Portsmouth City Centre Road Scheme - Air Quality Assessment for the Local Plan

Portsmouth City Council

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Quality information

Prepared by	Checked by	Verified by	Approved by
Sage Boyman Graduate Air Quality Consultant	Izzy Reeves Air Quality Consultant	Anna Savage Technical Director	Anna Savage Technical Director

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Distribution List

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Prepared for:

Portsmouth City Council

Prepared by:

Sage Boyman
Graduate Air Quality Consultant

AECOM Limited
Sunley House
4 Bedford Park
Croydon
London CR0 2AP
United Kingdom

T: +44(0)1256 310200
aecom.com

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1. Introduction

1.1 In 2005, Portsmouth City Council (PCC) declared thirteen Air Quality Management Areas (AQMAs) across the city, which represent areas with long term exceedances of the annual nitrogen dioxide (NO_2) Air Quality Objective value (AQO) close to where people live. Eight of the AQMAs were revoked in 2010, with five still in place as of March 2024.

1.2 In 2018, PCC were issued with a Ministerial Direction to produce a Local Air Quality Plan to bring NO_2 concentrations to within the legal limit value in the shortest possible time. This study focused on areas identified by Defra's Pollution Climate Mapping (PCM) model including the A3 Alfred Road/Hope Street.

1.3 As a result of the findings of the Local Air Quality Plan, PCC introduced a Clean Air Zone (CAZ) Class B in the city centre in November 2021. The CAZ targets emissions of buses, heavy goods vehicles (HGVs) and taxis driving to/from the motorways to the centre and the Port. PCC also introduced a large number of associated measures to reduce emissions including bus retrofitting, changes to signalisation in the city centre, electric vehicle (EV) charging points, changes to parking pricing and capacity, and walking and cycling improvements to encourage active travel (Portsmouth City Council, 2023). PCC also expanded their pollutant monitoring network to assess the impact of the CAZ and the associated supplementary measures.

1.4 In the majority of the PCC administrative area, annual mean NO_2 concentrations have declined since 2020, and are now within the limits. However, levels measured at roadside locations within the city centre are still above the limits despite the CAZ being in force. In 2022, there are a few roads (including Alfred Road and Hope Street) where levels have actually increased which can be attributed to the increased vehicle usage post pandemic, and these high levels were sustained into 2023. A full set of 2024 data are not available at the time of writing, but initial findings are that concentrations decrease at the majority of sites compared to 2023, including along Hope Street and Alfred Street where some exceedances may potentially remain while other sites look to experience reductions in annual mean NO_2 to below the AQO.

1.5 In July 2024, AECOM completed an Emissions Based Assessment for the Portsmouth Local Plan (AECOM, 2024). Road vehicle emissions were calculated based on data from Systra's strategic traffic model and showed that the largest changes in traffic and subsequent NO_X emissions were located in the city centre, as a result of the proposed City Centre Road Scheme (CCRS). The report recommended that an air quality modelling assessment of roads within the city centre with and without the Local Plan in place should be conducted to determine if the increased emissions would lead to exceedances of relevant objectives.

1.6 It is noted that modelling of the CCRS was previously conducted to support a Strategic Outline Case (SOC) for the Scheme business case and this proceeded the strategic model assessments conducted for the Local Plan. The strategy for the CCRS has evolved since the modelling for the SOC was undertaken, with the longer-term focus being on supporting bus priority, improving bus journey times and encouraging mode shift away from the private vehicle to enable higher level of development to come forward in the City Centre wider area. The Local Plan modelling provides a greater level of detail on the completions, permissions and allocated site locations and scale within the model but reflecting committed transport schemes only.

1.7 This report provides the findings of this detailed air quality assessment of the CCRS to model the impact of this scheme in the future year of 2041 with the new Local Plan allocations in place. The study uses updated Scheme traffic data from Systra based on a revised road scheme layout and considers impacts on selected representative receptors that are relevant for human health and receptors along the PCM road network to consider future compliance with the limit value.

2. Policy Context

National Policy

Air Quality Objectives

2.1 The UK National Air Quality Strategy (AQS) was initially published in 2000, under the requirements of the Environment Act 1995 (HM Government, 1995) – which was updated in 2021 (HM Government, 2021). A further revision of the Strategy (Defra, 2007) sets objectives to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive. Some of these objectives have been laid out within the Air Quality (England) Regulations 2000 (HM Government, 2000) and later amendments (HM Government, 2002).

2.2 The principal air quality legislation within the UK is the Air Quality Standards Regulations 2010 (as amended in 2016 by the Air Quality Standards (Amendment) Regulations 2016) (HM Government, 2016), which transposes relevant EU Air Quality Directives into national legislation.

2.3 The air quality objectives have been set down in regulation for the purposes of LAQM. Under the LAQM regime, local authorities have a duty to carry out regular assessments of air quality against the objectives and if it is unlikely that these will be met in the given timescale, they must designate an AQMA and prepare an AQAP with the aim of achieving the objectives. The boundary of an AQMA is set by the local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. It is not unusual for the boundary of an AQMA to include within it, relevant locations where air quality is not at risk of exceeding an air quality objective.

2.4 The UK's national air quality objectives for NO_2, PM_{10}, and $PM_{2.5}$ are presented in Table 2.1.

Table 2.1: UK Air Quality Objectives

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances/Target
NO_2	Annual Mean	40 µg/m^3	None
	Hourly Mean	200 µg/m^3	18 times per year
PM_{10}	Annual Mean	40 µg/m^3	None
	24-Hour Mean	50 µg/m^3	35 times per year
$PM_{2.5}$	Annual Mean	20 µg/m^3	None
		10 µg/m^3	By 2042
		12 µg/m^3	Interim target, (by end of January 2028)
	Exposure reduction compared to 2018	35%	By 2042
		22%	Interim target, (by end of January 2028)

Clean Air Strategy (2019)

2.5 In 2019, the UK government released its Clean Air Strategy 2019 (Defra, 2019) as part of its 25-year Environment Plan. The focus of this strategy is 'making our air healthier to breathe, protecting nature and boosting the economy'.

2.6 Local air quality management focus in recent years has primarily related to NO_2, and its principal source in the UK, road traffic. However, the 2019 Strategy broadens the focus to other areas, including domestic emissions from wood burning stoves and from agriculture. This shift in emphasis is part of a goal to reduce the levels of fine particulate matter ($PM_{2.5}$) in the air to below the World Health Organization guideline level; lower than the current UK objective is shown in Table 2.2 (World Health Organization, 2021; World Health Organization, 2005).

Table 2.2: 2005 and 2021 WHO Air Quality Guidelines

Pollutant	Averaging Period	2005 Level	2021 Level
NO_2	Annual Mean	40 µg/m^3	10 µg/m^3
	24-Hour Mean	-	25 µg/m^3
PM_{10}	Annual Mean	20 µg/m^3	15 µg/m^3
	24-Hour Mean	50 µg/m^3	45 µg/m^3
$PM_{2.5}$	Annual Mean	10 µg/m^3	5 µg/m^3
	24-Hour Mean	25 µg/m^3	15 µg/m^3

2.7 The Environment Act 2021 (HM Government, 2021) amends the Environment Act 1995. On 9th November 2021, the Act received Royal Assent after being first introduced to Parliament in January 2020 to address environmental protection and the delivery of the Government's 25-year Environment Plan following Brexit. It includes provisions to establish a post-Brexit set of statutory environmental principles and ensure environmental governance through an environmental watchdog, the Office for Environmental Protection.

2.8 The Secretary of State must publish a report reviewing the AQS every five years (as a minimum and with yearly updates to Parliament). The AQS proposes that the government set two targets by October 2022: the first on the amount of $PM_{2.5}$ in the ambient air (the figure and deadline for compliance remain unspecified) and a second long-term target set at least 15 years ahead to encourage stakeholder investment.

National Planning Policy Framework (2024)

2.9 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2024) sets out the Government's environmental, economic and social planning policies for England and how these are expected to be applied. The revised Framework replaces the previous National Planning Policy Framework published in March 2012. This was revised several times in 2019, 2021 and the latest version was issued in December 2024.

2.10 Paragraphs 180 and 192 of the NPPF provide advice on when air quality should be a material consideration in development management decisions. In particular, paragraph 192 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 (2019)

2.11 The Planning Practice Guidance (PPG) was launched in March 2014 and was updated most recently (Ministry of Housing, Communities and Local Government, 2019) with specific reference to air quality. The PPG states that the planning system should consider the potential effect of new developments on air quality where relevant limits have been exceeded or are near the limit.

Concerns also arise where the development is likely to adversely affect the implementation of air quality strategies and action plans.

2.12 In addition, air quality may also be considered to be material if the Proposed Scheme would be particularly sensitive to poor air quality in its vicinity. The PPG states:

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

Local Planning Policy

The Portsmouth Plan (2001-2011)

2.13 PCC adopted their local plan 'Portsmouth's City Council Plan 2001-2011' in 2006. This was amended in 2012 and contains missions and associated actions that relate to improving air quality within the council (Portsmouth City Council, 2006).

2.14 The plan focuses on:

- "Land use / transport planning must also achieve more sustainable patterns of development to minimise travel and to ensure that everyone has equal access to the transport network. This is in addition to the need to reduce adverse impacts on the natural environment and air quality."
- "Air quality is influenced by the emission of air pollutants in the city, input of pollutants from surrounding areas and atmospheric processes and dispersion. Across the whole city, the major source of air pollution is emissions from road traffic. Other significant sources include industrial processes."
- "The consideration of air quality impact will apply particularly to developments expected to generate significant additional traffic and sensitive developments located close to significant sources of air pollution. New developments that are expected to exceed the air quality objectives will not be acceptable. Developments that are expected to result in significant increases in air pollution in all or part of the city may also be unacceptable."

Pre-Submission Local Plan (2020 - 2040)

2.15 A new Local Plan for PCC is due to be submitted in January 2025. Once adopted it will become the statutory development plan for Portsmouth that will guide development in the city beyond 2040 (Portsmouth City Council, 2024). The plan allocates sites for development, sets targets for new homes and jobs. It will also introduce city wide policies on design, greening and the climate emergency while recognising that the capacity for growth in the city is limited by land supply, flooding, and special area for nature conservation.

2.16 The new Local Plan specifically addresses air quality through a development management policy 'Air Quality and Pollution' (PLP35) which looks to ensure that development proposals demonstrate that they will not contribute to and will not be subject to unacceptable levels of pollution, which cannot be mitigated. The Local Plan also includes specific reference to air quality in the Policy for the City Centre (PLP6) which requires development to provide evidence that air quality in adjoining AQMAs is not worsened.

2.17 In the Emissions Based Assessment of the Local Plan (completed by AECOM in July 2024 considered changes to road traffic emissions for the following scenarios:

- Scenario 1: 2019 Base – Baseline;
- Scenario 2: 2041 Baseline - No Local Plan development within Portsmouth except for committed sites (referred to as 'Do Minimum' in the Emissions Based Assessment Report);

- Scenario 3: 2041 Do Minimum - Full Local Plan development without transport mitigation (referred to as 'Do Something' in the Emissions Based Assessment Report); and
- Scenario 4: 2041 Do Something - Full Local Plan development with local transport mitigation (referred to as 'Do Something with mitigation' in the Emissions Based Assessment Report).

Local Strategies

Air Quality Strategy

The existing Air Quality Strategy was published in 2017 and it aimed to strive consistently towards achieving all statutory local air quality standards on a city wide basis by 2027 (Portsmouth City Council, 2017). However, many of the measures included within the Strategy are no longer relevant or have been started or completed, therefore the Strategy is now being refreshed by the City Council's Public Health team.

Local Air Quality Plan (2019)

2.18 PCC adopted their Air Quality Local Plan in 2019 to set out how compliance with legal limits for NO_2 can be achieved in the shortest possible time primarily focused on the area of exceedance in the city centre (Portsmouth City Council, 2019).

2.19 The preferred package consisted of the following elements:

- Class B CAZ (implemented in November 2021);
- Changes to parking capacity and pricing south of the city centre;
- Improvements to strategic cycling routes;
- Changes to Alfred Road traffic signals;
- Progressive tightening of taxi licensing rules;
- Rapid charging points at taxi ranks;
- Reduced fee/ free residents parking permits for low emission vehicles;
- Travel planning and behaviour change measures; and
- Targeted communications and marketing initiatives.

2.20 As concentrations in selected roadside locations are still above the legal limit, PCC produced a targeted feasibility study (TFS) in 2024 to review the effectiveness of the CAZ and to consider any further measures. to bring NO_2 within legal limits in the shortest possible time. This was submitted to Central Government's Joint Air Quality Unit (JAQU) in December 2024 for consideration and - at the time of writing - PCC is waiting for a response on the proposals and next steps.

City Centre Road Scheme (CCRS)

2.21 The CCRS is a long-term strategy to enable regeneration of currently underutilised land for large scale residential development and encourage development to come forward in the city centre, whilst improving the landscape, supporting bus priority, improving bus journey times and encouraging mode shift away from private cars. Due to the proposed changes to road layouts, there are concerns that the Scheme may result in increase levels of pollution on sections of the A3 within the CAZ, once implemented and during the construction, or potentially increasing the population in close proximity to roads experiencing poor air quality. Whilst the layout is subject to ongoing refinements to allow for the most efficient operation of transport modes and to minimise any disbenefits to air quality, the Local Plan includes the latest version of the Scheme which includes proposed junction improvements to roundabouts at Church Street, Marketway, Hope Street and Lake Road.

Other Relevant Standards and Guidance

2.22 There is currently no statutory guidance on the method by which an air quality assessment should be undertaken. Environmental Protection UK (EPUK), the Institute of Air Quality Management (IAQM) (Environmental Protection UK (EPUK) & IAQM, 2017). DMRB LA105 Air Quality Guidance (National Highways, 2019) and the Department for Environment, Food and Rural Affairs (Defra) (Defra, 2022) have published their own guidance for carrying out air quality assessments for development control. These guidance documents have considered as part of this air quality assessment.

3. Baseline Air Quality

Local Air Quality Management

3.1 Under the requirements of Part IV of the Environment Act (1995), PCC has carried out a review and assessment of local air quality.

3.2 PCC's five current AQMAs are declared for exceedances of the annual mean NO_2 AQO. These AQMAs are shown in Figure 7-4 and summarised below:

- AQMA 6 (2005) – An area encompassing a large number of residential properties extending north along Fratton Road; from Fratton Bridge into Kingston Road, continuing into London Road until the roundabout junction with Stubbington Road and Gladys Avenue.
- AQMA 7 (2005) – An area encompassing residential properties along Hampshire Terrace and St Michaels Road gyratory.
- AQMA 9 (2005) – An area encompassing residential properties near to the southernmost section of Eastern Road from Sword Sands Road south into Velder Avenue and its junction with Milton Road.
- AQMA 11 (2010) – This area encompasses a large number of residential properties east of the west transport corridor extending along part of the M275 and Mile End Road stretching from Rudmore roundabout south to Church Street roundabout.
- AQMA 12 (2005) – An area encompassing residential properties along Queen Street mainly an area stretching form The Hard to St James' Road.

3.3 During 2023, PCC operated five continuous monitoring sites (CAQMS) during 2023 with an additional site run by Defra, as summarised below:

- PCC's CAQMS C2 – London Road, North End;
- PCC's CAQMS C4 – Gatcombe Park Primary School, Hilsea;
- PCC's CAQMS C6 – Burrfields Road, Baffins;
- PCC's CAQMS C7 – Mile End Road, Buckland;
- Defra's CAQMS C8 – Anglesea Road, Southsea; and
- PCC's CAQMS C9 – Alfred Road, Southsea.

3.4 PCC also undertook non-automatic monitoring of NO_2 at an additional 228 sites and data from these are reported in their Annual Status Report (ASR)[1]. Selected monitoring sites in the study area are shown in Figure 7-4 with concentrations in Table 3.1 and Table 3.2.

3.5 There were three exceedances of the AQO, and 2005 WHO Level, for annual mean NO_2 in 2023. These locations were at diffusion tube sites; 117, 118, and 145 on Alfred Road and Hope Street in the city centre. These sites are located close to the existing city centre AQMA 11. All monitoring sites exceeded the 2021 WHO Level of 10 µg/m^3 for NO_2.

3.6 PCC also monitor particulates at their automatic sites. The highest annual mean PM_{10} concentration recorded in 2022 was 18.7 µg/m^3 at C8 on Anglesea Road. There have been no exceedances of the PM_{10} annual mean AQO or 24h mean AQO in the last few years and levels are mostly declining year on year. The annual mean PM_{10} concentrations at all automatic sites fell below the 2005 WHO Level of 20 µg/m^3 whilst C4 (14.6 µg/m^3) exceeds the 2021 WHO Level of 10 µg/m^3.

3.7 In 2022, the highest annual mean $PM_{2.5}$ concentration (9.9 µg/m^3) was recorded at C6 Burrfields Road. There have been no exceedances of the annual mean AQO in the last few years. All monitored $PM_{2.5}$ annual mean concentrations were therefore below the 2005 WHO Level and Air Quality Objective of 10 µg/m^3, but none were below the 2021 WHO Level of 5 µg/m^3.

[1] 2024 Data and ASR provided by PCC directly.

Table 3.1: PCC NO_2 Diffusion Tube Monitoring Data within 1 km of Portsmouth City Centre

			Annual Mean NO_2 Concentration (µg/m^3)				
Site ID	**Site Name**	**Site Type**	**2019**	**2020**	**2021**	**2022**	**2023**
DT30	Market Tavern (Mile End Rd) (MER-MT)	Roadside	34.3	28.2	29.2	31.4	30.0
DT34	Sovereign Gate, Commercial Rd (ComR-UF)	Roadside	31.0	25.3	25.2	27.9	26.0
DT44	4 Marketway, Portsmouth PO1 4BX	Roadside	32.4	27.5	26.7	27.8	26.5
DT45	5 Marketway, Portsmouth PO1 4BX	Roadside	31.9	27.6	28.6	30.5	29.0
DT117	Alfred Road, Column 9	Roadside	**48.0**	**41.0**	**43.0**	**48.5**	**42.8**
DT118	Alfred Road, Column 12	Roadside	**52.5**	38.8	**41.7**	**45.9**	**43.7**
DT119	St Agatha's Bus Stop, Market Way	Kerbside	30.7	24.7	28.1	27.5	28.0
DT120	Market Way, Cross from (MW-OppStABS)	Roadside	**46.9**	36.3	35.3	**44.9**	35.7
DT145	Hope Street (Cross from Column4)	Kerbside	**53.9**	**43.6**	**44.6**	**48.5**	**42.5**
DT157	Church Street (Cross from Column2)	Kerbside	37.3	28.0	28.0	29.9	27.1
DT167	Church Street, Column 11	Roadside	29.0	27.6	27.7	28.0	26.7
DT170	Commercial Road, Column 3	Roadside	**41.5**	30.7	27.9	30.7	27.7
DT171	Commercial Road, Column 4	Roadside	31.3	23.1	24.2	25.8	22.9
DT172	Hope Street, Column 11	Roadside	38.8	27.9	27.7	29.9	29.2
DT174	Church Street, Column 12	Roadside	31.3	25.7	24.6	24.2	23.7
DT175	Church Street, Column 2	Roadside	37.6	32.4	32.3	31.5	31.4
DT181	Trafalgar Gate, Column 3	Kerbside	-	24.3	24.6	26.0	24.1
DT182	Trafalgar Gate, Column 4	Kerbside	-	30.0	30.3	27.9	26.7
DT183	Flathouse Road Column 2 (11 Flathouse Rd, Portsmouth PO1 4QS)	Kerbside	-	26.4	24.7	25.1	22.7
DT184	Flathouse Road (Cross from 11 Flathouse Rd, Portsmouth PO1 4QS)	Roadside	-	24.2	24.7	24.4	22.4
DT188	Norman House, Kettering Terrace, Portsmouth PO2 7SB, Column 5	Kerbside	-	27.4	25.8	25.2	23.6
DT189	Norman House, Kettering Terrace, Portsmouth PO2 7SB, Column10	Kerbside	-	28.5	25.3	26.7	24.7
DT190	Prospect Road, Column 2	Roadside	-	27.7	25.7	25.8	24.5
DT191	Prospect Road, Column3	Roadside	-	27.2	24.9	26.3	25.7
DT222	Commercial Rd, Column 10 (Cross from Sovereign Gate, 308-314 Commercial Rd, Portsmouth PO1 4BL)	Roadside	-	-	27.5	28.6	25.7
DT251	Hope Street, Column 10	Roadside	-	-	30.2	32.0	30.5
DT252	Hope Street, Column 3	Kerbside	-	-	29.3	27.3	29.6
DT255	Hope Street (Cross from Column 10)	Roadside	-	-	29.8	31.6	28.7

			Annual Mean NO_2 Concentration ($\mu g/m^3$)				
Site ID	Site Name	Site Type	2019	2020	2021	2022	2023
DT268	Market Tavern, Mile End Road, Column 66A	Roadside	**-**	-	38.1	33.6	32.8
DT271	Market Way, Column 2	Kerbside	**-**	-	25.8	27.8	24.8
DT272	Market Way, Cross from Column 2	Kerbside	**-**	-	31.4	33.5	31.1

Note: Values that exceed the annual AQS Objective (40 $\mu g/m^3$) are shown in **bold.** Values above the hourly objective (60 $\mu g/m^3$) are also **underlined.**

Table 3.2: PCC Automatic NO_2 Monitoring Data within 1 km of Portsmouth City Centre

			Annual Mean NO_2 Concentration ($\mu g/m^3$)				
Site ID	Site Name	Site Type	2019	2020	2021	2022	2023
CAQMS C2	London Road, North End	Kerbside	**40.5**	32.7	29.3	32.1	30.4
CAQMS C7	Mile End Road, Buckland	Roadside	32.4	26.6	34.8	26.7	25.1
CAQMS C8	Anglesea Road, Southsea	Roadside	27.8	21.3	21.3	23.3	26.0
CAQMS C9	Alfred Road, Southsea.	Roadside	**-**	-	-	**43.5**	37.7

Note: Values that exceed the annual AQS Objective (40 $\mu g/m^3$) are shown in **bold.** Values above the hourly objective (60 $\mu g/m^3$) are also **underlined.**

4. Methodology

Overview

4.1 This section presents the methodology used to model pollutant concentrations in the study area.

4.2 The following sources of information and data have been used to form the basis of the air quality assessment:

- Defra's Air Quality Background Concentration Maps based on a 2018 base year (Department for Environment, Food and Rural Affairs, 2018)
- Defra's Air Quality Background Concentration Maps based on a 2021 base year (Department for Environment, Food and Rural Affairs, 2024);
- Defra's Vehicle Emission Factors within the Emission Factor Toolkit (EFT) v12.1 (Defra, 2024); Future vehicle fleet and emissions were forecast from the current baseline to the Local Plan year of 2041.
- Air quality monitoring data from PCC's ASR (Portsmouth City Council, 2023); and
- Modelled traffic count and speed data provided by Systra transport consultants for 2019 and 2041.

4.3 The modelling assessment was conducted following methodology within Defra's LAQM.TG(22) Technical Guidance (Defra, 2022) It is noted that the 2024 TFS followed a similar methodology to assess vehicle emissions, but used an earlier version of the EFT (v12.0.1).

Traffic Data

4.4 Modelled traffic data was provided by Systra from the Solent Sub-Regional Transport Model (SRTM), working on behalf of PCC. The traffic data was provided for a series of road links across the whole of Portsmouth.

4.5 Traffic data was in the form of 24-hour Annual Average Daily Traffic (AADT) flows, with percentage heavy duty vehicles (HDV) and average speed for a 2019 base, 2041 future scenario with the Local Plan and 2041 scenario with the Local Plan and City Centre Scheme.

Receptors

4.6 A desk-top review using aerial mapping with reference to the OS AddressBase was conducted to select representative locations where people are likely to be present, such as residential properties or educational centres.

4.7 The locations of the chosen sensitive representative receptors within and in the vicinity of the AQMAs are included in Figure 7-5 and Table 4.1.

4.8 Compliance receptors were modelled, in addition to representative human health receptors, along all road links which are part of Defra's 2018 PCM model within the study area, including roads where exceedances currently occur such as Alfred Road and Hope Street as there no sensitive receptors on these streets. These compliance receptors represent a more worst-case scenario than the representative receptors due to their closer proximity to the road edge. Further details on the Compliance Risk Assessment are provided in paragraphs 4.18 to 4.24 below and the modelled receptors and concentrations are provided in Appendix B – Compliance Receptors.

4.9 Receptors were modelled at the lowest point where there is residential exposure, either at ground floor level, at a height of 1.5 metres above ground, or at first floor level at 4.5 metres.

Table 4.1: Selected Receptor Locations

Receptor ID	Road Name	Within AQMA	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
R01	Charter Academy	No	464342.0	99998.9	1.5
R02	ARK Ayrton Primary Academy	No	464756.3	99964.1	1.5
R03	St Edmunds Roman Catholic School	No	464626.2	100397.6	1.5
R04	St John's Cathedral Roman Catholic Primary School	No	464762.7	100406.4	1.5
R05	Arundel Court Primary Academy	No	464814.3	100618.3	1.5
R06	Chaucer House and Margaret Rule Hall/ University House	No	463810.4	100195.9	1.5
R07	Madani Academy	Yes	465139.4	101000.7	1.5
R08	The Portsmouth Academy	Yes	465235.1	100935.6	1.5
R09	Dickens Primary Academy	No	464705.9	100959.3	1.5
R10	Manor Infant School	Yes	465207.6	101217.4	1.5
R11	Flying Bull Primary and Nursery School	No	464706.7	101619.5	1.5
R12	Ynystawe Primary School	Yes	464214.6	102360.0	1.5
R13	86 Sultan Road	No	464654.2	101288.4	4.5
R14	Nickleby House	No	464546.9	101087.8	4.5
R15	170 Estella Road	Yes	464548.5	101773.4	4.5
R16	14 Garfield Road	No	464763.6	101851.7	1.5
R17	3 Malthouse Road	No	464771.0	101825.1	1.5
R18	65A Kingston Crescent	Yes	464815.4	101931.1	1.5
R19	227-229 Compass House	Yes	464900.8	101847.6	4.5
R20	198A Kingston Road	Yes	464940.0	101759.0	4.5
R21	167B Kingston Road	Yes	464952.5	101678.9	1.5
R22	132A Kingston Road	Yes	465046.9	101558.6	4.5
R23	63 Kingston Road	Yes	465095.2	101394.2	1.5
R24	16 Malins Road	No	464719.8	101333.9	1.5
R25	128 Sultan Road	No	464869.7	101266.2	1.5
R26	Buckland Path	No	464945.6	101295.9	1.5
R27	231 Commercial Road	No	464368.7	100765.1	4.5
R28	6A Commercial Road	Yes	464364.1	100837.9	4.5
R29	14 Hallowell House	Yes	464449.8	100829.5	1.5
R30	Larch Court	Yes	464586.6	100961.3	1.5
R31	373-375 Old Commercial Road	Yes	464412.0	101156.9	1.5
R32	Grafton Street	Yes	464440.6	101344.6	1.5
R33	43A Kingston Road	Yes	465101.9	101334.5	4.5
R34	30B Kingston Road	Yes	465122.4	101292.2	4.5
R35	37B Kingston Road	Yes	465103.2	101319.8	4.5
R36	9 Hampshire Street	Yes	465160.3	101089.2	1.5
R37	Kilmiston Close	Yes	465091.5	101072.6	1.5
R38	Buckingham Green	No	464975.6	101042.2	1.5

Receptor ID	Road Name	Within AQMA	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
R39	211A Lake Road	Yes	464821.9	100974.7	4.5
R40	3 Drummond Road	No	464713.9	100822.5	1.5
R41	31 Holbrook Road	No	464777.6	100789.9	1.5
R42	243 Fratton Road	Yes	465117.6	100793.4	1.5
R43	216A Fratton Road	Yes	465123.3	100597.3	4.5
R44	72 Wimpole Street	No	464890.0	100458.8	1.5
R45	171 Arundel Street	No	464645.3	100433.6	1.5
R46	232 Arundel Street	No	464995.1	100431.4	4.5
R47	19 Angmering House	No	464416.0	100400.4	1.5
R48	1-4 Albany Apartments	No	464156.4	100343.2	4.5
R49	5A Edinburgh Road	No	464131.1	100433.7	4.5
R50	13A Edinburgh Road	No	464066.7	100441.4	4.5
R51	Catherine House Student Accommodation	No	464074.4	100327.8	4.5
R52	2 Wellington Street	No	464217.4	99901.9	1.5
R53	8 Plymouth Street	No	464368.2	99928.6	1.5
R54	143-147 Somers Road	No	464727.7	99903.2	1.5
R55	Unite Students Chaucer House	No	464270.6	100104.7	4.5
R56	2 Montgomerie Road	No	464752.9	99875.0	1.5
R57	4 Lower Forbury Road	No	464625.9	99861.3	1.5
R58	Illustrious House	No	464347.1	99903.9	4.5
R59	31 Froddington Road	No	464924.2	99991.0	1.5
R60	16-48 Priory View	No	465085.4	99971.2	4.5
R61	26 Bridgeside Close	No	464821.1	100297.9	1.5
R62	2A Fratton Road	No	465163.9	100068.3	1.5
R63	43A Fratton Road	Yes	465148.0	100209.1	4.5
R64	150-156 Pink Court	Yes	465139.6	100447.5	1.5
R65	22 Mills Road	Yes	464586.3	101994.7	1.5
R66	90 Stanley Road	Yes	464331.4	102197.3	1.5
R67	Island View Terrace	Yes	464209.6	102224.7	1.5
R68	119 Whale Island Way	Yes	464234.4	102193.5	1.5
R69	252 Kingsbury Mansions	Yes	464910.9	101893.8	1.5
R70	73-75 Clarence Street	No	464248.6	100853.2	4.5
R71	Unicorn Road	No	464061.5	100505.1	1.5
R72	Bishops House	No	463974.6	100474.8	1.5
R73	338 Commercial Road	Yes	464441.2	100963.1	4.5
R74	James Watson Hall	Yes	463924.9	99996.9	4.5
R75	Unite Students Trafalgar Hall	No	464111.8	99913.3	4.5
R76	Edgbaston House	No	464485.2	99857.8	4.5
R77	120A Lake Road	Yes	464756.1	100902.4	1.5
R78	287 Commercial Road	Yes	464402.7	100896.0	4.5

Receptor ID	Road Name	Within AQMA	X co-ordinate (m)	Y co-ordinate (m)	Height (m)
R79	28-40 Lake Road	No	464507.8	100756.9	1.5
R80	Northesk House	No	464614.8	100830.2	1.5
R81	250 Somers Road North	No	464950.9	100220.7	1.5
R82	Enterprise House	No	464191.4	100189.9	4.5
R83	5 Estella Road	Yes	464511.9	101490.6	4.5
R84	Blendworth House	No	464583.3	100783.9	1.5
R85	Rudmore Court	Yes	464472.4	102081.4	1.5
R86	Crown Place Apartments	No	464212.2	100332.7	4.5

Model Setup

4.10 Road traffic emissions of nitrogen oxides (NOx) were derived using Defra's latest version of the EFT (v12.1) at the time of assessment and associated guidance and tools[2].

4.11 Detailed dispersion modelling was undertaken using the current version of ADMS-Roads (v5.0.1.3) to model concentrations of NOx, $PM_{2.5}$, and PM_{10} using the parameters in Table 4.2 for the following scenarios:

- 2019 Baseline – 2019 AADT, 2019 emission factors and 2019 background concentrations;
- 2041 'Do Minimum (DM)' – 2041 AADT, uses 2040 emission factors and 2040 background concentrations[3]; and
- 2041 'Do Something (DS)' – 2041 AADT, uses 2040 emission factors and 2040 background concentrations.

Table 4.2: General ADMS-Roads Model Conditions

Variables	ADMS-Roads Model Input
Surface roughness at source	0.5m
Surface roughness at Meteorological Site	0.3m
Minimum Monin-Obukhov length for stable conditions	30m
Receptor location	x, y coordinates determined by GIS, z = 1.5m for human receptors or 4.5m for first floor.
Emissions	NO_x, PM_{10} and $PM_{2.5}$ – Defra's EFT v12.1
Meteorological data	1 year (2019) hourly sequential data from Thorney Island meteorological station.
Receptors	Selected receptors
Model output	Long-term (annual) mean NO_x, PM_{10}, and $PM_{2.5}$ concentrations.

Meteorological Data

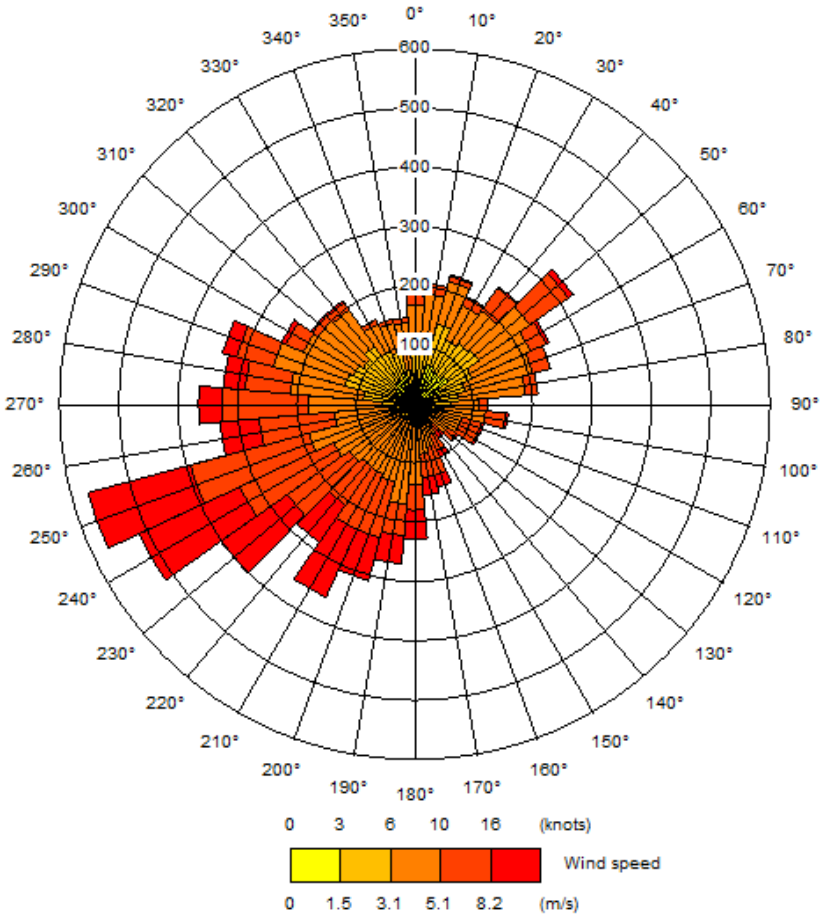
4.12 One year (2019) of hourly sequential observation data from Thorney Island meteorological station was used in this assessment to correspond with the baseline traffic data and monitoring data used for model verification. The station is located approximately 11km north-east of Portsmouth City Centre

4.13 Thorney Island experiences meteorological conditions that are representative of those experienced within the air quality study area.

[2] https://laqm.defra.gov.uk/
[3] Defra's tools only project forward up to 2040.

4.14 Figure 4-1 shows that the dominant direction of wind was from the south-west, as is typical for the UK.

Figure 4-1: Wind Rose, Thorney Island Meteorological Data, 2019



Note: Figure 4-1 shows a wind rose for the Thorney Island Meteorological site in 2019, this shows the dominant wind direction is from the south-west with other smaller peaks from the south to the west and from the north-east.

Background Data

4.15 Background concentrations of NO_2, NO_X, PM_{10} and $PM_{2.5}$ for 2019 and 2040 were sourced from Defra's 2018 and 2021-based 1x1km background maps.

4.16 The background data presented in Table 4.3 show that the mapped background concentrations are predicted to decrease between 2019 and 2040, particularly NO_2 and NO_X.

Table 4.3: Defra Mapped Background Pollutant NO_x, NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Grid Square		Annual Mean Concentrations (µg/m³)							
X	Y	2019				2040			
		NO_2	NOx	PM_{10}	$PM_{2.5}$	NO_2	NOx	PM_{10}	$PM_{2.5}$
463500	102500	17.0	24.1	13.9	9.9	9.1	11.8	9.8	6.0
464500	102500	19.8	29.0	18.5	13.6	10.5	13.8	12.3	7.4
463500	101500	27.7	45.6	14.2	10.2	17.3	24.5	10.1	6.3
464500	101500	24.1	37.3	16.6	11.9	13.5	18.3	11.6	6.9
463500	100500	23.0	35.1	15.3	10.7	16.0	22.2	10.9	6.6
464500	100500	21.3	31.6	16.1	11.3	10.9	14.4	11.2	6.7

Note: Sectors removed as emissions included in detailed dispersion modelling: Motorway (in of 1x1km grid square), Trunk A road (in of 1x1km grid square) and Primary A Road (in of 1x1km grid square)

Model Verification

4.17 Predicted results from an air quality dispersion model may differ from measured concentrations for several reasons, including uncertainties associated with traffic flows and emissions factors, meteorology and limitations inherent to the modelling software. In light of this, and in accordance with advice in LAQM.TG(22), for roads-based air quality assessments it is best-practice to perform a comparison of modelled results with local monitoring data to minimise these modelling uncertainties. This provides a verification factor, by which the output of the ADMS-Roads model is adjusted, to gain greater confidence in the results. The verification of the modelling output was carried out as prescribed in LAQM.TG(22) and details are provided in Appendix C.

Compliance Risk Assessment

4.18 A compliance risk assessment was carried out in accordance with DMRB LA105 Air Quality Guidance (National Highways, 2019) to evaluate the effect of the scheme on the UK's ability to comply with the Air Quality Directive and NO_2 Limit Value.

4.19 All road links which are part of Defra's 2018 PCM model[4] and within the study area were identified. Receptors were chosen alongside the PCM links in the following locations:

- at 'qualifying features' at worst-case exposure within 15m of the running lanes of a road/kerbside (but not within 25m of a junction), for example footpaths that run parallel to the road; and
- at 'validation points' 4m from the road edge at a height of 2m, for comparison with PCM modelled concentrations.

4.20 The concentrations of NO_2 at these points were modelled in the same manner as for public exposure receptors. This is to ensure the compliance risk assessment is consistent with Defra's reporting on compliance with the Limit Values.

4.21 The concentrations of NO_2 predicted by the air quality model at the validation points in the 2019 Base and DM and DS scenario for 2041 were compared to the PCM modelled concentrations for 2019 and 2030 as the model does not predict any further into the future.

4.22 The compliance risk assessment aims to conclude that there is no risk to the UK's reported ability to comply with the Air Quality Directive in the shortest timescale possible where:

- there are no modelled exceedances of the air quality thresholds for any PCM link; or
- there are modelled exceedances of the air quality thresholds for any PCM link, but the change in annual mean NO_2 concentrations between the DM and DS is less than or equal to +/-0.4 µg/m³.

[4] This is the most recent version that projects concentrations into the future.

4.23 If these criteria are not met, further assessment is required to evaluate the compliance risk, including comparison to the maximum PCM modelled concentrations within the reporting zone.

4.24 There are a number of road links in the Defra's PCM network that are located within the study area as displayed in Table 4.4. Most links are predicted to have NO_2 concentrations that comply with the limit value in 2019 except for sections of the A3.

Table 4.4: PCM road links in study area

PCM Census ID	Road Name
802080804	A2030
802038333	A2047
802048196	A3
802080805	A2030
802074476	A3
802057614	A3
802036116	A2047
802074735	A3
802080848	A3
802080847	A3
802080849	A2030
802080806	A2030

5. Modelled Pollutant Concentrations

5.1 Modelled results at the selected representative receptors are presented in Table 5.1, Table 5.2 and Table 5.3 for NO_2, PM_{10} and $PM_{2.5}$ respectively. The modelled annual mean NO_2 concentrations for DS 2041 are shown in

5.2 Figure 7-6 in Appendix A.

NO_2 Concentrations

5.3 Following the adjustment of the model outputs based on the factor calculated from the verification of the 2019 data, shown in Appendix C – Model Verification Details, there were no sensitive receptors that were predicted to exceed the AQO for annual mean NO_2 of 40 µg/m^3 and the hourly mean AQO in the 2019 Baseline. The receptor with the highest annual mean NO_2 concentrations of 39.1 µg/m^3 was at R31, located at 373-375 Old Commercial Road, approximately 12 m from the A3, and within AQMA 11.

5.4 By 2041, all of the 86 selected receptors were estimated to have annual mean NO_2 concentrations below the annual mean AQO in both future scenarios. There are therefore unlikely to be any exceedances of the hourly mean objective in 2041.

5.5 The modelled NO_2 concentrations ranged from to 8.6 µg/m^3 to 17.4 µg/m^3 at selected receptors in the 2041 DM scenario. Receptors located along the A3, Anglesea Road, generally had the highest NO_2 annual mean concentrations, with the maximum concentration of 17.4 µg/m^3 estimated at Receptor R06, Chaucer House and Margaret Rule Hall of Residence/ University House, which overlooks the A3.

5.6 In the 2041 DS Scenario, annual mean NO_2 concentrations were predicted to decrease slightly at most receptors compared to in the 2041 DM scenario. A maximum concentration of 17.2 µg/m^3 was estimated at Receptor R06. The receptor that was predicted to experience the greatest decrease was R69, 252 Kingsbury Mansions, where concentrations decreased by 2.3 µg/m^3 between the DS and DM. In the DS Scenario, the lowest concentration of 8.6 µg/m^3 was estimated at Receptor R79 on 28-40 Lake Road, a property located approximately 8m from the B2152. There were small increases up to a maximum of 0.3-0.4 µg/m^3 with the DS at receptors close to the A3 or A2030.

5.7 These results have been compared to the findings of the previous Emissions Based Assessment. This found that NOx emissions were likely to be highest on the A3 (Alfred Road, Hope Street, Marketway and Mile End Road) and A2030 (Holbrook Road). This is consistent with the fact that the highest modelled NO_2 concentration at sensitive human health receptor in the DS scenario were found at R06 on the A3 and highest overall concentrations were seen at the compliance receptors on Hope Street and Alfred Road. Receptors R05, R32, R41, R44 and R77, where increases of 0.3-0.4 µg/m^3 in NO_2 concentrations were seen between DM and DS, were located on these same roads that had high annual link based emissions (ie Lake Road, A2030 Holbrook Road and A3 Mile End Road).

5.8 In the 2019 base, 21 of the compliance receptors had modelled NO_2 concentrations lower than that of the PCM NO_2 concentrations but 29 of the compliance receptors had modelled NO_2 concentrations that were higher than that of the PCM NO_2 concentrations. The difference is primarily due to the difference in traffic flow, local conditions and local vehicle fleet between the national based PCM model and the more detailed local SRTM used in this study. There were some compliance and qualifying receptors located on the footpaths that were predicted to have concentrations well above the 40 µg/m^3 limit value, all located along the A3 PCM links.

5.9 All compliance and qualifying receptors have NO_2 concentrations that are compliant with the limit value by 2041, although there were increases in levels predicted at receptors on the A3 PCM links due to the predicted increases in traffic flow and congestion as per the findings of the Emissions Based Assessment. It is noted that the results cannot be compared with the PCM NO_2 concentrations as these are only forecast up to 2030.

5.10 Results from all modelled compliance receptors are displayed in Table 7.1 in Appendix B.

Particulate Concentrations

5.11 There were no sensitive receptors that exceeded the annual mean PM_{10} AQO of 40 µg/m^3 in the 2019 Baseline. The receptor that was found to experience the highest annual mean PM_{10} and $PM_{2.5}$ concentrations of 21.0 µg/m^3 and 15.4 µg/m^3 respectively, was at R36. This receptor is located at 9 Hampshire Street, approximately 12 m from the A2047, and is located within AQMA 6.

5.12 By 2041, all the 86 selected receptors were also estimated to have annual mean PM_{10} and $PM_{2.5}$ concentrations below their respective annual mean AQO in DM and DS. There are therefore unlikely to be any exceedances of the daily mean PM_{10} objective in 2041.

5.13 The modelled PM_{10} concentrations ranged from to 10.2 µg/m^3 to 14.8 µg/m^3 at selected receptors in the 2041 DM scenario. The maximum PM_{10} concentration was estimated at Receptor R31, 373-375 Old Commercial Road, which is 20m from the Landport Roundabout.

5.14 The modelled $PM_{2.5}$ concentrations ranged from to 6.1 µg/m^3 to 8.6 µg/m^3 at selected receptors in the 2041 DM scenario. The maximum $PM_{2.5}$ concentration was estimated at Receptor R36, located at 9 Hampshire Street, approximately 12 m from the A2047.

5.15 In the 2041 DS Scenario, annual mean PM_{10} and $PM_{2.5}$ concentrations were predicted to decrease slightly at most receptors compared to 2041 DM. Maximum PM_{10} and $PM_{2.5}$ concentrations of 14.3 µg/m^3 and 8.5 µg/m^3 respectively were estimated at Receptor R66, 90 Stanley Road close to the M275, which was a small increase from DM. The lowest PM_{10} concentration of 10.5 µg/m^3 was estimated at Receptor R57 on 4 Lower Forbury Road, a property located approximately 15m from the A2030. The lowest $PM_{2.5}$ concentration of 6.1 µg/m^3 was estimated at Receptor R76, Edgbaston House, a property located approximately 30m from the A2030.

5.16 When compared to results from the Emissions Based Assessment, as for NOx, the highest particulate emissions were seen along the A3 (Alfred Road, Hope Street, Marketway and Mile End Road), A2030 (Holbrook Road) and M275. The receptor with the highest concentrations (R66) was located close to the M275 and it is noted there are no sensitive receptors on Alfred Road and Hope Street.

5.17 The receptor that experienced the greatest decrease in PM_{10} and $PM_{2.5}$ was R29, 14 Hallowell House, where concentrations decreased by 1.1 µg/m^3 and 0.6 µg/m^3 respectively.

5.18 The greatest increase in PM_{10} and $PM_{2.5}$ concentrations between the DM and DS, was 0.9 µg/m^3 and 0.5 µg/m^3 respectively, both seen at R30, Larch Court, on Church Street. This is consistent with the results in the Emissions Based Assessment which predicted increases on this road.

5.19 The results show that the annual mean $PM_{2.5}$ target of 10 µg/m^3 by 2040, is likely to be achieved, as the maximum annual mean $PM_{2.5}$ concentration from our modelled results for 2041 DS was 8.5 µg/m^3.

Table 5.1: Predicted Annual Mean NO_2 Concentrations at Selected Receptors

Receptor ID	NO_2 Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R01	22.7	9.7	9.7	<0.1
R02	20.3	9.4	9.5	<0.1
R03	23.6	11.3	11.3	<0.1
R04	24.4	11.4	11.5	0.1
R05	29.6	11.9	12.2	0.3
R06	32.1	17.4	17.2	-0.2
R07	25.6	10.9	10.8	-0.1
R08	20.5	9.6	9.6	<0.1
R09	24.6	11.4	11.5	0.1
R10	22.1	10.4	10.4	<0.1
R11	26.1	13.8	13.8	<0.1
R12	27.2	11.7	11.8	<0.1
R13	26.8	13.9	13.9	<0.1
R14	28.7	14.3	14.2	-0.1
R15	29.8	14.4	14.4	<0.1
R16	28.0	14.1	14.0	-0.1
R17	28.0	14.1	14.1	-0.1
R18	34.2	15.1	15.1	-0.1
R19	29.1	14.5	14.0	-0.5
R20	28.0	14.1	14.0	-0.1
R21	29.6	14.3	14.2	-0.1
R22	23.5	10.6	10.5	<0.1
R23	28.3	11.3	11.1	-0.2
R24	27.2	14.0	14.0	<0.1
R25	26.9	13.9	13.9	<0.1
R26	26.4	13.8	13.8	<0.1
R27	25.9	11.8	11.6	-0.2
R28	28.5	12.1	11.5	-0.7
R29	30.2	12.5	11.4	-1.1
R30	31.5	12.6	12.6	0.1
R31	39.1	16.0	16.1	0.1
R32	31.0	14.6	15.0	0.4
R33	24.9	10.8	10.7	-0.1
R34	25.5	10.9	10.8	-0.1
R35	25.2	10.9	10.7	-0.2
R36	28.6	11.4	11.4	<0.1
R37	23.6	10.5	10.5	<0.1
R38	27.5	13.9	13.9	<0.1

Receptor ID	NO_2 Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R39	24.3	11.3	11.3	<0.1
R40	26.2	11.5	11.7	0.2
R41	28.6	11.8	12.1	0.3
R42	25.8	10.6	10.4	-0.1
R43	22.1	9.9	9.9	<0.1
R44	29.2	11.9	12.2	0.3
R45	24.4	11.4	11.5	0.1
R46	23.5	11.3	11.3	0.1
R47	25.2	11.6	11.8	0.1
R48	23.5	11.3	11.3	0.1
R49	23.1	11.2	11.2	<0.1
R50	23.7	11.2	11.3	<0.1
R51	23.2	11.2	11.2	<0.1
R52	22.0	9.7	9.8	0.1
R53	23.7	9.9	10.0	<0.1
R54	22.5	9.8	9.8	<0.1
R55	23.4	11.2	11.2	<0.1
R56	23.2	9.3	9.3	<0.1
R57	20.0	8.9	8.8	<0.1
R58	21.8	9.7	9.7	<0.1
R59	23.2	9.9	9.9	<0.1
R60	22.9	9.5	9.5	<0.1
R61	23.6	11.2	11.2	<0.1
R62	26.7	11.0	10.9	-0.1
R63	21.6	9.8	9.8	<0.1
R64	26.1	10.5	10.5	<0.1
R65	29.0	14.4	14.4	<0.1
R66	29.6	12.2	12.2	<0.1
R67	27.2	11.8	11.8	<0.1
R68	26.7	11.7	11.7	<0.1
R69	38.5	17.0	14.7	-2.3
R70	25.8	11.7	11.6	<0.1
R71	25.1	11.4	11.4	<0.1
R72	26.5	16.5	16.5	<0.1
R73	28.7	12.3	12.0	-0.4
R74	23.8	10.6	10.6	<0.1
R75	21.1	9.6	9.6	<0.1
R76	18.6	8.6	8.6	<0.1
R77	28.7	11.8	12.2	0.4
R78	28.0	12.1	11.6	-0.5

Receptor ID	NO_2 Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R79	27.5	11.7	11.5	-0.1
R80	26.2	11.5	11.5	<0.1
R81	24.7	11.4	11.4	<0.1
R82	23.6	11.2	11.2	<0.1
R83	28.3	14.1	14.3	0.1
R84	27.2	11.6	11.5	-0.1
R85	26.6	11.7	11.7	<0.1
R86	23.4	11.3	11.5	0.1

Table 5.2 Predicted Annual Mean PM_{10} Concentrations at Selected Receptors

Receptor ID	PM_{10} Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R01	16.8	11.4	11.5	<0.1
R02	16.5	11.0	11.1	<0.1
R03	16.5	11.8	11.9	<0.1
R04	16.7	12.0	12.1	0.1
R05	17.8	12.9	13.1	0.2
R06	17.0	12.8	12.7	-0.1
R07	20.2	13.2	13.1	-0.1
R08	18.4	12.1	12.0	<0.1
R09	16.6	11.8	12.0	0.1
R10	19.6	12.6	12.5	<0.1
R11	17.0	11.9	12.0	<0.1
R12	19.5	13.6	13.8	0.1
R13	17.1	12.1	12.0	-0.1
R14	17.5	12.5	12.3	-0.2
R15	17.4	12.5	12.6	0.1
R16	17.3	12.3	12.3	<0.1
R17	17.3	12.3	12.3	<0.1
R18	18.1	13.0	12.9	-0.1
R19	17.4	12.4	12.3	-0.1
R20	17.4	12.4	12.3	-0.1
R21	17.8	12.8	12.7	-0.1
R22	20.0	12.9	12.9	-0.1
R23	20.8	13.7	13.5	-0.2
R24	17.2	12.2	12.2	<0.1
R25	17.1	12.1	12.1	<0.1
R26	17.0	12.0	12.0	<0.1

Receptor ID	PM_{10} Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R27	16.9	12.2	11.9	-0.3
R28	17.4	12.8	11.8	-1.0
R29	17.7	12.9	11.8	-1.1
R30	17.6	13.0	13.9	0.9
R31	19.5	14.8	14.2	-0.7
R32	17.9	13.0	13.1	0.1
R33	20.1	13.0	12.9	-0.1
R34	20.2	13.1	13.0	-0.1
R35	20.1	13.0	12.9	-0.1
R36	21.0	13.9	13.6	-0.3
R37	19.9	12.8	12.7	-0.1
R38	17.3	12.1	12.1	<0.1
R39	16.6	11.8	11.8	<0.1
R40	17.0	12.1	12.3	0.1
R41	17.6	12.6	12.8	0.2
R42	19.4	13.2	13.1	-0.1
R43	18.8	12.5	12.5	<0.1
R44	17.7	12.9	13.1	0.2
R45	16.7	12.1	12.1	0.1
R46	16.5	11.8	11.8	0.1
R47	16.8	12.3	12.4	0.1
R48	16.4	11.6	11.6	<0.1
R49	16.4	11.6	11.6	<0.1
R50	16.5	11.7	11.7	<0.1
R51	16.4	11.6	11.6	<0.1
R52	16.8	11.5	11.6	0.1
R53	17.2	11.9	11.9	0.1
R54	16.9	11.5	11.5	<0.1
R55	16.4	11.6	11.6	<0.1
R56	15.6	11.1	11.1	<0.1
R57	15.0	10.5	10.5	<0.1
R58	16.8	11.5	11.5	<0.1
R59	17.0	11.4	11.5	0.1
R60	20.0	12.4	12.4	<0.1
R61	16.5	11.7	11.7	<0.1
R62	19.6	13.3	13.3	<0.1
R63	18.7	12.3	12.3	<0.1
R64	19.6	13.4	13.4	<0.1
R65	17.4	12.5	12.6	0.1
R66	19.9	14.1	14.3	0.2

Receptor ID	PM_{10} Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R67	19.6	13.9	14.0	0.1
R68	19.5	13.7	13.9	0.1
R69	18.8	13.7	13.4	-0.3
R70	16.9	12.2	12.1	-0.2
R71	16.7	12.0	11.9	-0.1
R72	15.9	11.6	11.6	<0.1
R73	17.5	12.9	12.2	-0.6
R74	15.0	10.8	10.8	<0.1
R75	16.6	11.3	11.3	<0.1
R76	14.7	10.2	10.2	<0.1
R77	17.4	12.4	12.7	0.3
R78	17.3	12.7	12.0	-0.7
R79	17.2	12.2	12.0	-0.2
R80	17.0	12.1	12.0	-0.1
R81	16.7	11.8	11.9	<0.1
R82	16.4	11.6	11.6	<0.1
R83	17.3	12.4	12.5	0.1
R84	17.3	12.2	12.0	-0.3
R85	19.4	13.6	13.7	0.1
R86	16.4	11.6	11.6	<0.1

Table 5.3 Predicted Annual Mean $PM_{2.5}$ Concentrations at Selected Receptors

Receptor ID	$PM_{2.5}$ Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R01	11.8	6.7	6.7	<0.1
R02	11.6	6.5	6.5	<0.1
R03	11.6	7.0	7.1	<0.1
R04	11.7	7.1	7.2	<0.1
R05	12.3	7.6	7.7	0.1
R06	11.6	7.6	7.5	-0.1
R07	14.9	8.2	8.1	<0.1
R08	13.5	7.4	7.4	<0.1
R09	11.6	7.0	7.1	0.1
R10	14.6	7.8	7.8	<0.1
R11	12.1	7.1	7.1	<0.1
R12	14.2	8.1	8.2	0.1
R13	12.1	7.2	7.2	<0.1
R14	12.3	7.4	7.3	-0.1

Receptor ID	$PM_{2.5}$ Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R15	12.4	7.5	7.5	0.1
R16	12.2	7.3	7.3	<0.1
R17	12.3	7.4	7.3	<0.1
R18	12.7	7.7	7.7	<0.1
R19	12.3	7.4	7.3	<0.1
R20	12.3	7.4	7.3	<0.1
R21	12.5	7.6	7.5	-0.1
R22	14.8	8.0	8.0	<0.1
R23	15.3	8.5	8.4	-0.1
R24	12.2	7.3	7.3	<0.1
R25	12.2	7.2	7.2	<0.1
R26	12.1	7.2	7.2	<0.1
R27	11.8	7.2	7.1	-0.2
R28	12.1	7.5	7.0	-0.5
R29	12.2	7.6	7.0	-0.6
R30	12.2	7.6	8.1	0.5
R31	13.5	8.6	8.3	-0.3
R32	12.6	7.7	7.8	0.1
R33	14.9	8.1	8.0	-0.1
R34	14.9	8.1	8.1	-0.1
R35	14.9	8.1	8.0	-0.1
R36	15.4	8.6	8.4	-0.2
R37	14.8	8.0	7.9	<0.1
R38	12.3	7.2	7.2	<0.1
R39	11.6	7.0	7.0	<0.1
R40	11.8	7.2	7.2	0.1
R41	12.2	7.5	7.5	0.1
R42	14.1	8.0	8.0	<0.1
R43	13.7	7.7	7.6	<0.1
R44	12.2	7.6	7.7	0.1
R45	11.7	7.2	7.2	<0.1
R46	11.6	7.0	7.0	<0.1
R47	11.7	7.3	7.3	<0.1
R48	11.5	6.9	6.9	<0.1
R49	11.5	6.9	6.9	<0.1
R50	11.6	7.0	6.9	<0.1
R51	11.5	6.9	6.9	<0.1
R52	11.8	6.8	6.8	<0.1
R53	12.0	6.9	7.0	<0.1
R54	11.9	6.8	6.8	<0.1

Receptor ID	$PM_{2.5}$ Annual Mean ($\mu g/m^3$)			Change from DM – DS ($\mu g/m^3$)
	2019 Baseline	2041 DM	2041 DS	
R55	11.5	6.9	6.9	<0.1
R56	10.8	6.6	6.5	<0.1
R57	10.5	6.2	6.2	<0.1
R58	11.8	6.7	6.7	<0.1
R59	11.9	6.7	6.8	<0.1
R60	14.7	7.6	7.6	<0.1
R61	11.6	7.0	7.0	<0.1
R62	14.1	8.1	8.1	<0.1
R63	13.7	7.6	7.6	<0.1
R64	14.2	8.1	8.1	<0.1
R65	12.3	7.4	7.5	<0.1
R66	14.4	8.4	8.5	0.1
R67	14.2	8.2	8.3	0.1
R68	14.2	8.2	8.2	0.1
R69	13.1	8.1	7.9	-0.2
R70	11.8	7.2	7.1	-0.1
R71	11.7	7.1	7.0	<0.1
R72	11.0	6.9	6.9	<0.1
R73	12.1	7.6	7.2	-0.3
R74	10.3	6.3	6.3	<0.1
R75	11.7	6.6	6.7	<0.1
R76	10.3	6.1	6.1	<0.1
R77	12.1	7.3	7.5	0.2
R78	12.0	7.5	7.1	-0.4
R79	12.0	7.2	7.1	-0.1
R80	11.9	7.1	7.1	<0.1
R81	11.7	7.0	7.0	<0.1
R82	11.5	6.9	6.9	<0.1
R83	12.3	7.4	7.4	0.1
R84	12.0	7.2	7.1	-0.1
R85	14.1	8.1	8.1	0.1
R86	11.5	6.9	6.9	<0.1

6. Summary and Recommendations

6.1 This report presents the results of the air quality assessment for Portsmouth City Centre to consider the impact of the City Centre Road Scheme (CCRS) in the Local Plan year of 2041.

6.2 The assessment shows that annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ are expected to decline substantially from the baseline year of 2019 to 2041 due to future improvements in vehicle fleet and a large reduction in background levels. For example, the average annual mean NO_2 background concentration reduced from around 21 µg/m^3 in 2019 to 11.5 µg/m^3 in 2041, and NOx emissions reduced by more than 80% on some roads. Additionally, the average annual mean PM_{10} and $PM_{2.5}$ background concentration reduced from around 15.7 µg/m^3 and 11.6 µg/m^3, respectively in 2019, to 11.0 µg/m^3 and 6.7 µg/m^3 respectively in 2041. These predicted $PM_{2.5}$ levels are still in exceedance of the 2021 WHO Guideline of 5 µg/m^3.

6.3 Predicted concentrations at all selected sensitive receptors and compliance locations are estimated to be well below the relevant AQS objectives and NO_2 limit value within and without the Scheme in 2041. The assessment shows that there are likely to be improvements to concentrations at many of the representative residential or educational receptors due to the Scheme but increases in concentrations on the footpath along the PCM link of the A3 (Mile End Road, Hope Street and Alfred Road).

6.4 Despite the slight differences in the traffic data supplied for the revised CCRS modelled in this study, overall, the location of the receptors with the highest predicted modelled concentrations in the DS scenario was found to be consistent with the areas predicted to experience the highest traffic flows and emissions as found in the Emissions Based Assessment for the Local Plan review.

6.5 As concentrations are well below the relevant AQS objectives and the NO_2 limit value in 2041, no mitigation measures are required or recommended at this stage.

7. References

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Appendix A – Figures

Figure 7-1: Study Area, Local Monitoring, PCM Links and AQMAs

Figure 7-2: Air Quality Receptors

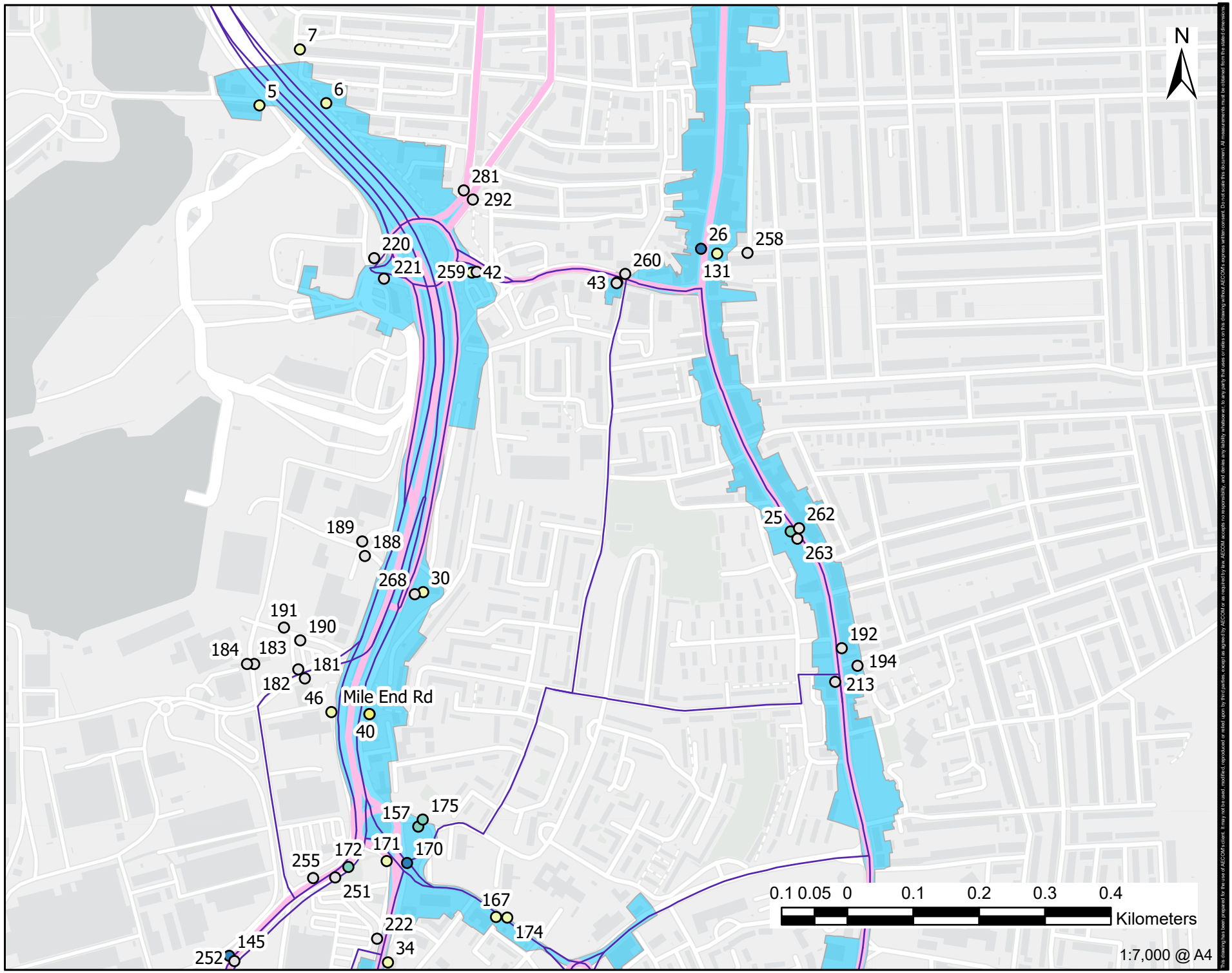
Figure 7-3: Modelled NO_2 Concentrations at Sensitive Human Health Receptors in the DS Scenario

Notes:

Figure 7.1 – These figures show a map of Portsmouth City Centre from just north of Rudmore Roundabout across the Kingston Road, down to the junctions between A3, A288 and A2030 in the southwest and A2047, A2030, Victoria Road North in the southeast, split across two separate figures for the north and southern half of the study area. Points on the map show the monitored concentration for local authority monitoring sites in 2019, the figure also includes the location of Air Quality Management Areas, the modelled road network and the Pollution Climate Mapping Compliance Road Links within the study area.

Figure 7.2 – These figures show the same map extent as Figure 7.1 with the location of modelled receptors shown with the modelled road network.

Figure 7.3 – These figures show the same map extent as Figure 7.1 and 7.2 with the modelled concentrations with the Proposed Scheme in place at all of the modelled receptor locations shown in Figure 7.2, with the modelled road network.



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Portsmouth City Centre - Air Quality Modelling Assessment

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Portsmouth City Council

CONSULTANT

AECOM Limited
Sunley House
4 Bedford Park
Croydon
London, CR0 2AP
www.aecom.com

LEGEND

Local Authority Automatic Monitoring Sites 2019 NO_2 Concentrations ($\mu g/m^3$)

- No Data
- < 36
- 36 - 40
- > 40

Local Authority Diffusion Tube Monitoring Sites 2019 NO_2 Concentrations ($\mu g/m^3$)

- < 36
- 36 - 40
- > 40
- No Data

- Modelled Road Network
- Pollution Climate Mapping Compliance Road Links
- Air Quality Management Areas

NOTES

Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
Air Quality Management Areas (AQMA), Defra
Pollution Climate Mapping (PCM), Defra
Portsmouth City Council Annual Status Report (ASR), 2023

ISSUE PURPOSE

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PROJECT NUMBER

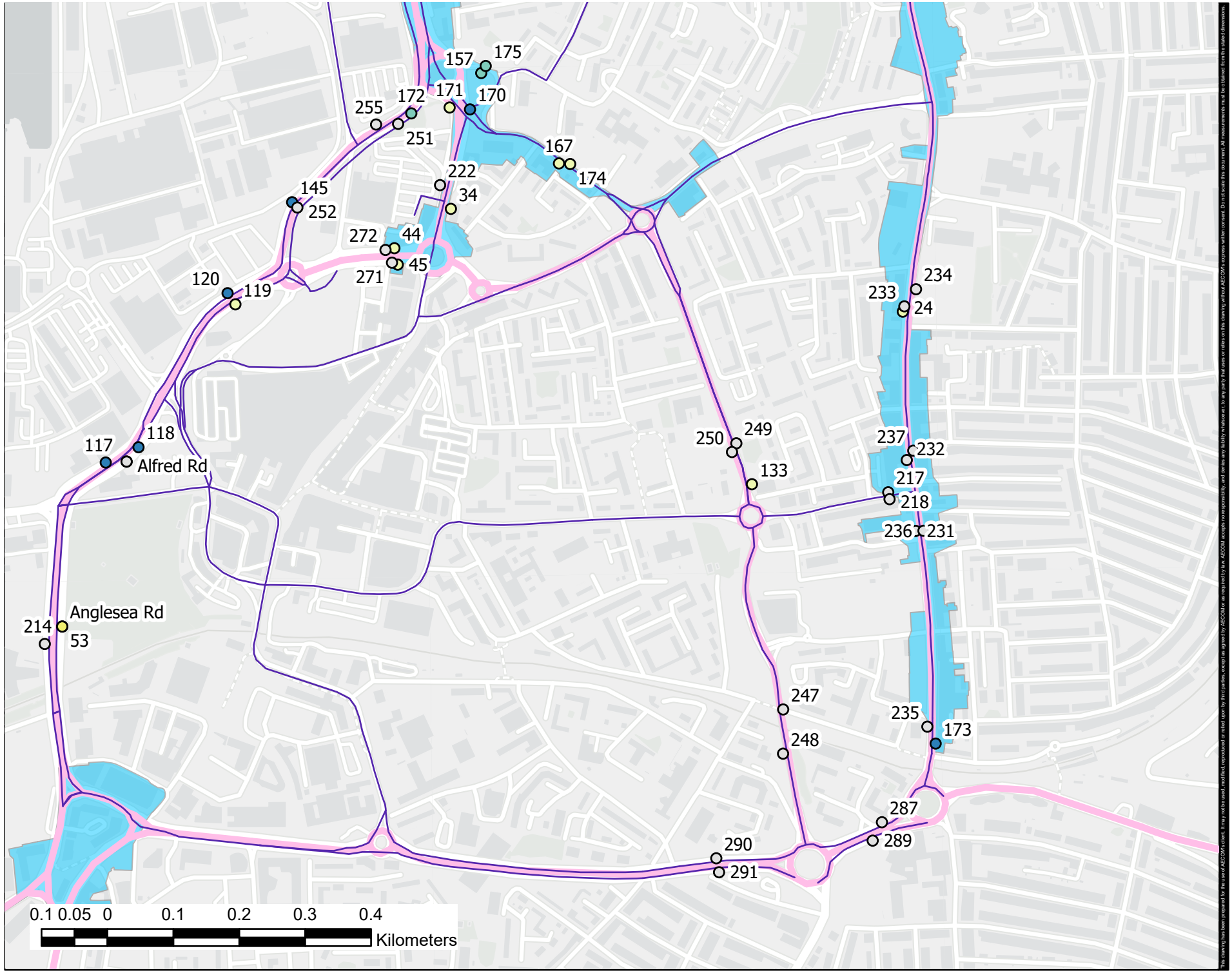
60586784

SHEET TITLE

Location of Study Area, Local Monitoring, PCM Links and AQMAs, North of City Centre

SHEET NUMBER

Figure 7.1



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Portsmouth City Council

CONSULTANT

AECOM Limited
Sunley House
4 Bedford Park
Croydon
London, CR0 2AP
www.aecom.com

LEGEND

Local Authority Automatic Monitoring Sites 2019 NO_2 Concentrations ($\mu g/m^3$)

- No Data
- < 36
- 36 - 40
- > 40

Local Authority Diffusion Tube Monitoring Sites 2019 NO_2 Concentrations ($\mu g/m^3$)

- < 36
- 36 - 40
- > 40
- No Data

Modelled Road Network

Pollution Climate Mapping Compliance Road Links

Air Quality Management Areas

NOTES

Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS
Air Quality Management Areas (AQMA), Defra
Pollution Climate Mapping (PCM), Defra
Portsmouth City Council Annual Status Report (ASR), 2023

ISSUE PURPOSE

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PROJECT NUMBER

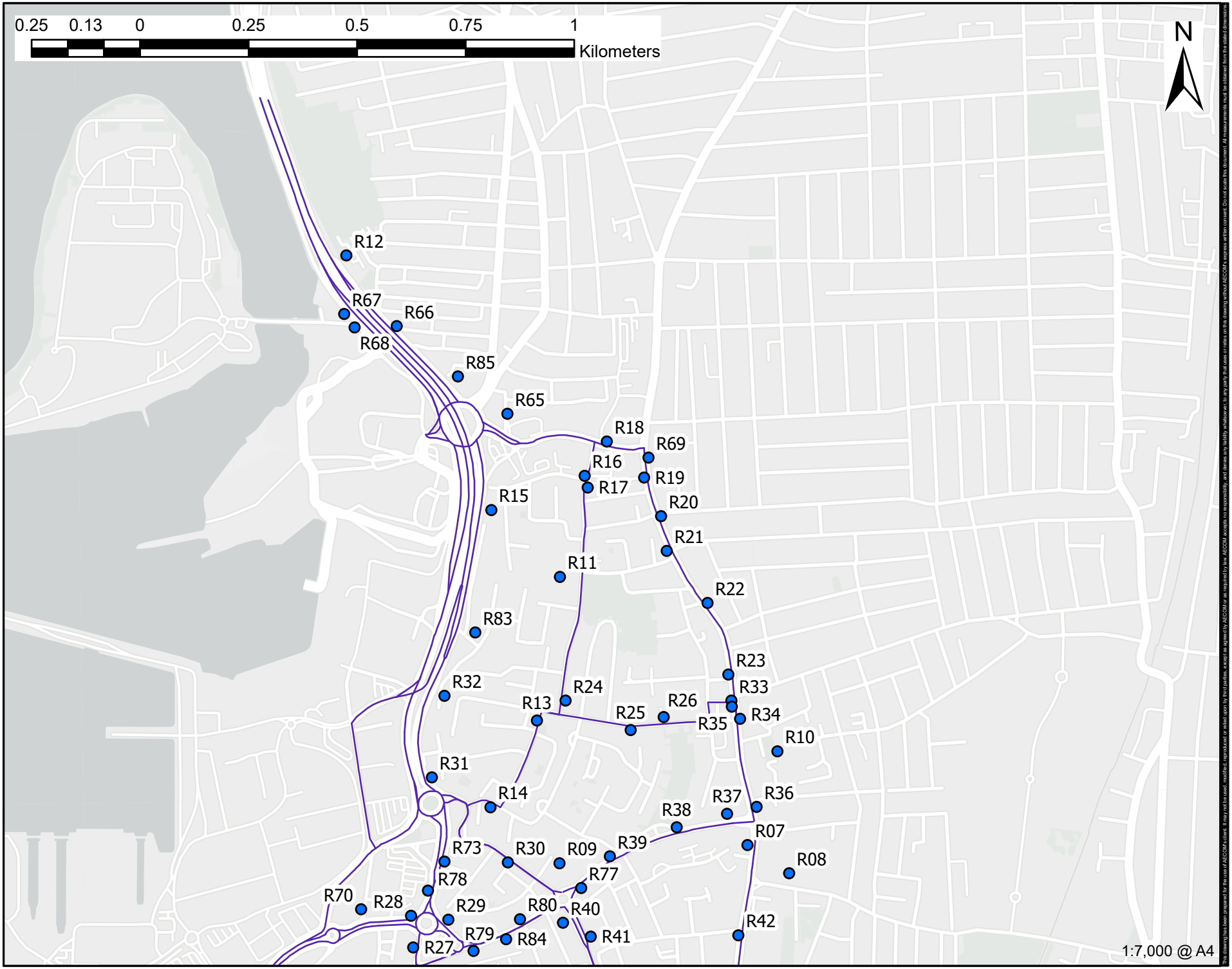
60586784

SHEET TITLE

Location of Study Area, Local Authority Monitoring, PCM Links and AQMAs, South of City Centre

SHEET NUMBER

Figure 7.1



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AECOM Limited
Sunley House
4 Bedford Park
Croydon
London, CR0 2AP
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LEGEND

- Modelled Sensitive Human Health Receptors
- Modelled Road Network

NOTES

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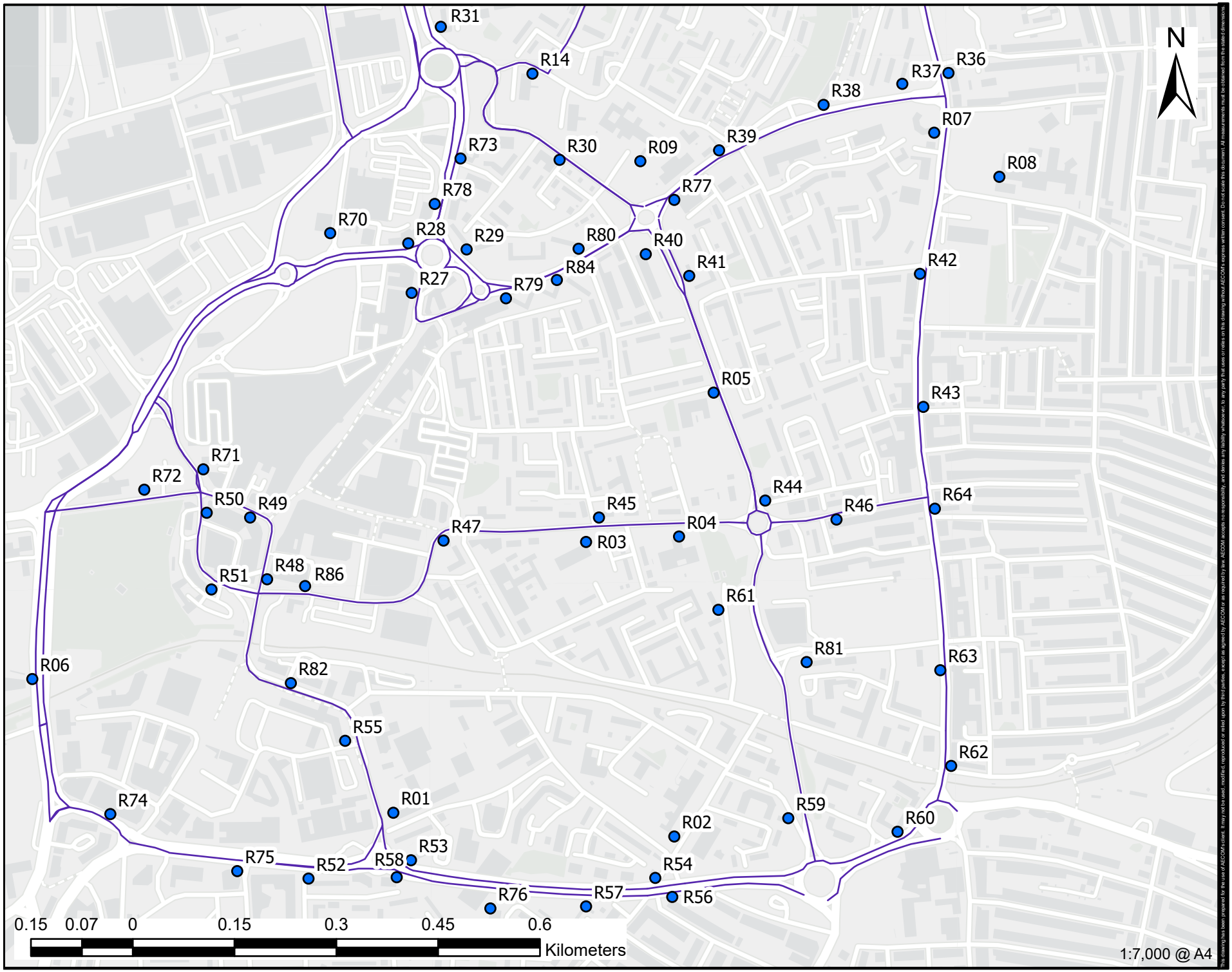
SHEET TITLE

Air Quality Receptors
North of City Centre

SHEET NUMBER

Figure 7.2



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Sunley House
4 Bedford Park
Croydon
London, CR0 2AP
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LEGEND

- Modelled Sensitive Human Health Receptors
- Modelled Road Network

NOTES

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SHEET TITLE

Air Quality Receptors- South of City Centre

SHEET NUMBER

Figure 7.2

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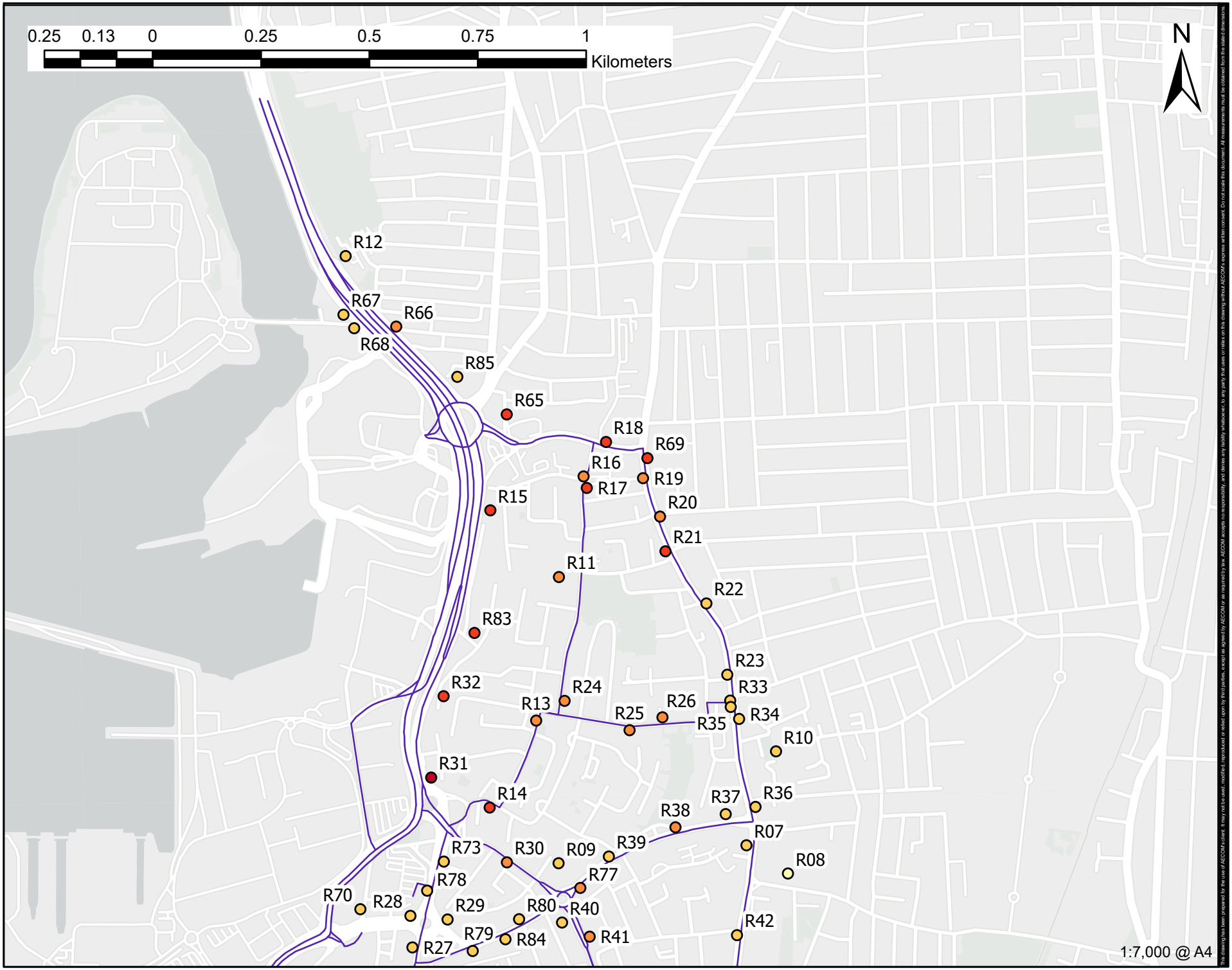

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Croydon
London, CR0 2AP
www.aecom.com

LEGEND

Modelled Road Network

Modelled DS NO_2 Concentrations ($\mu g/m^3$)

- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16
- 16 - 18

NOTES

Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS

ISSUE PURPOSE

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PROJECT NUMBER

60586784

SHEET TITLE

Modelled NO_2 Concentrations at Sensitive Human Health Receptors in the DS Scenario, North of City Centre

SHEET NUMBER

Figure 7.3

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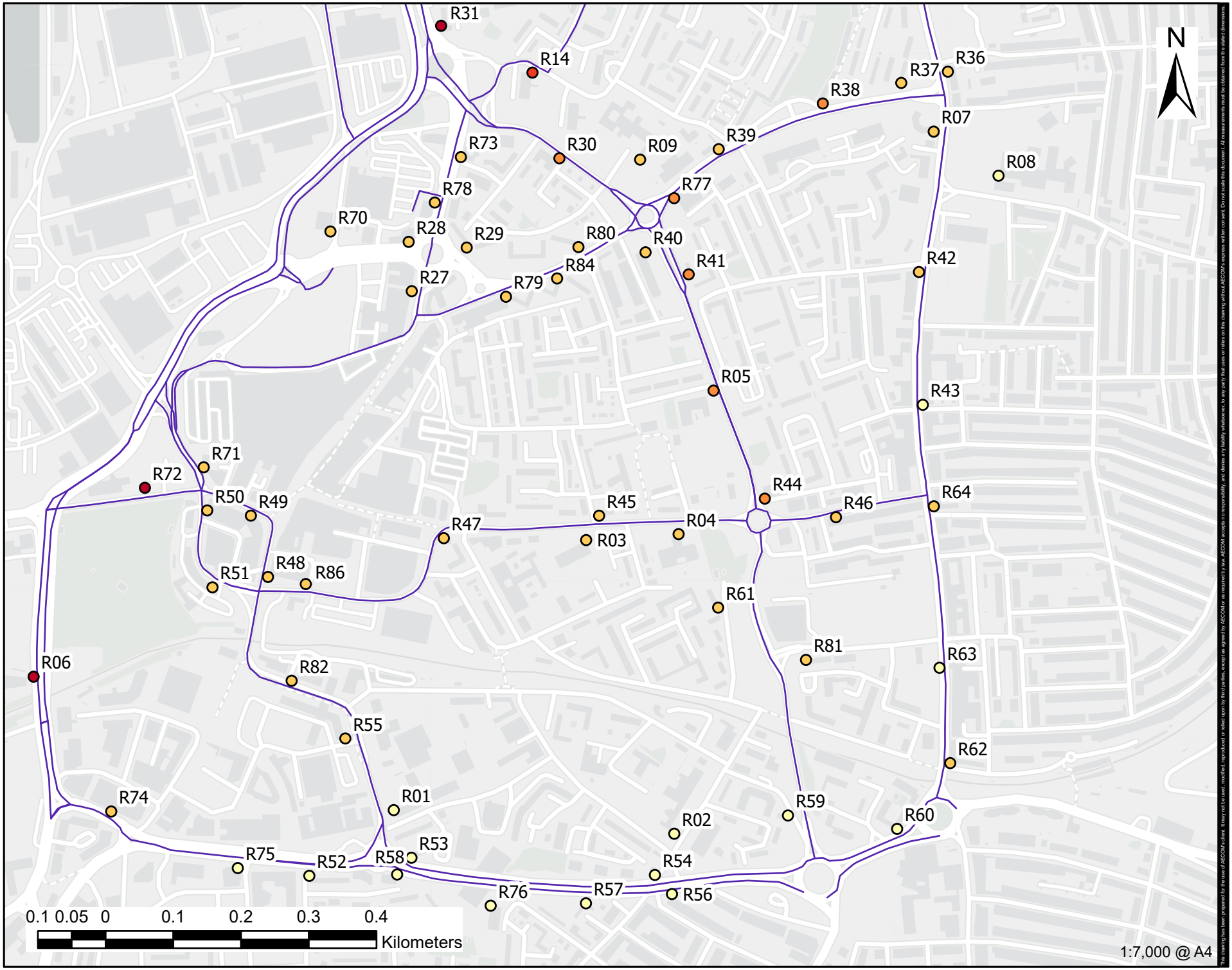
Revision: 1



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Sunley House
4 Bedford Park
Croydon
London, CR0 2AP
www.aecom.com

LEGEND

- Modelled Road Network

Modelled DS NO_2 Concentrations ($\mu g/m^3$)

- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16
- 16 - 18

NOTES

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ISSUE PURPOSE

FINAL

PROJECT NUMBER

60586784

SHEET TITLE

Modelled NO_2 Concentrations at Sensitive Human Health Receptors in the DS Scenario, South of City Centre

SHEET NUMBER

Figure 7.3

Appendix B – Compliance Receptors

Table 7.1: Summary of PCM modelled NO_2 concentrations in the base year and opening year

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
Compliance Receptors									
C01	464578	99872	802080804	21.1	23.2	9.1	9.0	15.0	-10
C02	464580	99896	802080804	21.0	23.2	9.0	9.0	15.0	-10
C03	464392	101255	802048196	37.7	**45.3**	15.6	16.0	27.1	-20
C04	464754	100773	802080805	27.8	30.1	11.7	11.9	19.5	-8
C05	464864	100297	802080805	28.5	30.1	11.8	11.9	19.5	-6
C06	464929	100061	802080805	29.7	30.1	12.1	12.2	19.5	-1
C07*	464407 / 464410	101153 / 10115	802048196	**41.5**	**45.3**	16.4	17.2	27.1	-9
C08	464466	101873	802074476	33.2	27.1	15.3	15.0	20.5	18
C09	464522	101715	802074476	33.9	27.1	15.0	15.1	20.5	20
C10	463809	100274	802057614	30.1	33.9	17.1	16.9	21.7	-13
C11	463819	100086	802057614	31.1	33.9	17.3	17.1	21.7	-9
C12	464204	99913	802080804	23.5	23.2	9.9	10.0	15.0	1
C13	464064	99942	802080804	23.5	23.2	10.1	10.1	15.0	1
C14	463834	100240	802057614	31.1	33.9	17.2	17.1	21.7	-9
C15	465158	100312	802036116	24.7	26.7	10.2	10.2	16.8	-8

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$)	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
C16	465108	100581	802036116	24.2	26.7	10.2	10.1	16.8	-10
C17	465118	101355	802036116	28.7	26.7	11.4	11.1	16.8	7
C18	464902	101821	802036116	31.3	26.7	14.8	14.2	16.8	15
C19	464037	100724	802018114	**48.4**	**40.4**	15.4	14.9	23.8	17
C22	464344	101208	802048196	33.8	**45.3**	15.2	15.5	27.1	-34
C23	464363	101133	802074735	38.1	32.6	16.1	16.0	20.4	14
C24*	464425 / 464435	101028 / 101021	802080848	35.4	34.9	16.8	17.4	21.6	1
C25	464429	100915	802080848	33.9	34.9	13.3	11.9	21.6	-3
C26*	464239 / 464240	100960 / 100959	802074735	**41.9**	32.6	14.7	15.7	20.4	22
C27*	464233 / 464238	100932 / 100927	802074735	**44.5**	32.6	15.2	17.8	20.4	27
C28	464340	100834	802080847	31.5	34.0	12.6	11.5	20.9	-8
C29	464309	100807	802080847	31.8	34.0	12.7	11.5	20.9	-7
C30	464441	100791	802080849	31.6	25.1	12.9	11.5	17.5	21
C31	464459	100808	802080849	30.3	25.1	12.4	11.4	17.5	17
C32	464582	100805	802080849	27.3	25.1	11.6	11.5	17.5	8
C33	464620	100805	802080849	27.6	25.1	11.6	11.5	17.5	9
C34	464109	100752	802018114	34.5	**40.4**	13.0	12.8	23.8	-17
C35	463943	100522	802018114	**57.6**	**40.4**	21.6	21.2	23.8	30
C36	463933	100533	802018114	**54.6**	**40.4**	21.1	20.7	23.8	26
C37	463839	100131	802057614	32.7	33.9	17.5	17.4	21.7	-4

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$)	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
C38	465109	99946	802080806	27.4	20.4	10.1	10.2	14.0	26
C39	465078	99964	802080806	27.0	20.4	10.0	10.1	14.0	24
C40	464952	100020	802080805	31.5	30.1	12.4	12.5	19.5	4
C41	464894	100260	802080805	30.2	30.1	12.0	12.1	19.5	0
C42	465132	100381	802036116	23.8	26.7	10.1	10.1	16.8	-12
C43	464831	100618	802080805	30.4	30.1	12.0	12.4	19.5	1
C44	464816	100614	802080805	28.9	30.1	11.8	12.1	19.5	-4
C45	465150	100880	802036116	26.1	26.7	10.6	10.5	16.8	-2
C46	465071	101495	802036116	26.6	26.7	11.0	10.9	16.8	0
C47	464640	101919	802038333	35.2	31.7	14.9	14.7	21.0	10
C48	464619	101937	802038333	34.4	31.7	15.2	14.9	21.0	8
C49	464922	101825	802036116	32.8	26.7	15.0	14.4	16.8	19
C50	464470	101788	802074476	32.4	27.1	15.0	14.8	20.5	16
Qualifying Receptors									
Q01	463926	100526	802018114	**53.9**	**40.4**	21.0	20.6	23.8	25
Q02	463879	100475	802018114	**58.4**	**40.4**	21.8	21.3	23.8	31
Q03	463818	100342	802057614	32.7	33.9	17.5	17.3	21.7	-4
Q04	463832	100241	802057614	32.1	33.9	17.4	17.3	21.7	-6
Q05	463823	100086	802057614	34.0	33.9	17.9	17.6	21.7	0
Q06	463912	100001	802057614	31.1	33.9	17.1	17.2	21.7	-9

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
Q07	464065	99950	802080804	22.0	23.2	9.8	9.8	15.0	-5
Q08	464204	99917	802080804	25.3	23.2	10.2	10.4	15.0	8
Q09	463922	99976	802057614	26.6	33.9	11.0	11.0	21.7	-27
Q10	464792	101922	802038333	36.9	31.7	15.5	15.4	21.0	14
Q11	464041	100722	802018114	**57.4**	**40.4**	17.2	16.7	23.8	30
Q12	464107	100755	802018114	36.9	**40.4**	13.4	13.2	23.8	-9
Q13*	464242 /464243	100958 /100957	802074735	**48.6**	32.6	16.0	17.2	20.4	33
Q14	464366	101133	802074735	**40.6**	32.6	16.7	16.4	20.4	20
Q15*	464428 / 464438	101028 / 101021	802080848	37.3	34.9	17.8	18.0	21.6	6
Q16	464425	100914	802080848	36.6	34.9	13.8	12.0	21.6	5
Q17	464444	100793	802080849	32.9	25.1	13.0	11.5	17.5	24
Q18	464458	100807	802080849	30.6	25.1	12.4	11.4	17.5	18
Q19	464618	100808	802080849	29.4	25.1	11.7	11.6	17.5	15
Q20	464583	100801	802080849	29.0	25.1	11.7	11.7	17.5	13
Q21	464667	100849	802080849	29.1	25.1	11.8	11.9	17.5	14
Q22	464820	100615	802080805	31.7	30.1	12.2	12.6	19.5	5
Q23	464863	100521	802080805	35.0	30.1	12.6	13.2	19.5	14
Q24	464892	100259	802080805	31.3	30.1	12.1	12.3	19.5	4
Q25	464934	100097	802080805	35.2	30.1	13.0	13.1	19.5	14
Q26	464759	99899	802080804	22.7	23.2	9.2	9.2	15.0	-2

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$)	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
Q27	464951	100020	802080805	32.0	30.1	12.5	12.6	19.5	6
Q28	464755	99880	802080804	25.3	23.2	9.7	9.6	15.0	8
Q29	464535	101879	802048196	34.2	27.1	15.2	15.2	20.5	21
Q30	464382	101407	802048196	36.7	**45.3**	15.8	16.5	27.1	-23
Q31	464410	101332	802048196	36.6	**45.3**	15.5	16.2	27.1	-24
Q32	464619	101935	802038333	35.7	31.7	15.4	15.0	21.0	11
Q33	464692	101952	802038333	36.3	31.7	14.8	14.6	21.0	13
Q34	464871	101919	802038333	35.7	31.7	15.6	15.4	21.0	11
Q35	464638	101921	802038333	37.5	31.7	15.1	14.9	21.0	15
Q36	464906	101822	802036116	33.5	26.7	15.1	14.5	16.8	20
Q37	464965	101694	802036116	33.1	26.7	14.8	14.6	16.8	19
Q38	465074	101497	802036116	28.1	26.7	11.2	11.1	16.8	5
Q39	465114	101355	802036116	30.8	26.7	11.7	11.4	16.8	13
Q40	465128	101149	802036116	30.5	26.7	11.7	11.8	16.8	12
Q41	465147	100880	802036116	27.7	26.7	10.9	10.7	16.8	4
Q42	465111	100581	802036116	25.6	26.7	10.4	10.4	16.8	-4
Q43	465130	100505	802036116	27.2	26.7	10.7	10.6	16.8	2
Q44	465136	100381	802036116	25.4	26.7	10.3	10.3	16.8	-5
Q45	465154	100312	802036116	26.4	26.7	10.5	10.4	16.8	-1
Q46	465147	100267	802036116	25.2	26.7	10.3	10.3	16.8	-6

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$)	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
Q47	465162	100125	802036116	26.5	26.7	10.6	10.5	16.8	-1
Q48	465108	99949	802080806	30.4	20.4	10.5	10.6	14.0	33
Q49	465079	99960	802080806	30.3	20.4	10.5	10.5	14.0	33
Q50	464431	101562	802048196	32.7	**45.3**	14.9	15.2	27.1	-39
Q51	464507	101633	802074476	33.9	27.1	15.0	15.1	20.5	20
Q52	464472	101788	802074476	33.2	27.1	15.2	14.9	20.5	18
Q53*	464187 / 464195	100884 / 100882	802074735	**47.6**	32.6	15.8	20.3	20.4	32
Q54*	464325 / 464348	101022 / 101017	802074735	36.3	32.6	15.8	16.5	20.4	10
Q55	464257	100805	802080847	34.3	34.0	13.2	11.6	20.9	1
Q56	464268	100829	802080847	30.2	34.0	12.4	11.6	20.9	-13
Q57	464340	100830	802080847	34.4	34.0	13.0	11.5	20.9	1
Q58	464309	100810	802080847	33.8	34.0	13.0	11.5	20.9	-1
Q59	464167	100853	802074735	**44.7**	32.6	15.2	15.9	20.4	27
Q60	464346	101208	802048196	34.9	**45.3**	15.4	15.7	27.1	-30
Q61*	464019 / 464024	100631 / 100631	802018114	31.9	**40.4**	12.6	12.5	23.8	-27
Q62	463968	100600	802018114	**55.0**	**40.4**	21.2	20.9	23.8	27
Q63	463963	100552	802018114	**60.3**	**40.4**	22.2	21.8	23.8	33
Q64	463812	100274	802057614	31.7	33.9	17.3	17.1	21.7	-7
Q65	463835	100131	802057614	36.3	33.9	18.1	18.0	21.7	7
Q66	463865	100016	802057614	34.0	33.9	17.7	17.7	21.7	0

				Base 2019	2019	2041 DM	2041 DS	2030	
Model ID	X co-ordinates	Y co-ordinates	PCM Census ID	Modelled NO_2 Concentrations ($\mu g/m^3$	PCM NO_2 Concentrations ($\mu g/m^3$)	Modelled NO_2 Concentrations ($\mu g/m^3$)		PCM NO_2 Concentrations ($\mu g/m^3$)	Percentage Difference in Base 2019 (%)
Q67	463975	99941	802080804	24.7	23.2	10.8	10.8	15.0	6
Q68	464472	101485	802074476	34.0	27.1	15.0	15.2	20.5	20
Q72*	464230 / 464238	100934 / 100927	802074735	**50.4**	32.6	16.4	17.8	20.4	35
Q73	463892	100502	802018114	**52.6**	**40.4**	20.7	20.3	23.8	23
Q74	463942	100522	802018114	**60.7**	**40.4**	22.2	21.7	23.8	33
Q75	464578	99876	802080804	22.4	23.2	9.3	9.2	15.0	-4
Q76	464580	99893	802080804	22.3	23.2	9.2	9.2	15.0	-4
Q77	464932	100061	802080805	31.7	30.1	12.4	12.5	19.5	5
Q78	464913	100183	802080805	31.3	30.1	12.4	12.5	19.5	4
Q79	464827	100617	802080805	33.4	30.1	12.4	12.9	19.5	10
Q80	464918	101824	802036116	35.2	26.7	15.3	14.7	16.8	24
Q81	464518	101715	802074476	35.4	27.1	15.3	15.4	20.5	23

Note 1: * The location of the receptor has moved in the DS due to road alignment or width changes.
Note 2: Concentrations in bold are above the Limit Value.

Appendix C – Model Verification Details

7.1 Model verification is the process by which the performance of the model is assessed to identify any discrepancies between modelled and measured concentrations at air quality monitoring sites within the study area.

7.2 Modelled predictions were made for annual mean NO_2 concentrations at local authority monitoring sites to compare monitored and modelled NO_2 concentrations. The comparison of model outputs was made to 2019 monitoring data in line with the baseline year of assessment, traffic data and meteorological data.

7.3 From these sites, only those representative of modelled sensitive receptor locations and with sufficient data capture (2019) were considered suitable for the purposes of model verification. Table 7.2 details the sites used in model verification.

7.4 Some diffusion tubes sites were excluded from model verification including DT26, DT131 and DT173 which were outside of the final modelled road network.

Table 7.2: Local Authority Monitoring Sites used in Model Verification

Site ID	Site Type	Site Name	X	Y
DT5	Roadside	119 Whale Island Way (WIW-119)	464229.94	102194.02
DT6	Roadside	88 Stanley Road (SR-88)	464331.34	102197.40
DT7	Urban Background	138 Lower Derby Road (LDR-138)	464291.34	102278.95
DT24	Roadside	221 Fratton Road (FR-221)	465111.06	100736.98
DT25	Roadside	117 Kingston Rd (KR-117)	465036.41	101547.29
DT30	Roadside	Market Tavern (Mile End Rd) (MER-MT)	464478.56	101455.20
DT34	Roadside	Sovereign Gate, Commercial Rd (ComR-UF)	464425.03	100893.03
DT42	Roadside	Kingston Crescent-Admiral Drake PH- (KC-ADPH)	464552.44	101940.30
DT43	Urban Background	Kingston Crescent-Vanguard House (KC-VH)	464773.06	101925.42
DT44	Roadside	Opposite 6 Market Way, MW-(opp 6)	464339.25	100833.28
DT45	Roadside	5 Market Way (MW-4)	464344.31	100808.41
DT46	Roadside	Mile End Road-Col5(MW-Col5)	464339.12	101273.05
DT117	Roadside	Alfred Road Column 9 (AR-Col 9)	463901.00	100507.98
DT118	Roadside	Alfred Road Column 12 (AR-Col 12)	463950.81	100531.12
DT120	Roadside	Market Way Opposite MW-StABS (MW-OppStABS)	464086.00	100765.01
DT133	Roadside	Labour Party Club Holbrook Road (HR-LPC)	464882.06	100475.02
DT145	Kerbside	Cross from Hope Street Column4	464183.97	100903.04
DT157	Kerbside	Opposite Column2 Church Street (Cs-OCol2)	464471.06	101099.17
DT167	Roadside	Column 11 Church Street (CS-Col11)	464589.06	100962.00

DT170	Roadside	Column 3 Commercial Road (ComR-Col3)	464454.03	101044.00
DT171	Roadside	Column 4 Commercial Road (ComR-Col4)	464423.09	101046.87
DT172	Roadside	Column 11 Hope Street (HS-Col11)	464364.91	101037.95
DT174	Roadside	Column 12 Church Street (CS-Col12)	464606.12	100961.09
DT175	Roadside	Column 2 Church Street (CS-Col2)	464477.88	101109.91
Mile End Rd	Roadside	Mile End Road	464396.94	101270.01
Anglesea Rd	Roadside	Anglesea Road	463835.00	100259.00

Note: Some sites have been removed by the local authority, with the numbers in brackets being the new site IDs of the remaining sites.

7.5 Following Defra's Technical Guidance LAQM.TG(22), model performance was analysed at these monitoring sites. Without adjustment the root mean square error (RMSE) of the model was 9.8 µg/m^3.

7.6 The RMSE should ideally be less than 10% of the relevant air quality objective (for NO_2, 4.0 µg/m^3) but less than 10.0 µg/m^3 is acceptable. Two adjustment factors were calculated for two zones, as shown in Table 7.3.

Table 7.3: Verification details

Verification Zones	Number of Sites	Number of Monitoring Sites within ±10% of the Monitored Concentration Pre-Adjustment	RMSE pre-adjustment (µg/m^3)	Model Adjustment Factor Applied	Number of Sites within ±10% of the Monitored Concentration Post Adjustment	RMSE post adjustment (µg/m^3)	Fractional Bias post adjustment)
Zone 1	30	13	9.8	1.40	15	3.9	0.0
Zone 2	4	13	9.8	3.84	-2	7.4	0.0

7.7 Zone 1 represented the majority of the road network and modelled outputs within this zone were adjusted by applying a factor of 1.40 in all modelled scenarios. Zone 2 represented the higher concentrations associated with the specific traffic conditions along the A3, on Hope Street and Alfred Road, at diffusion tubes DT117, DT118, DT120 and DT145. A higher model adjustment factor of 3.84 was applied to the modelled outputs of the compliant and qualifying receptors along this stretch of road.