0.36-2.18**

Predicted Concentrations and Deposition at Ecological Receptors in 2035 baseline and Scenario 3

Receptor and Distance in Habitat	2035 Baseline			Scenario 3		
	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)						
CH 0m	18.7	12.6	Not sensitive	20.1	12.7	Not sensitive
CH 5m	17.1	12.5		18.2	12.6	
CH 10m	16.0	12.4		17.0	12.5	
CH 15m	15.2	12.4		16.1	12.4	
CH 20m	14.7	12.3		15.5	12.4	
CH 30m	13.9	12.3		14.5	12.3	
CH 40m	13.4	12.2		13.9	12.3	
CH 50m	13.0	12.2		13.5	12.2	
CH 75m	12.5	12.2		12.8	12.2	
Critical Level / Load	**30**	**20**		**30**	**20**	
Pagham Harbour SPA - Neutral Grassland (Unit 18)						
PH Un18 0m	**45.5**	14.6	1.20	**56.9**	15.4	1.26
PH Un18 5m	29.4	13.5	1.12	**35.5**	13.9	1.15
PH Un18 10m	23.6	13.0	1.09	27.8	13.3	1.11
PH Un18 15m	20.5	12.8	1.07	23.7	13.0	1.09
PH Un18 20m	18.7	12.6	1.06	21.2	12.8	1.08
PH Un18 30m	16.5	12.5	1.05	18.3	12.6	1.06
PH Un18 40m	15.3	12.4	1.04	16.7	12.5	1.05
PH Un18 50m	14.5	12.3	1.04	15.6	12.4	1.05
PH Un18 75m	13.4	12.2	1.03	14.1	12.3	1.04
PH Un18 100m	12.8	12.2	1.03	13.4	12.2	1.03
PH Un18 125m	12.4	12.2	1.03	12.9	12.2	1.03
PH Un18 150m	12.2	12.1	1.03	12.5	12.2	1.03
PH Un18 175m	12.0	12.1	1.03	12.3	12.1	1.03
PH Un18 200m	11.9	12.1	1.03	12.1	12.1	1.03
Critical Level / Load	**30**	**20**	**1.07-5.07**	**30**	**20**	**1.07-5.07**
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)						
PH Un5 0m	**36.4**	**23.6**	1.88	**45.1**	**24.9**	1.97
PH Un5 5m	25.1	**22.0**	1.76	**30.2**	**22.8**	1.82
PH Un5 10m	20.6	**21.3**	1.71	24.2	**21.9**	1.75
PH Un5 15m	18.1	**20.9**	1.69	20.9	**21.4**	1.72
PH Un5 20m	16.6	**20.7**	1.67	18.9	**21.0**	1.69
PH Un5 30m	14.8	**20.4**	1.65	16.4	**20.7**	1.67
PH Un5 40m	13.7	**20.2**	1.64	15.0	**20.4**	1.65
PH Un5 50m	13.0	**20.1**	1.63	14.1	**20.3**	1.64
PH Un5 75m	12.0	**20.0**	1.62	12.7	**20.1**	1.62
PH Un5 100m	11.4	**19.9**	1.61	12.0	**20.0**	1.62
PH Un5 110m	11.3	**19.9**	1.61	11.8	**19.9**	1.61

Receptor and Distance in Habitat	2035 Baseline			Scenario 3		
	Total NO_x (µg/m³)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
Critical Level / Load	**30**	**10**	**0.36-2.18**	**30**	**10**	**0.36-2.18**

Appendix H Ecological Receptors Scheme Contribution Scenario 3

Predicted Scheme Contribution Scenario 3

Receptor and Distance in Habitat	Total NOx (µg/m³)	NO_x % of Critical Level	NOx % increase from 2035 Baseline
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)			
CH 0m	1.3	4.5	7.1
CH 5m	1.1	3.8	6.7
CH 10m	1.0	3.3	6.2
CH 15m	0.9	2.9	5.7
CH 20m	0.8	2.6	5.3
CH 30m	0.6	2.1	4.5
CH 40m	0.5	1.7	3.9
CH 50m	0.4	1.5	3.4
CH 75m	0.3	1.0	2.5
Pagham Harbour SPA - Neutral Grassland (Unit 18)			
PH Un18 0m	11.4	38.2	25.2
PH Un18 5m	6.1	20.4	20.9
PH Un18 10m	4.2	14.0	17.8
PH Un18 15m	3.2	10.6	15.4
PH Un18 20m	2.5	8.5	13.6
PH Un18 30m	1.8	6.0	11.0
PH Un18 40m	1.4	4.7	9.2
PH Un18 50m	1.1	3.8	7.8
PH Un18 75m	0.8	2.5	5.7
PH Un18 100m	0.6	1.9	4.4
PH Un18 125m	0.4	1.4	3.5
PH Un18 150m	0.3	1.2	2.9
PH Un18 175m	0.3	1.0	2.4
PH Un18 200m	0.2	0.8	2.1
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)			
PH Un5 0m	8.7	29.1	24.0
PH Un5 5m	5.1	16.9	20.2
PH Un5 10m	3.6	12.0	17.4
PH Un5 15m	2.8	9.3	15.3
PH Un5 20m	2.3	7.6	13.7
PH Un5 30m	1.7	5.5	11.2
PH Un5 40m	1.3	4.3	9.5
PH Un5 50m	1.1	3.6	8.2
PH Un5 75m	0.7	2.4	6.1
PH Un5 100m	0.5	1.8	4.7
PH Un5 110m	0.5	1.7	4.5

Predicted Scheme Contribution Scenario 3

Receptor and Distance in Habitat	Nitrogen Deposition (kgN/ha/yr)	% N Deposition of Critical Load	N deposition% increase from 2035 Baseline	Acid Deposition (keqN/ha/yr)	% Critical Level
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)					
CH 0m	0.10	0.5	0.8	-	
CH 5m	0.09	0.5	0.7		
CH 10m	0.08	0.4	0.6		
CH 15m	0.07	0.3	0.6		
CH 20m	0.06	0.3	0.5		
CH 30m	0.05	0.2	0.4		
CH 40m	0.04	0.2	0.3		
CH 50m	0.03	0.2	0.3		
CH 75m	0.02	0.1	0.2		
Pagham Harbour SPA - Neutral Grassland (Unit 18)					
PH Un18 0m	0.76	3.8	5.2	0.054	**1.1**
PH Un18 5m	0.44	2.2	3.3	0.032	0.6
PH Un18 10m	0.31	1.6	2.4	0.022	0.4
PH Un18 15m	0.24	1.2	1.9	0.017	0.3
PH Un18 20m	0.19	1.0	1.5	0.014	0.3
PH Un18 30m	0.14	0.7	1.1	0.010	0.2
PH Un18 40m	0.11	0.5	0.9	0.008	0.2
PH Un18 50m	0.09	0.4	0.7	0.006	0.1
PH Un18 75m	0.06	0.3	0.5	0.004	0.1
PH Un18 100m	0.05	0.2	0.4	0.003	0.1
PH Un18 125m	0.03	0.2	0.3	0.002	0.0
PH Un18 150m	0.03	0.1	0.2	0.002	0.0
PH Un18 175m	0.02	0.1	0.2	0.002	0.0
PH Un18 200m	0.02	0.1	0.2	0.001	0.0
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)					
PH Un5 0m	1.22	**12.2**	5.2	0.087	**4.0**
PH Un5 5m	0.75	**7.5**	3.4	0.054	**2.5**
PH Un5 10m	0.55	**5.5**	2.6	0.039	**1.8**
PH Un5 15m	0.43	**4.3**	2.0	0.031	**1.4**
PH Un5 20m	0.35	**3.5**	1.7	0.025	**1.2**
PH Un5 30m	0.26	**2.6**	1.3	0.018	0.9
PH Un5 40m	0.21	**2.1**	1.0	0.015	0.7
PH Un5 50m	0.17	**1.7**	0.8	0.012	0.6
PH Un5 75m	0.12	**1.2**	0.6	0.008	0.4
PH Un5 100m	0.09	0.9	0.4	0.006	0.3
PH Un5 110m	0.08	0.8	0.4	0.006	0.3

Appendix I Ecological Receptors Results Scenario 1 With Mitigation

Predicted Concentrations and Deposition at Ecological Receptors in 2035 baseline and scenario 1 with mitigation

Receptor and Distance in Habitat	2035 Baseline			Scenario 1 with mitigation		
	Total NO_x (μg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (μg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)						
CH 0m	18.7	12.6	Not sensitive	20.2	12.8	Not sensitive
CH 5m	17.1	12.5		18.2	12.6	
CH 10m	16.0	12.4		16.9	12.5	
CH 15m	15.2	12.4		16.0	12.4	
CH 20m	14.7	12.3		15.4	12.4	
CH 30m	13.9	12.3		14.4	12.3	
CH 40m	13.4	12.2		13.8	12.3	
CH 50m	13.0	12.2		13.4	12.2	
CH 75m	12.5	12.2		12.7	12.2	
Critical Level / Load	**30**	**20**		**30**	**20**	
Pagham Harbour SPA - Neutral Grassland (Unit 18)						
PH Un18 0m	**45.5**	14.6	1.20	**50.0**	14.9	1.22
PH Un18 5m	29.4	13.5	1.12	**31.8**	13.6	1.13
PH Un18 10m	23.6	13.0	1.09	25.2	13.1	1.10
PH Un18 15m	20.5	12.8	1.07	21.8	12.9	1.08
PH Un18 20m	18.7	12.6	1.06	19.7	12.7	1.07
PH Un18 30m	16.5	12.5	1.05	17.2	12.5	1.06
PH Un18 40m	15.3	12.4	1.04	15.8	12.4	1.05
PH Un18 50m	14.5	12.3	1.04	14.9	12.4	1.04
PH Un18 75m	13.4	12.2	1.03	13.7	12.3	1.04
PH Un18 100m	12.8	12.2	1.03	13.0	12.2	1.03
PH Un18 125m	12.4	12.2	1.03	12.6	12.2	1.03
PH Un18 150m	12.2	12.1	1.03	12.3	12.1	1.03
PH Un18 175m	12.0	12.1	1.03	12.1	12.1	1.03
PH Un18 200m	11.9	12.1	1.03	12.0	12.1	1.03
Critical Level / Load	**30**	**20**	**1.07-5.07**	**30**	**20**	**1.07-5.07**
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)						
PH Un5 0m	**36.4**	**23.6**	1.88	**39.7**	**24.1**	1.91
PH Un5 5m	25.1	**22.0**	1.76	27.0	**22.3**	1.78
PH Un5 10m	20.6	**21.3**	1.71	22.0	**21.5**	1.73
PH Un5 15m	18.1	**20.9**	1.69	19.2	**21.1**	1.70
PH Un5 20m	16.6	**20.7**	1.67	17.5	**20.8**	1.68
PH Un5 30m	14.8	**20.4**	1.65	15.4	**20.5**	1.65

Receptor and Distance in Habitat	2035 Baseline			Scenario 1 with mitigation		
	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m^3)	Total Nitrogen Deposition (kgN/ha/yr)	Total Acid Deposition (keqN/ha/yr)
PH Un5 40m	13.7	**20.2**	1.64	14.2	**20.3**	1.64
PH Un5 50m	13.0	**20.1**	1.63	13.4	**20.2**	1.63
PH Un5 75m	12.0	**20.0**	1.62	12.2	**20.0**	1.62
PH Un5 100m	11.4	**19.9**	1.61	11.6	**19.9**	1.61
PH Un5 110m	11.3	**19.9**	1.61	11.5	**19.9**	1.61
Critical Level / Load	**30**	**10**	**0.36-2.18**	**30**	**10**	**0.36-2.18**

Appendix J Ecological Receptors Scheme Contribution Scenario 1 With Mitigation

Predicted Scheme Contribution Scenario 1 with mitigation

Receptor and Distance in Habitat	Total NO_x (µg/m³)	NO_x % of Critical Level	NO_x % increase from 2035 Baseline
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)			
CH 0m	1.4	4.8	7.7
CH 5m	1.1	3.8	6.6
CH 10m	0.9	3.1	5.9
CH 15m	0.8	2.6	5.2
CH 20m	0.7	2.3	4.7
CH 30m	0.5	1.8	3.9
CH 40m	0.4	1.5	3.3
CH 50m	0.4	1.2	2.8
CH 75m	0.2	0.8	2.0
Pagham Harbour SPA - Neutral Grassland (Unit 18)			
PH Un18 0m	4.5	14.9	9.8
PH Un18 5m	2.4	8.0	8.1
PH Un18 10m	1.6	5.4	6.9
PH Un18 15m	1.2	4.1	6.0
PH Un18 20m	1.0	3.3	5.3
PH Un18 30m	0.7	2.4	4.3
PH Un18 40m	0.5	1.8	3.6
PH Un18 50m	0.4	1.5	3.0
PH Un18 75m	0.3	1.0	2.2
PH Un18 100m	0.2	0.7	1.7
PH Un18 125m	0.2	0.6	1.4
PH Un18 150m	0.1	0.5	1.1
PH Un18 175m	0.1	0.4	0.9
PH Un18 200m	0.1	0.3	0.8
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)			
PH Un5 0m	3.3	11.0	9.1
PH Un5 5m	1.9	6.4	7.7
PH Un5 10m	1.4	4.5	6.6
PH Un5 15m	1.1	3.5	5.8
PH Un5 20m	0.9	2.9	5.2
PH Un5 30m	0.6	2.1	4.3
PH Un5 40m	0.5	1.7	3.6
PH Un5 50m	0.4	1.4	3.2
PH Un5 75m	0.3	0.9	2.3
PH Un5 100m	0.2	0.7	1.8
PH Un5 110m	0.2	0.7	1.7

Predicted Scheme Contribution Scenario 1 with mitigation

Receptor and Distance in Habitat	Nitrogen Deposition (kgN/ha/yr)	% N Deposition of Critical Load	N deposition% increase from 2035 Baseline	Acid Deposition (keqN/ha/yr)	% Critical Level
Chichester and Langstone Harbours/Solent Maritime SPA, Coastal and Floodplain Grazing Marsh (Unit 29)					
CH 0m	0.11	0.6	0.9	-	
CH 5m	0.09	0.4	0.7		
CH 10m	0.07	0.4	0.6		
CH 15m	0.06	0.3	0.5		
CH 20m	0.05	0.3	0.4		
CH 30m	0.04	0.2	0.3		
CH 40m	0.03	0.2	0.3		
CH 50m	0.03	0.1	0.2		
CH 75m	0.02	0.1	0.2		
Pagham Harbour SPA - Neutral Grassland (Unit 18)					
PH Un18 0m	0.30	1.5	2.1	0.054	**1.1**
PH Un18 5m	0.17	0.9	1.3	0.032	0.6
PH Un18 10m	0.12	0.6	0.9	0.022	0.4
PH Un18 15m	0.09	0.5	0.7	0.017	0.3
PH Un18 20m	0.08	0.4	0.6	0.014	0.3
PH Un18 30m	0.06	0.3	0.4	0.010	0.2
PH Un18 40m	0.04	0.2	0.3	0.008	0.2
PH Un18 50m	0.03	0.2	0.3	0.006	0.1
PH Un18 75m	0.02	0.1	0.2	0.004	0.1
PH Un18 100m	0.02	0.1	0.1	0.003	0.1
PH Un18 125m	0.01	0.1	0.1	0.002	0.0
PH Un18 150m	0.01	0.1	0.1	0.002	0.0
PH Un18 175m	0.01	0.0	0.1	0.002	0.0
PH Un18 200m	0.01	0.0	0.1	0.001	0.0
Pagham Harbour - Broadleaved, Mixed and Yew Woodland (Unit 5)					
PH Un5 0m	0.47	**4.7**	2.0	0.087	**4.0**
PH Un5 5m	0.29	**2.9**	1.3	0.054	**2.5**
PH Un5 10m	0.21	**2.1**	1.0	0.039	**1.8**
PH Un5 15m	0.16	**1.6**	0.8	0.031	**1.4**
PH Un5 20m	0.13	**1.3**	0.6	0.025	**1.2**
PH Un5 30m	0.10	1.0	0.5	0.018	0.9
PH Un5 40m	0.08	0.8	0.4	0.015	0.7
PH Un5 50m	0.06	0.6	0.3	0.012	0.6
PH Un5 75m	0.05	0.5	0.2	0.008	0.4
PH Un5 100m	0.03	0.3	0.2	0.006	0.3
PH Un5 110m	0.03	0.3	0.2	0.006	0.3

Appendix K Figures

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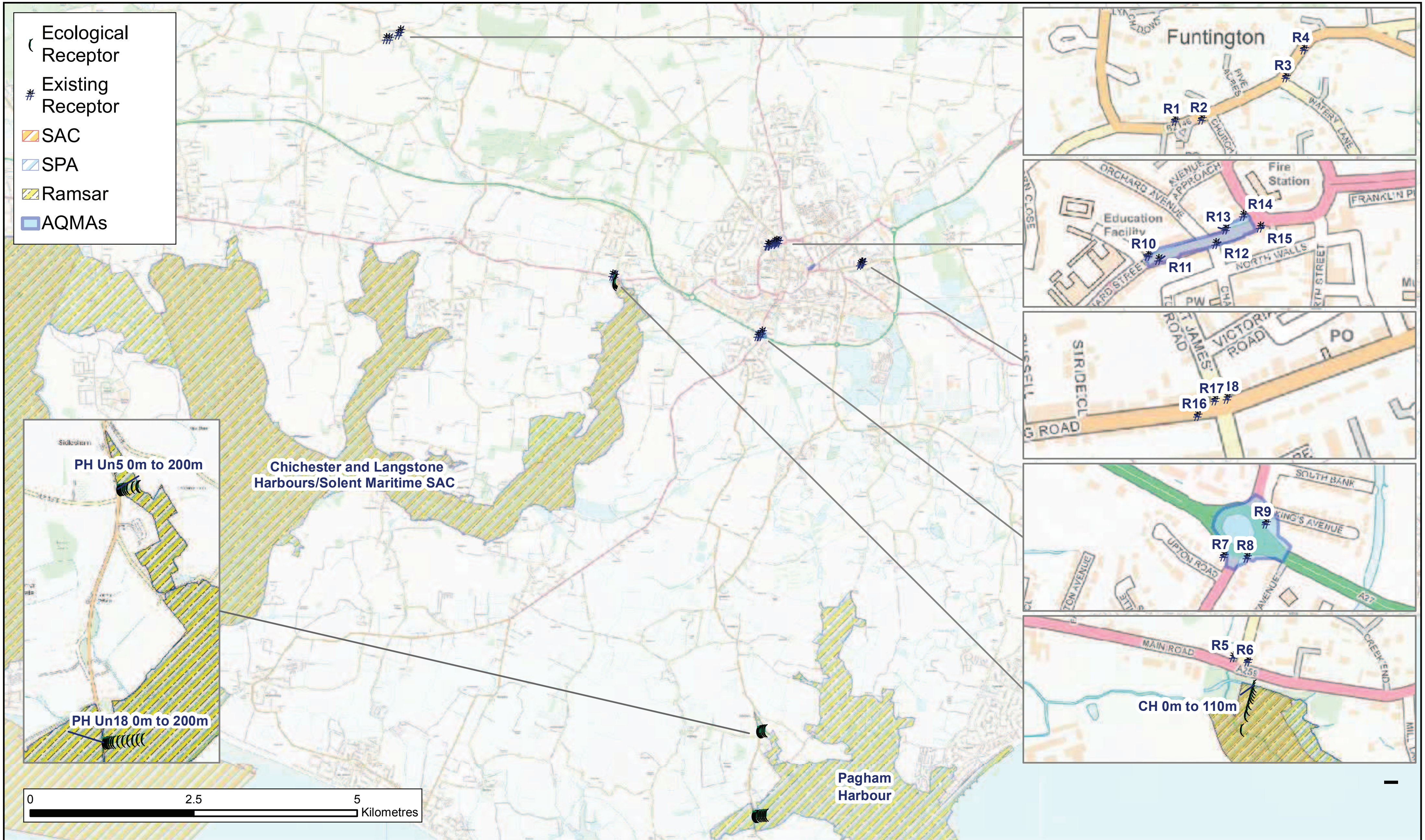

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Air Quality Receptor Locations Appendix G - Air Quality Assessment

Figure 1 | Rev A

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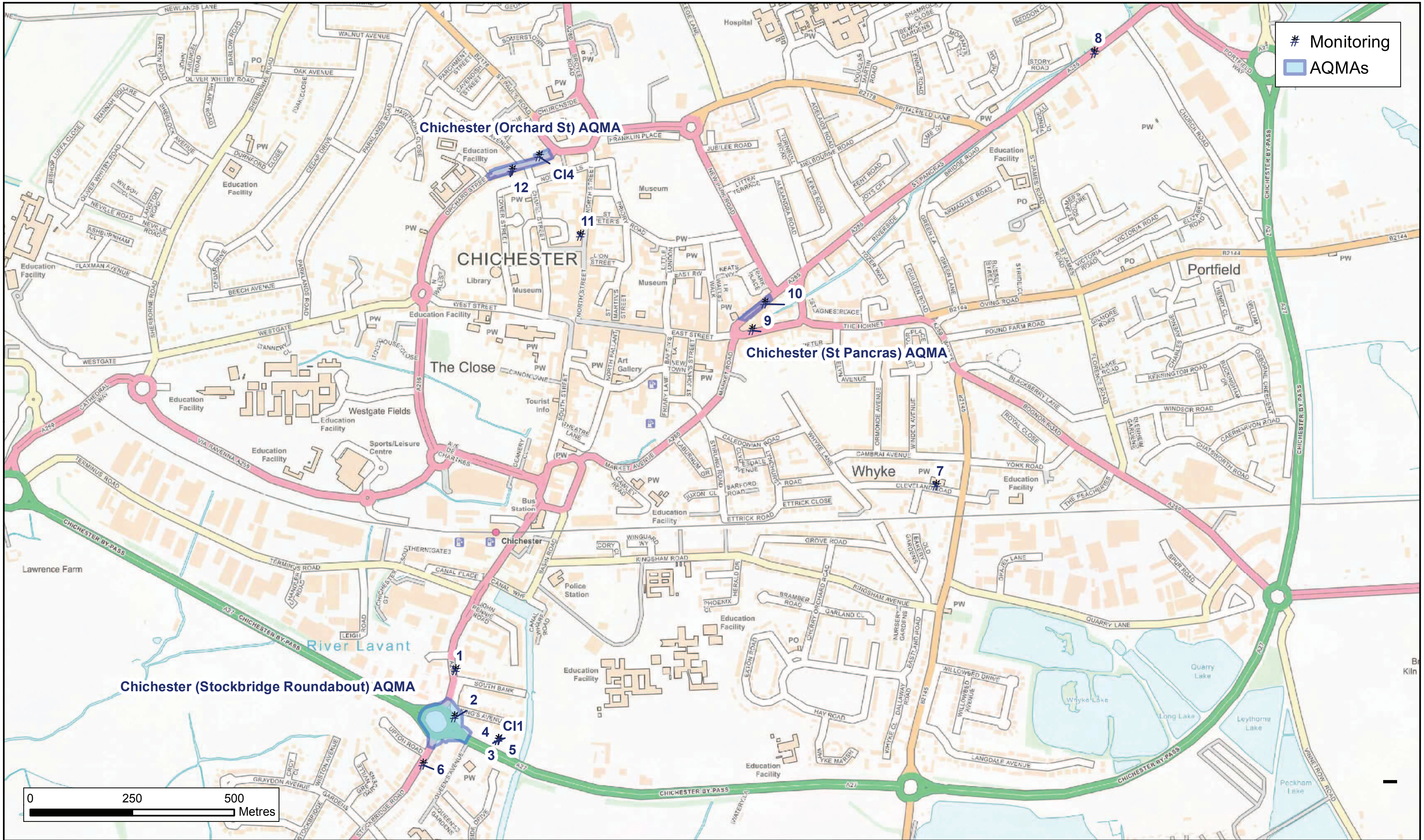

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Air Quality Managment Areas and Monitoring Locations

Figure 2

Rev A