Chichester Air Quality Action Plan Review - 2020

Report 2: Scenario modelling

August 2020

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Chichester District Council

East Pallant
Chichester
West Sussex PO19 1TY

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Phlorum Limited

Southern Office: Unit 12, Hunns Mere Way, Woodingdean, Brighton, East Sussex, BN2 6AH

T: 01273 307 167 E: info@phlorum.com W: www.phlorum.com

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1. Introduction

1.1 Chichester District Council (CDC) commissioned Phlorum Ltd to undertake a review of air quality across their district and to assess key areas of concern for air quality. The review will contribute towards the development of a new Air Quality Action Plan (AQAP) for CDC.

1.2 The key priority of an AQAP is to deliver compliance with the Air Quality Standards (AQS) within all Air Quality Management Areas (AQMAs), but also to improve air quality across the district.

Baseline modelling update (2020)

1.3 The previous report (Report 1 v7) provided an update to the baseline air quality modelling and source apportionment study following the provision of updated bus data as provided by Stagecoach Ltd (June 2020).

1.4 The updated Stagecoach data identified significant differences in the ratio of Euro class buses operating in the district from those identified in the Department for Environment, Food and Rural Affairs (Defra) Emissions Factor Toolkit (EFT). This data is significant as the Euro class determines the type of emissions control system that a vehicle has fitted and the higher the Euro class number (i.e. VI/6), the cleaner the vehicle and the lower the emissions.

Summary of previous report (Report 1)

1.5 The baseline modelling assessment reviewed key locations across Chichester district including the existing AQMAs and locations of concern. The air quality modelling was undertaken for the years 2018 (base and model verification year), 2020 and 2025.

1.6 The objective of the modelling assessment is to determine if and where there are predicted exceedances of national Air Quality Objectives of the key pollutants; nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$).

1.7 The air quality assessment identified exceedances of the NO_2 40µg.m^{-3} annual mean AQS in 2018; this included locations within the St Pancras AQMA (receptor 10), the Hornet (9 and 15), Whyke/A27 roundabout (W1), Oving Rd/A27 intersection (O2) and Rumbold's Hill (Midhurst) (14). The Stockbridge Roundabout AQMA (2) was predicted to be marginally below the AQS by 0.8 µg/m^{-3}.

1.8 Predicted exceedances of the NO_2 40µg.m^{-3} AQS in 2020, occurred in three locations in Chichester District at; St Pancras AQMA, the Hornet and at Whyke roundabout.

1.9 In 2025, it is predicted that all locations within Chichester District will be compliant with the NO_2 40µg.m^{-3} annual mean AQS.

1.10 No exceedances of the NO_2 40µg.m^{-3} AQS were predicted within the Orchard Street AQMA, the Stockbridge Roundabout AQMA, or on Westhampnett Road in any assessment years. Although the Stockbridge Roundabout AQMA was only marginally below the AQS in 2018.

1.11 No exceedances of PM_{10} and $PM_{2.5}$ AQS were identified at any of the modelled locations in 2018, 2020 and 2025.

1.12 The source apportionment study identified sources of emissions at the three key locations of concern (St Pancras AQMA, Stockbridge AQMA/A27 and Midhurst) for emissions of oxides of nitrogen (NOx) and particulates.

1.13 The diesel sector emissions were the dominant source for both NOx and particulate emissions in all locations assessed. Petrol and diesel fuelled cars were also identified as a major contributing source of PM_{10} and $PM_{2.5}$ as tyre and brake wear particulate emissions make up a more significant source of total PM emissions than exhaust emissions. As such, as there are significantly more cars than other vehicles travelling through these locations, their proportion of emissions is subsequently higher.

Report 2: AQMA scenario testing

1.14 The scenario testing will involve using ADMS Roads (v5.0) and introducing a percentage of non-car mode scenarios at locations identified in exceedance from 2020, as reported in Report 1, namely:

- St Pancras AQMA;
- the Hornet;
- Whyke/A27 roundabout;
- Oving Rd/A27 intersection; and
- Rumbold's Hill (Midhurst).

1.15 The air quality modelling assessment for the scenarios at the above locations will follow this process:

- Undertake further baseline (do nothing/business as usual) modelling for the intermediate years, 2021 – 2024, to determine likely year of compliance with "no intervention";
- Run model scenarios for non-compliant locations with the following intervention options:
    - Early transition of bus fleet to Euro VI (from 2021), such as could be implemented through a "Bus Low Emission Zone" (Bus LEZ) intervention in Chichester; and
    - Modal shift options;
        - 2% modal shift equivalent to 2% reduction in car journeys; and
        - 5% modal shift equivalent to 5% reduction in car journeys.
- Provide draft AQAP scenario report for discussion (R2 – Report 2)

1.16 Finalise Report 2 after feed-back and discussion.

Report 3

1.17 Finalise assessment and provide final AQAP scenario report to include:

- Simple cost and benefit assessment to prioritise measures; and
- R3 – Report 3 (including Modelling Technical Report)

2. Baseline Modelling (2020 – 2025)

Predicted baseline results

NO_2 results

2.1 The predicted concentrations of NO_2 in a baseline ('do nothing') scenario are included in Table 2.1 below. Baseline year (2018) and future year results for 2020 to 2025 are presented to identify where there are predicted exceedances of the AQS and locations of concern for air quality going forward.

2.2 Receptor descriptions and locations are provided in Appendix A.

Table 2.1: NO_2 concentration results

Receptor	NO_2 Concentration – annual mean (µg.m^{-3})						
	2018	2020	2021	2022	2023	2024	2025
Chichester							
1	34.5	31.5	29.4	27.9	26.4	25.1	23.8
2	39.9	36.4	33.8	31.9	30.1	28.5	27.0
(3,4,5)	31.8	29.1	27.2	25.8	24.5	23.3	22.1
6	34.6	31.5	29.5	27.9	26.4	25.1	23.8
8	32.3	30.4	29.0	27.9	26.8	25.8	24.5
9	**41.5**	39.0	37.2	35.8	34.4	33.1	31.3
10	**50.2**	**47.0**	**44.7**	**42.6**	**40.7**	38.8	36.6
12	36.6	34.4	32.8	31.6	30.3	29.2	27.6
CI1	31.8	29.1	27.2	25.8	24.5	23.3	22.1
CI4	24.7	23.4	22.5	21.8	21.1	20.5	19.7
15	**40.0**	37.6	35.9	34.6	33.3	32.0	30.3
W1	**43.5**	39.5	36.8	34.8	32.9	31.2	29.5
W2	31.3	28.6	26.8	25.5	24.3	23.1	22.0
O1	30.7	28.4	26.8	25.7	24.7	23.7	22.7
O2	**42.4**	39.0	36.6	35.0	33.4	31.9	30.3
Midhurst							
14	39.9	36.9	35.4	33.8	32.6	31.8	29.1
18	36.2	33.6	32.2	30.8	29.6	28.9	26.6
19	37.7	34.9	33.4	32.0	30.9	30.1	27.6
20	34.7	32.2	30.9	29.6	28.5	27.8	25.6
21	32.6	30.3	29.1	27.9	26.9	26.3	24.2

Note:
The NO_2 annual mean AQS = 40µg.m^{-3}
Receptors in **bold** (> AQS), receptors underlined (within 10% of AQS)

2.3 Table 2.1 shows that five locations are predicted to exceed the 40µg.m^{-3} long-term AQS in 2018, with five other locations within 10% of the AQS. The locations in exceedance include:

- St Pancras AQMA (receptor 10);
- locations in the Hornet (9 and 15);
- Nursing Home, Whyke Rd (W1) ; and
- 187/188 Oving Rd (O2).

2.4 Two locations were also predicted to be marginally under the AQS at Stockbridge Roundabout AQMA (2) and Rumbold's Hill, Midhurst (14) plus a further three locations within 10% of the AQS in 2018.

2.5 Only one location was predicted to be in exceedance of the 40µg.m^{-3} AQS in 2020:

- St Pancras AQMA (receptor 10)

2.6 Three locations were also predicted to be marginally under the AQS, namely; the Hornet (9), Nursing Home on Whyke Rd (W1) and 187/188 Oving Rd (O2).

2.7 St Pancras AQMA (receptor 10) is predicted to be non-compliant until 2024, however will remain with 10% of the AQS up to and including 2025.

2.8 As no location is likely to exceed the annual mean of 60µg.m^{-3}, no location is likely to exceed the short-term NO_2 AQS[1].

AQMA results

2.9 No exceedances of the NO_2 AQS were predicted in any assessment years at:

- Orchard Street AQMA;
- Stockbridge Roundabout AQMA; and
- Midhurst AQMA.

Particulate results

2.10 PM_{10} and $PM_{2.5}$ modelling was undertaken, and results showed no exceedance of the long or short-term AQSs in any baseline scenarios from 2018 to 2025. These results are provided in Appendix A.

[1] The annual mean 60µg.m^{-3} concentration value is used to indicate likely exceedances of the short-term (1-hour) AQS for NO_2.

3. Scenario Modelling (2021 – 2024)

3.1 Scenario modelling was undertaken to demonstrate the potential impact of individual interventions on local air quality. Each scenario is modelled independently and presented for the following scenarios.

Chichester Bus Low Emission Zone Scenario

3.2 The Bus LEZ scenario modelling is based on upgrading the local Chichester bus fleet from current baseline bus Euro ratios to becoming Euro VI compliant from 2021. This scenario reflects the change in concentrations if non-compliant buses were converted to Euro VI buses. No electric or hybrid buses were modelled.

3.3 The Bus LEZ scenario focused on Chichester only, i.e. excludes Midhurst, as the location was predicted to be compliant by 2021.

Chichester Bus LEZ

3.4 The predicted concentrations of NO_2 in the Bus LEZ scenario intervention is presented for future years 2021 to 2024 in Table 3.1 below.

Table 3.1: NO_2 concentration results – Bus LEZ

Receptor	Concentration NO_2 – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	29.4	27.6	26.2	26.1
2	33.7	31.6	29.8	29.7
(3,4,5)	27.1	25.6	24.2	24.2
6	29.4	27.6	26.2	26.1
8	27.2	26.0	24.9	24.8
9	33.9	32.2	30.8	30.7
10	**41.9**	39.7	37.7	37.6
12	30.5	29.0	27.7	27.7
CI1	27.1	25.6	24.2	24.2
CI4	21.2	20.4	19.7	19.7
15	32.7	31.1	29.8	29.7
W1	36.7	34.4	32.5	32.4
W2	26.8	25.3	24.0	24.0
O1	26.5	25.2	24.1	24.0
O2	35.7	33.7	32.1	32.0

Note:
The NO_2 annual mean AQS = $40\mu g.m^{-3}$
Receptors in **bold** (> AQS), receptors underlined (within 10% of AQS)

3.5 Table 3.1 shows that the Chichester Bus LEZ scenario predicts only one exceedance of the AQS at St Pancras AQMA (receptor 10) in 2021.

3.6 The predicted change in NO_2 concentrations are presented in Table 3.2. The concentration changes presented below are the difference between the predicted baseline concentrations (Table 2.1) and the predicted scenario concentration values.

Table 3.2: NO_2 concentration change – Chichester Bus LEZ

Receptor	Concentration change NO_2 – annual mean(µg.m^{-3})			
	2021	2022	2023	2024
Chichester				
1	-0.2	-0.2	-0.2	-0.2
2	-0.3	-0.3	-0.3	-0.3
(3,4,5)	-0.2	-0.2	-0.2	-0.2
6	-0.2	-0.2	-0.2	-0.3
8	-1.9	-1.9	-1.9	-2.0
9	-3.5	-3.6	-3.7	-3.7
10	-2.9	-2.9	-3.0	-3.0
12	-2.5	-2.6	-2.6	-2.7
CI1	-0.2	-0.2	-0.2	-0.2
CI4	-1.4	-1.4	-1.4	-1.4
15	-3.4	-3.4	-3.5	-3.5
W1	-0.4	-0.4	-0.4	-0.4
W2	-0.3	-0.3	-0.3	-0.3
O1	-0.5	-0.6	-0.6	-0.6
O2	-1.2	-1.3	-1.3	-1.3

Note: Negative values = reductions in concentration.

3.7 Table 3.2 shows significant reductions in predicted concentrations within Chichester at receptors 8, 9, 10, 12, 15 and O2. Concentration changes were lower at the A27 receptor locations due to the relative lower number of buses using these routes.

3.8 The range of concentration reductions in Chichester ware predicted to be between -0.2 µg.m^{-3} to -3.7 µg.m^{-3} (equivalent to a 0.5% - 9.25% change in concentrations in relation to the AQS).

Particulates

3.9 PM_{10} and $PM_{2.5}$ scenario modelling was undertaken, and results showed no exceedance of the long or short-term AQSs in this scenario from 2021 to 2024. These results are provided in Appendix B.

3.10 There was no significant change in PM_{10} or $PM_{2.5}$ concentrations in the Chichester Bus LEZ scenario.

Modal Shift Scenario

3.11 The modal shift scenarios are provided to demonstrate the impact of influencing the shift in modes of transport i.e. moving people from car journeys to more sustainable or active journeys. The scenarios proposed demonstrate a 2% and 5% modal shift which has been modelled by reducing car journeys across the district by 2% and 5%.

2% Modal Shift Scenario

3.12 The predicted concentrations of NO_2 in the 2% modal shift scenario are presented for future years 2021 to 2024 in Table 3.3 below.

Table 3.3: NO_2 concentration results – 2% Modal Shift Scenario.

Receptor	Concentration NO_2 – annual mean (µg.m^{-3})			
	2021	2022	2023	2024
Chichester				
1	29.4	27.7	26.3	24.9
2	33.7	31.7	29.9	28.3
(3,4,5)	27.2	25.6	24.3	23.1
6	29.4	27.7	26.3	24.9
8	28.9	27.7	26.6	25.6
9	37.2	35.6	34.2	32.9
10	**44.4**	**42.3**	**40.4**	38.6
12	32.8	31.4	30.1	29.0
CI1	27.2	25.6	24.3	23.1
CI4	22.5	21.7	21.0	20.4
15	35.8	34.3	33.0	31.8
W1	36.8	34.6	32.7	31.0
W2	26.9	25.4	24.1	23.0
O1	26.9	25.6	24.5	23.6
O2	36.7	34.8	33.2	31.7
Midhurst				
14	35.2	33.7	32.4	31.3
18	32.1	30.7	29.5	28.5
19	33.3	31.9	30.7	29.7
20	30.7	29.4	28.4	27.5
21	28.9	27.8	26.8	25.9

Note:
The NO_2 annual mean AQS = 40µg.m^{-3}
Receptors in **bold** (> AQS), receptors underlined (within 10% of AQS)

3.13 Table 3.3 shows that the 2% modal shift scenario predicted a continuance of the exceedance of the AQS at St Pancras AQMA (receptor 10) until 2024.

3.14 Other receptor locations, such as locations in the Hornet (9), Nursing Home on Whyke Rd (W1) and 187/188 Oving Rd (O2), are predicted to continue to be within 10% of the AQS until 2022 under this scenario.

3.15 The predicted change in NO_2 concentrations are presented in Table 3.4. The concentration changes presented below are the difference between the predicted baseline concentrations (Table 2.1) and the predicted scenario concentration values.

Table 3.4: NO_2 concentration change – 2% Modal Shift Scenario.

Receptor	Concentration change NO_2 – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	-0.2	-0.2	-0.2	-0.1
2	-0.2	-0.2	-0.2	-0.2
(3,4,5)	-0.2	-0.1	-0.1	-0.1
6	-0.2	-0.2	-0.2	-0.2
8	-0.2	-0.2	-0.2	-0.2
9	-0.2	-0.2	-0.2	-0.2
10	-0.3	-0.3	-0.3	-0.3
12	-0.2	-0.2	-0.2	-0.2
CI1	-0.2	-0.1	-0.1	-0.1
CI4	-0.1	-0.1	-0.1	-0.1
15	-0.2	-0.2	-0.2	-0.2
W1	-0.2	-0.2	-0.2	-0.2
W2	-0.1	-0.1	-0.1	-0.1
O1	-0.1	-0.1	-0.1	-0.1
O2	-0.2	-0.2	-0.2	-0.2
Midhurst				
14	-0.2	-0.2	-0.1	-0.4
18	-0.1	-0.1	-0.1	-0.3
19	-0.1	-0.2	-0.1	-0.4
20	-0.1	-0.1	-0.1	-0.4
21	-0.1	-0.1	-0.1	-0.3

Note: Negative values = reductions in concentration.

3.16 Table 3.4 shows consistent reductions in predicted concentrations across all receptors.

3.17 The modelled receptors in Chichester showed minor reductions in concentrations between 0.1$\mu g.m^{-3}$ to 0.2$\mu g.m^{-3}$ (equivalent to 0.25% - 0.5% of the AQS) over the period. Midhurst receptors are predicted to have slightly higher reductions in concentrations ranging from 0.1$\mu g.m^{-3}$ to 0.4 $\mu g.m^{-3}$ (equivalent to 0.25% - 1% of the AQS) between 2021 and 2024.

Particulates

3.18 PM_{10} and $PM_{2.5}$ scenario modelling was undertaken, and results showed no exceedance of the long or short-term AQSs in this scenario from 2021 to 2024. These results are provided in Appendix B.

3.19 There was no significant change in PM_{10} or $PM_{2.5}$ concentrations in the 2% modal shift scenario. The maximum annual mean concentration reduction for both PM_{10} and $PM_{2.5}$ was 0.1µg.m^{-3} (equivalent to 0.25% of the PM_{10} AQS).

5% Modal Shift Scenario

3.20 The predicted concentrations of NO_2 in the 5% modal shift scenario is presented for future years 2021 to 2025 in Table 3.5 below.

Table 3.5: NO_2 concentration results – 5% Modal Shift Scenario.

Receptor	Concentration NO_2 – annual mean (µg.m^{-3})			
	2021	2022	2023	2024
Chichester				
1	29.1	27.4	26.0	24.7
2	33.4	31.4	29.6	28.0
(3,4,5)	27.0	25.4	24.1	23.0
6	29.2	27.4	26.0	24.7
8	28.6	27.4	26.4	25.4
9	36.8	35.2	33.9	32.6
10	**43.9**	**41.8**	39.9	38.1
12	32.4	31.0	29.8	28.7
CI1	27.0	25.4	24.1	23.0
CI4	22.3	21.5	20.9	20.2
15	35.5	34.0	32.7	31.5
W1	36.5	34.2	32.4	30.7
W2	26.6	25.1	23.9	22.8
O1	26.6	25.4	24.3	23.4
O2	36.4	34.5	32.9	31.4
Midhurst				
14	34.9	33.4	32.2	31.1
18	31.8	30.4	29.3	28.3
19	33.0	31.6	30.5	29.5
20	30.5	29.2	28.2	27.3
21	28.7	27.6	26.6	25.8

Note:
The NO_2 annual mean AQS = 40µg.m^{-3}
Receptors in **bold** (> AQS), receptors underlined (within 10% of AQS)

3.21 Table 3.5 shows that the 5% modal shift scenario predicted a continuance of the exceedance of the AQS at St Pancras AQMA (receptor 10) until 2023. This receptor is predicted to continue to be within 10% of the AQS until 2025, under this scenario.

3.22 Other receptor locations, such as locations in the Hornet (9), Nursing Home, Whyke Rd (W1) and 187/188 Oving Rd (O2), are predicted to continue to be within 10% of the AQS until 2022 under this scenario.

3.23 The predicted change in NO_2 concentrations are presented in Table 3.6. The concentration changes presented below are the difference between the predicted baseline concentrations (Table 2.1) and the predicted scenario concentration values.

Table 3.6: NO_2 concentration change – 5% Modal Shift Scenario.

Receptor	Concentration change NO_2 – annual mean (µg.m^{-3})			
	2021	2022	2023	2024
Chichester				
1	-0.5	-0.4	-0.4	-0.4
2	-0.5	-0.5	-0.5	-0.5
(3,4,5)	-0.4	-0.4	-0.3	-0.3
6	-0.5	-0.4	-0.4	-0.4
8	-0.5	-0.5	-0.4	-0.4
9	-0.6	-0.6	-0.5	-0.5
10	-0.9	-0.8	-0.8	-0.7
12	-0.6	-0.5	-0.5	-0.5
CI1	-0.4	-0.4	-0.3	-0.3
CI4	-0.3	-0.3	-0.3	-0.3
15	-0.6	-0.6	-0.5	-0.5
W1	-0.6	-0.6	-0.5	-0.5
W2	-0.4	-0.4	-0.3	-0.3
O1	-0.3	-0.3	-0.3	-0.3
O2	-0.5	-0.5	-0.5	-0.5
Midhurst				
14	-0.4	-0.4	-0.4	-0.7
18	-0.4	-0.3	-0.3	-0.6
19	-0.4	-0.4	-0.4	-0.6
20	-0.4	-0.4	-0.3	-0.6
21	-0.3	-0.3	-0.3	-0.5

Note: Negative values = reductions in concentration.

3.24 Table 3.6 shows consistent reductions in predicted concentrations across all receptors.

3.25 The modelled receptors in Chichester showed more significant reductions in concentrations between 0.3µg.m^{-3} to 0.9µg.m^{-3} (equivalent to 0.8% - 2.3% of the AQS) over the period. Midhurst receptors are predicted to have slightly lower reductions in concentrations ranging from 0.3µg.m^{-3} to 0.7 µg.m^{-3} (equivalent to 0.8% - 1.7% of the AQS) between 2021 to 2024.

Particulates

3.26 PM_{10} and $PM_{2.5}$ scenario modelling was undertaken, and results showed no exceedance of the long or short-term AQSs in this scenario from 2021 to 2024. These results are provided in Appendix B.

3.27 There was no significant change in PM_{10} or $PM_{2.5}$ concentrations in the 5% modal shift scenario. The maximum annual mean concentration reduction for PM_{10} was -0.3µg.m^{-3} (equivalent to 0.8% of the PM_{10} AQS) and 0.2µg.m^{-3} for $PM_{2.5}$.

Contoured 2024 Scenario Results

3.1 The modelled NO_2 results for the Chichester Bus Low Emission Zone and -5% Modal Shift scenarios were gridded to provide a graphical representation of the resulting concentration contours at key locations for the year 2024.

3.2 The scenario contours and locations are presented as Figures as shown in Table 3.7 below.

Table 3.7: Scenario figures

Location	Bus LEZ scenario	5% Modal Shift Scenario.
St Pancras and Hornet	Figure 9	Figure 10
Oving Rd/A27 Intersection	Figure 11	Figure 12
Stockbridge AQMA	Figure 13	Figure 14
Whyke Roundabout	Figure 15	Figure 16
Midhurst	-	Figure 17

4. Summary of Scenario Assessments

4.1 The scenario assessment presented three potential intervention scenarios which were modelled to determine likely impacts on air quality at key receptors across Chichester district, these were:

- Chichester Bus Low Emission Zone Scenario;
- 2% Modal Shift Scenario; and
- 5% Modal Shift Scenario.

Nitrogen dioxide

4.2 The Chichester Bus Low Emission Zone Scenario intervention predicted significant concentration reductions of NO_2 in Chichester, delivering compliance of the AQS within 1 year of implementation i.e. by 2022, if implemented in 2021. Considering Midhurst is also likely to be compliant already, in reference to the baseline modelling (Table 2.1), the whole of the district is therefore predicted to be fully compliant by 2022.

4.3 The 2% Modal Shift Scenario resulted in lower impact changes in concentrations across the district and is predicted to deliver full compliance of the AQS by 2024.

4.4 The 5% Modal Shift Scenario resulted in higher impact changes in concentrations across the district, when compared to the 2% modal shift scenario, and is predicted to deliver full compliance of the AQS by 2023, at the earliest.

Particulates

4.5 There were reductions in particulate (PM_{10} and $PM_{2.5}$) concentrations in the scenarios, however these were not significant.

Glossary

Term	Definition
ADMS	Atmospheric Dispersion Modelling System
ANPR	Automatic Number Plate Recognition
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere.
Annual mean	The mean (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between two years, which is useful for pollutants that have higher concentrations during the winter months.
AQAP	Air Quality Action Plan.
AQMA	Air Quality Management Area.
AQS	Air Quality Standard
ASR	Annual Status Report
CERC	Cambridge Environmental Research Consultants
Defra	Department for Environment, Food and Rural Affairs
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
HDV	Heavy Duty Vehicles: Heavy Goods Vehicles and buses.
HGV	Heavy Goods Vehicles
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicles: motorcycles, cars and Light Goods Vehicles.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
$\mu g/m^{-3}$. micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1μg/cu.m. means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UK-AIR	UK Air Information Resource: data resource for UK measurements and tools
UKAQS	United Kingdom Air Quality Strategy.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Figures and Appendices

Figures 1- 7: Chichester and Midhurst modelled links and receptor maps.

Figure 1: Chichester modelled links and receptors.

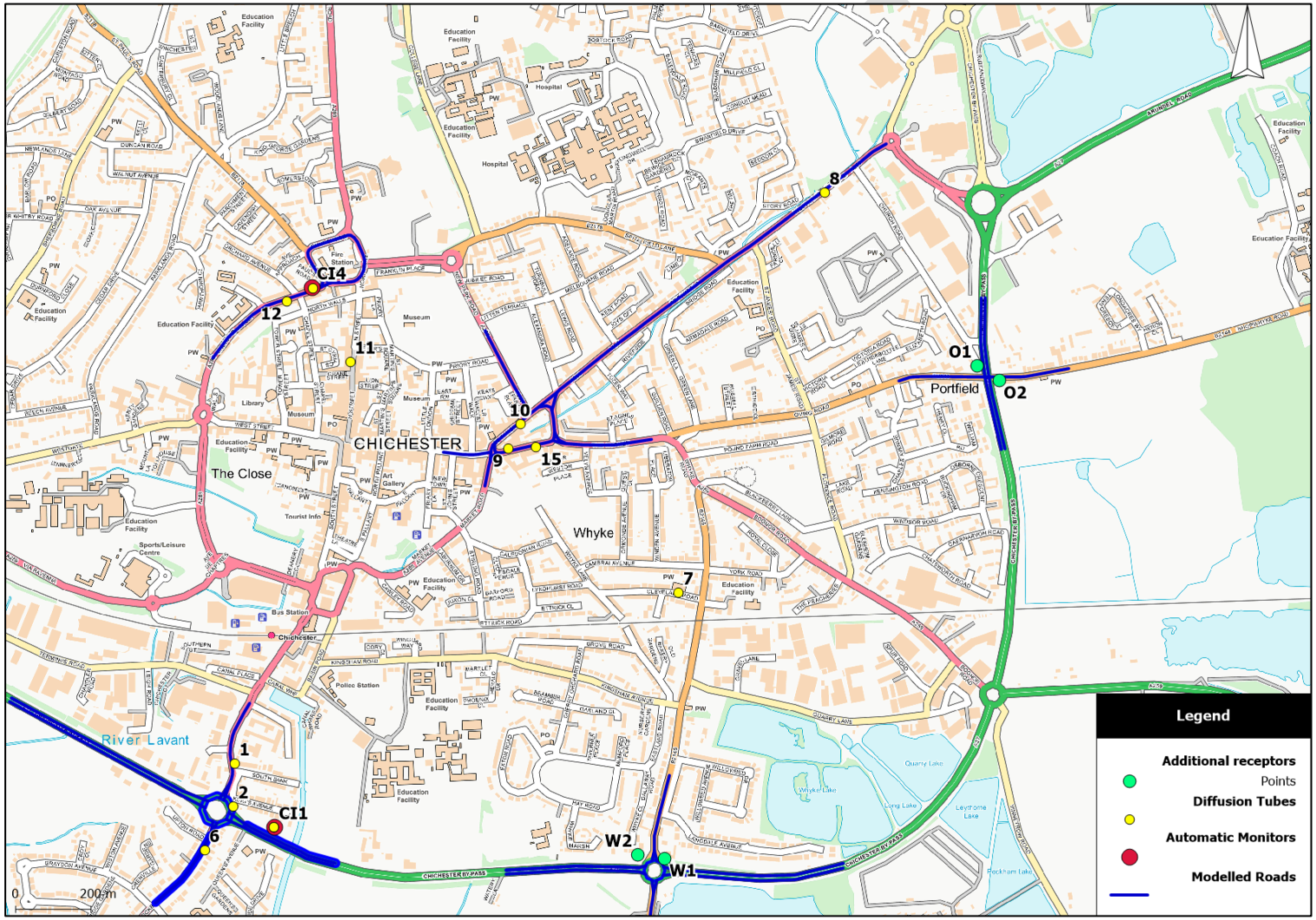


Figure 2: St Pancras AQMA and Hornet modelled links and receptors.

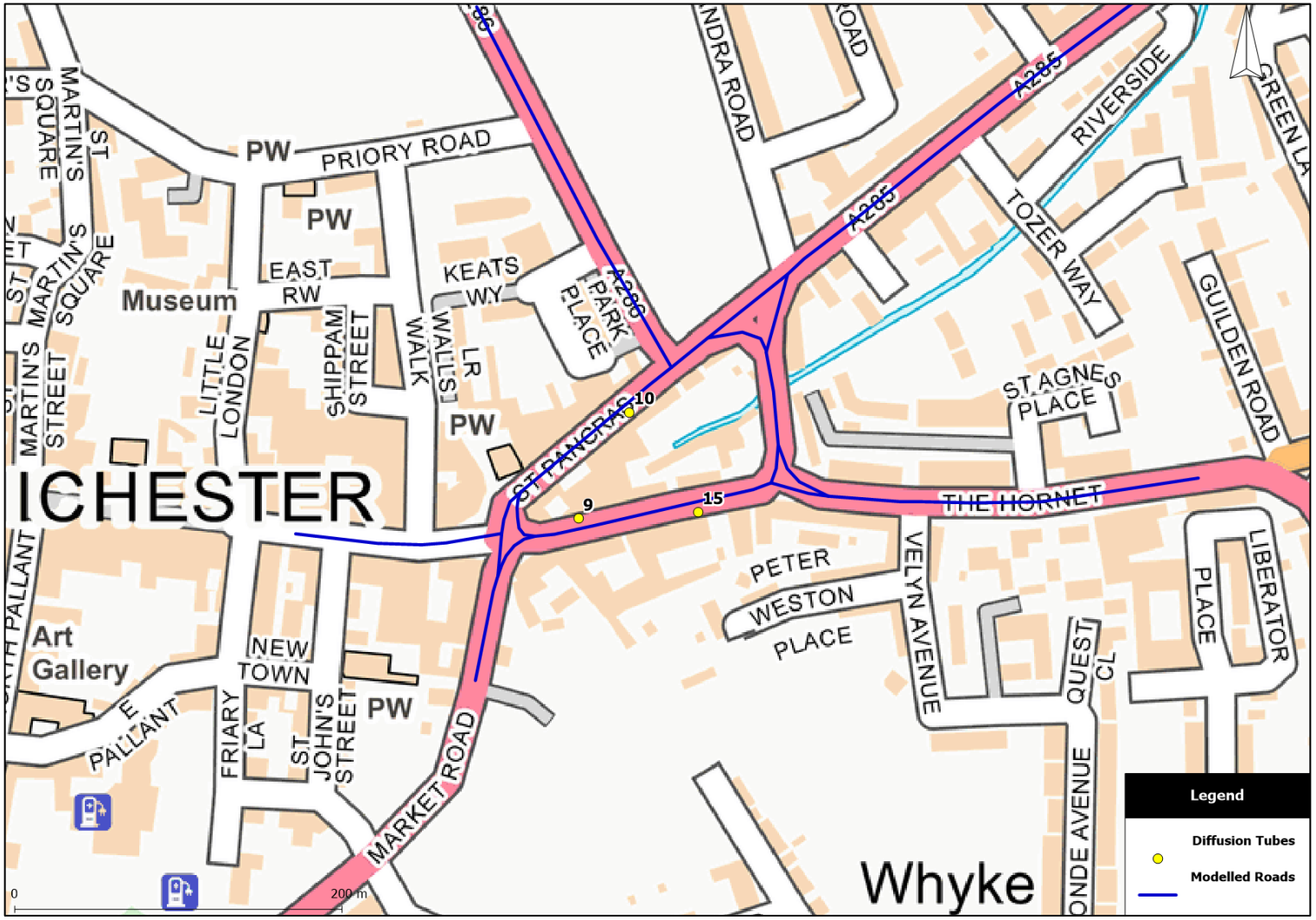


Figure 3: Orchard Street AQMA modelled links and receptors

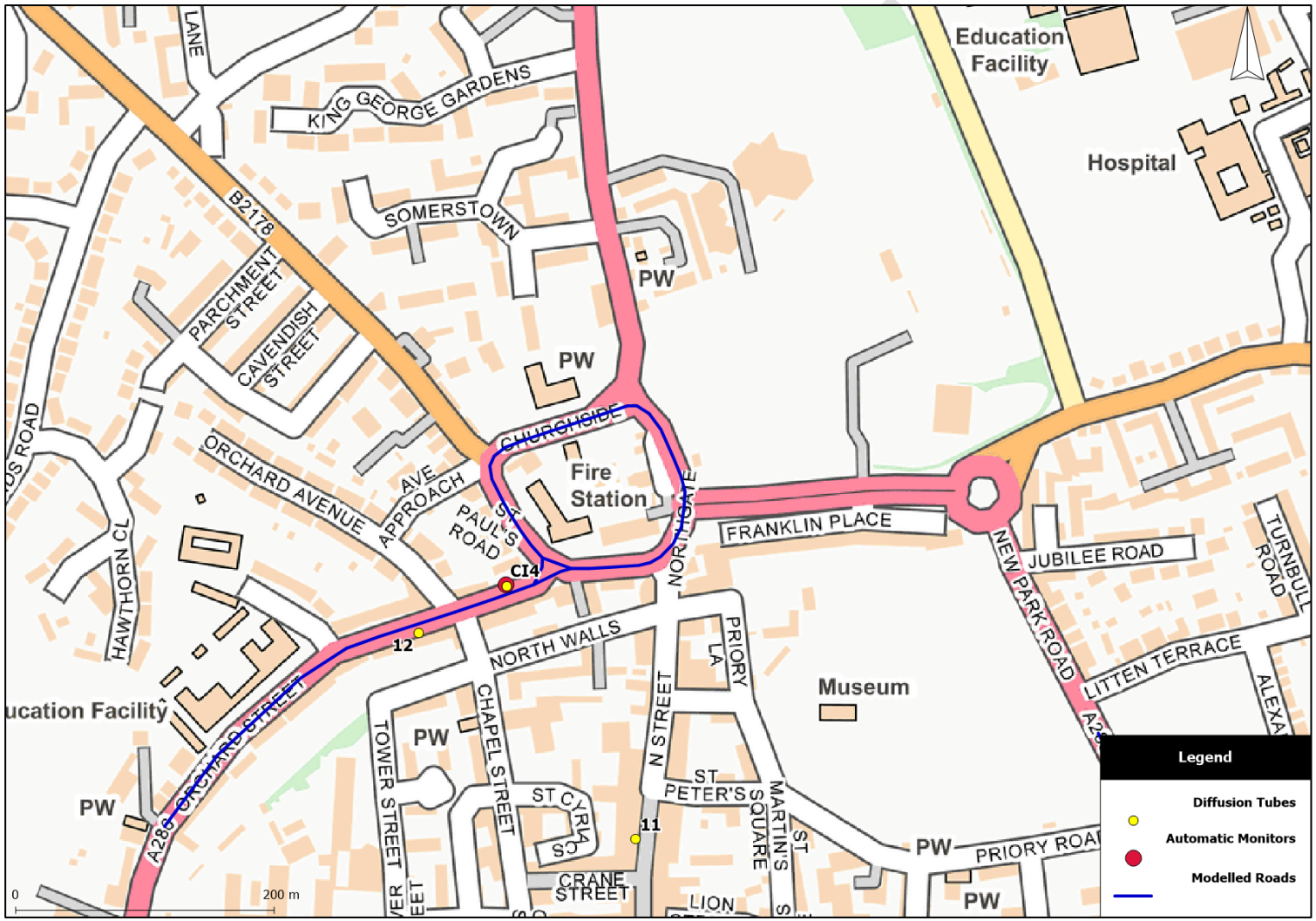


Figure 4: Oving Rd/A27 Intersection modelled links and receptors

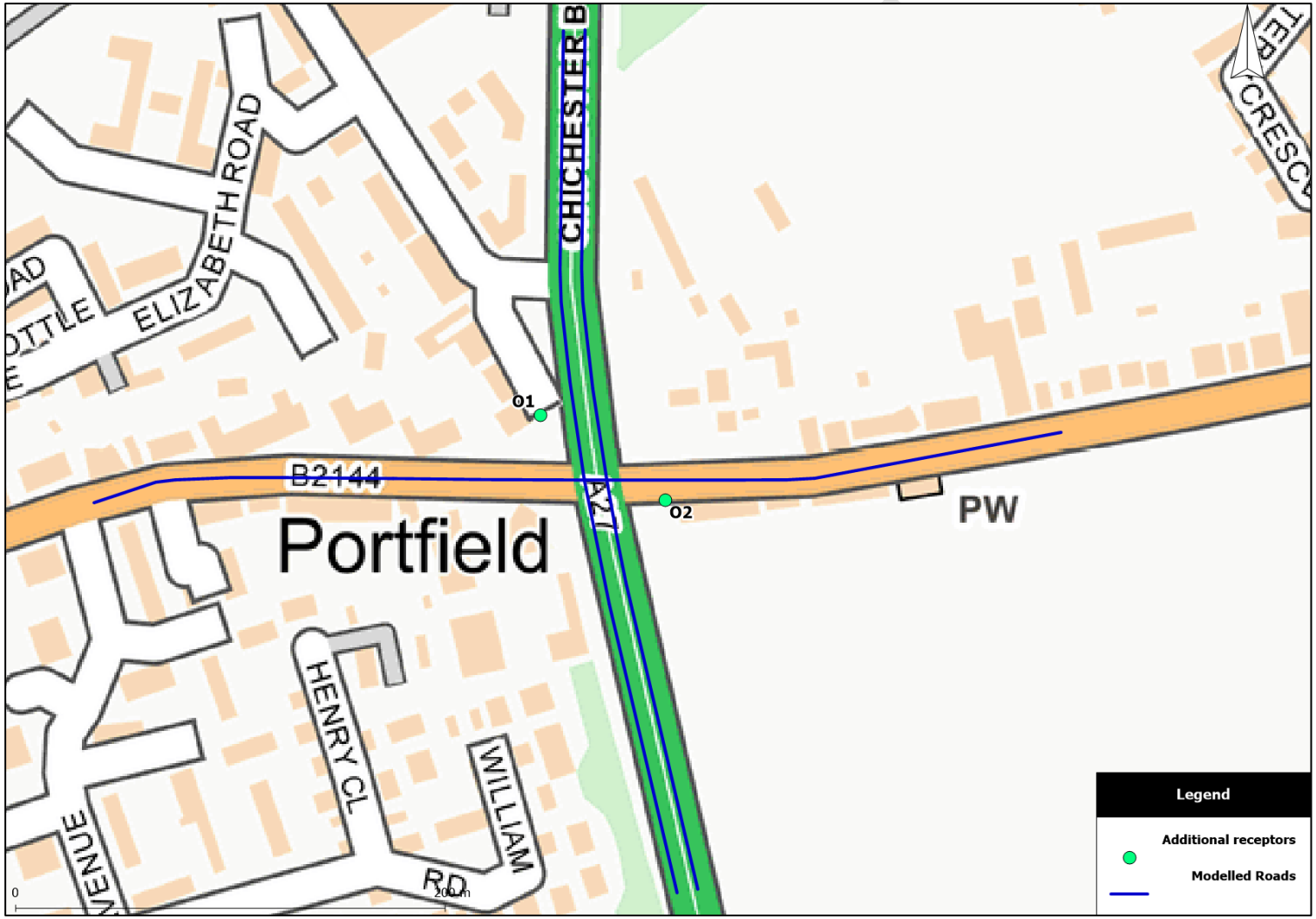


Figure 5: Stockbridge AQMA modelled links and receptors

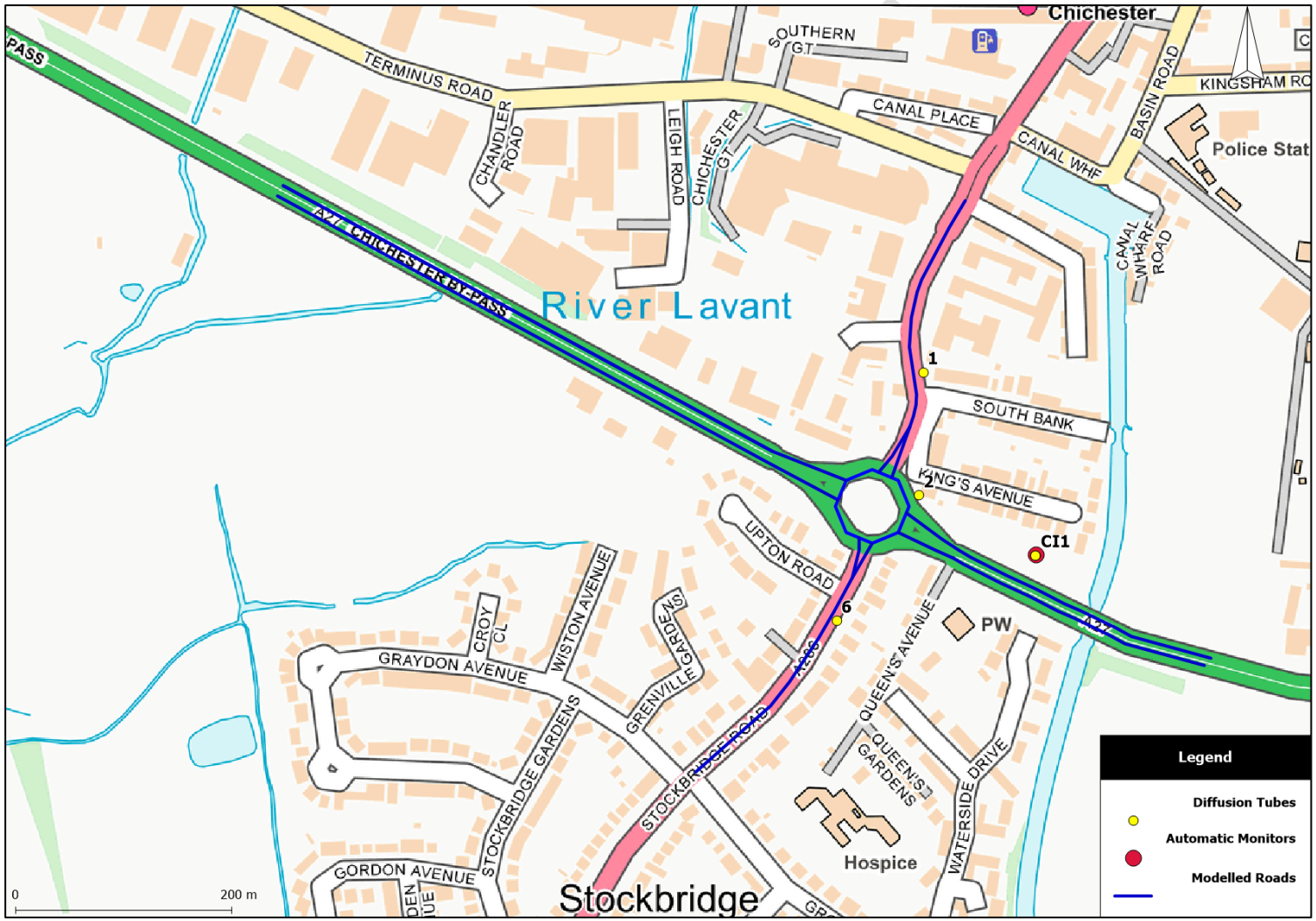


Figure 6: Whyke Roundabout modelled links and receptors

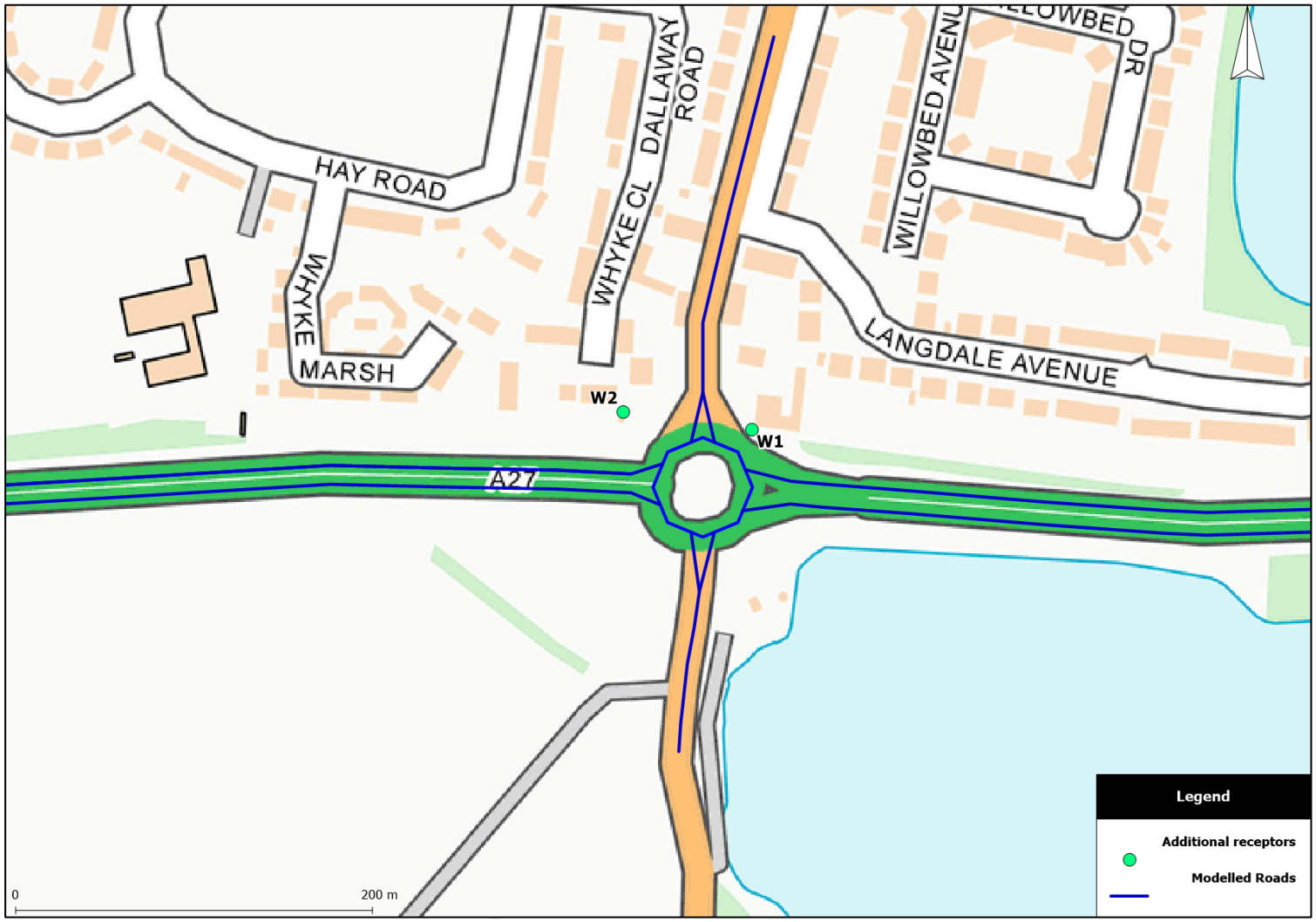
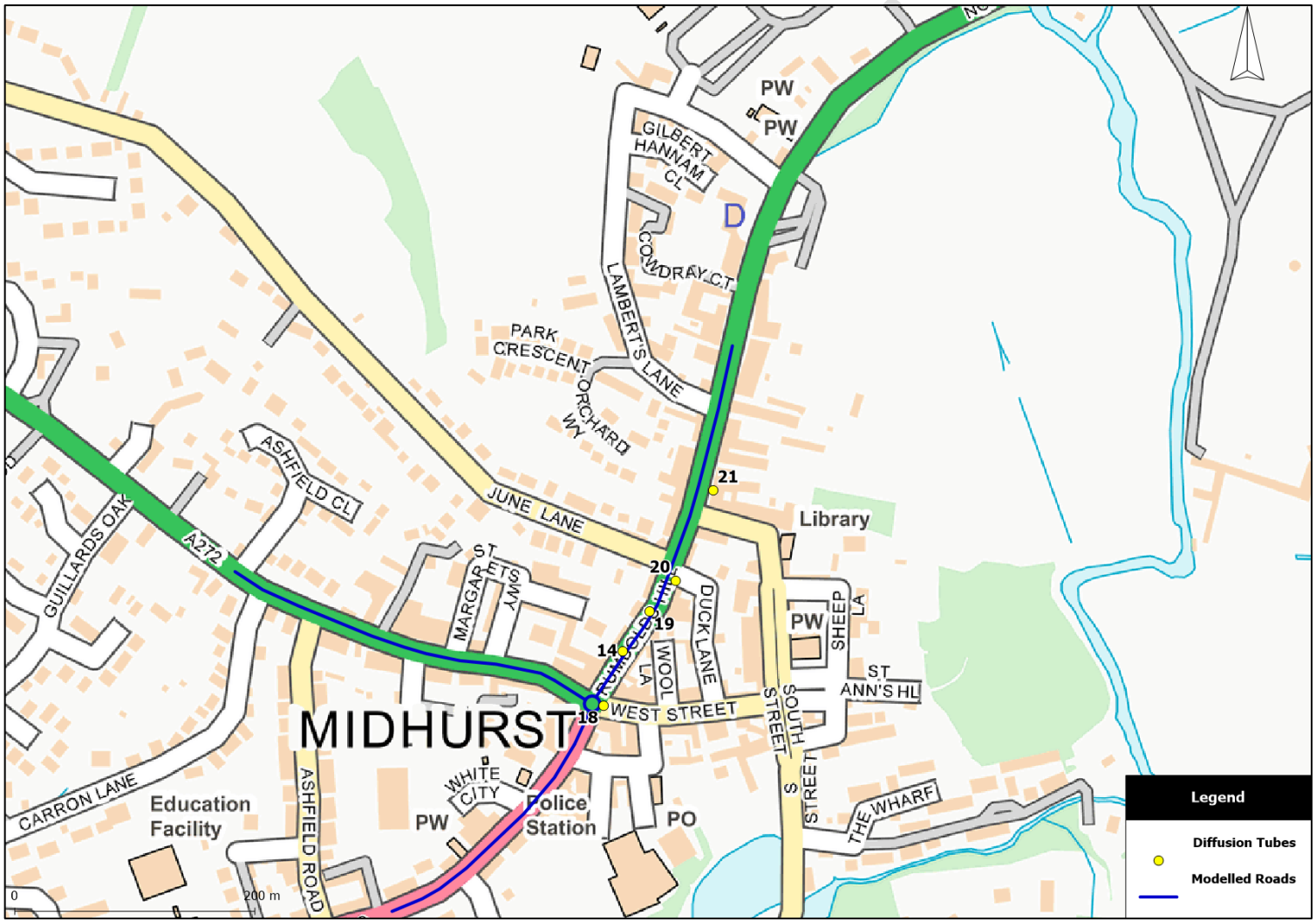


Figure 7: Midhurst modelled links and receptors



Figures 9 - 17: Chichester and Midhurst modelled annual mean NO_2 concentration contours (2024).

Figure 9: St Pancras and Hornet – Bus LEZ annual mean NO_2 concentration contours.

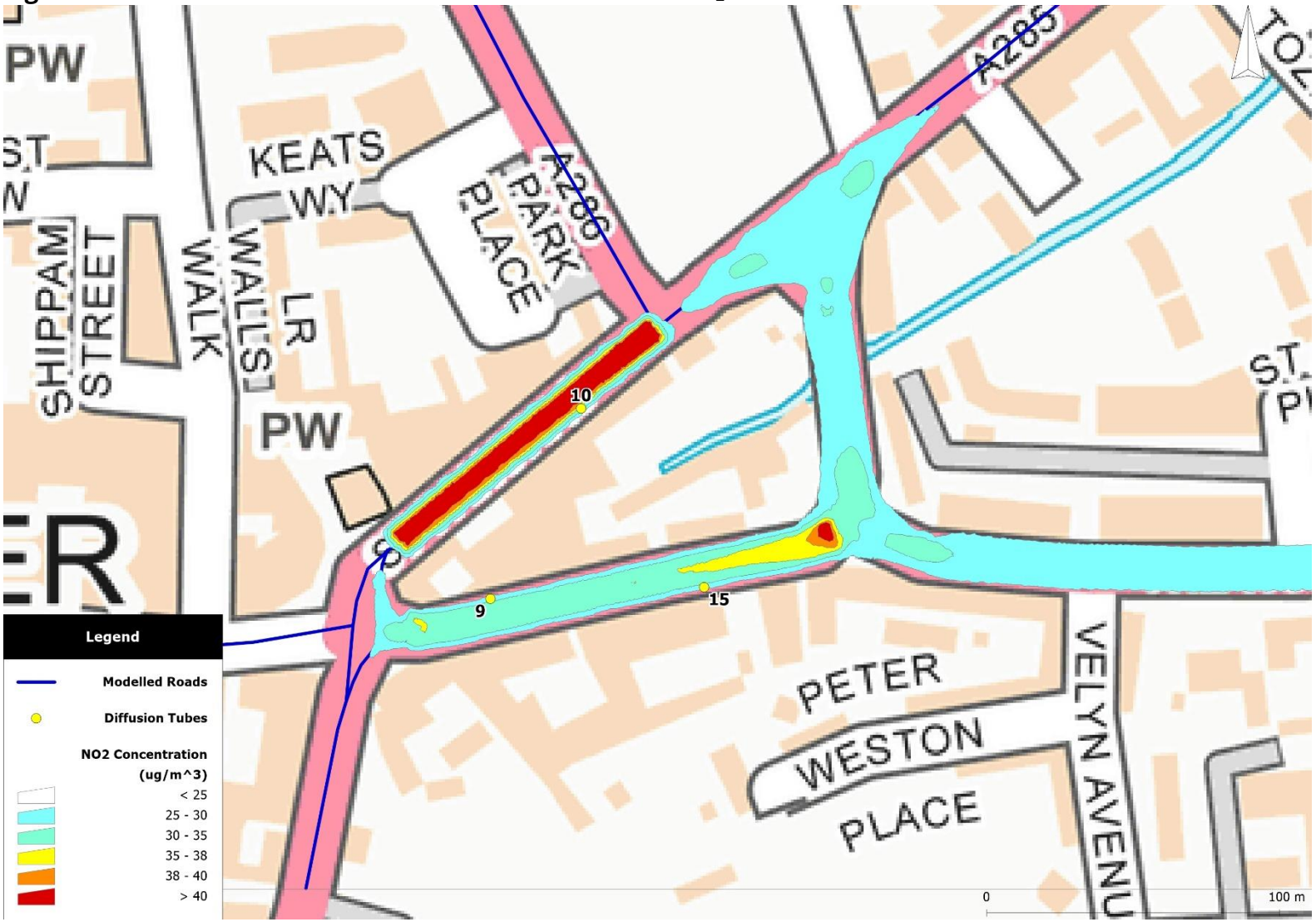


Figure 10: St Pancras and Hornet – 5% Modal Shift annual mean NO_2 concentration contours.

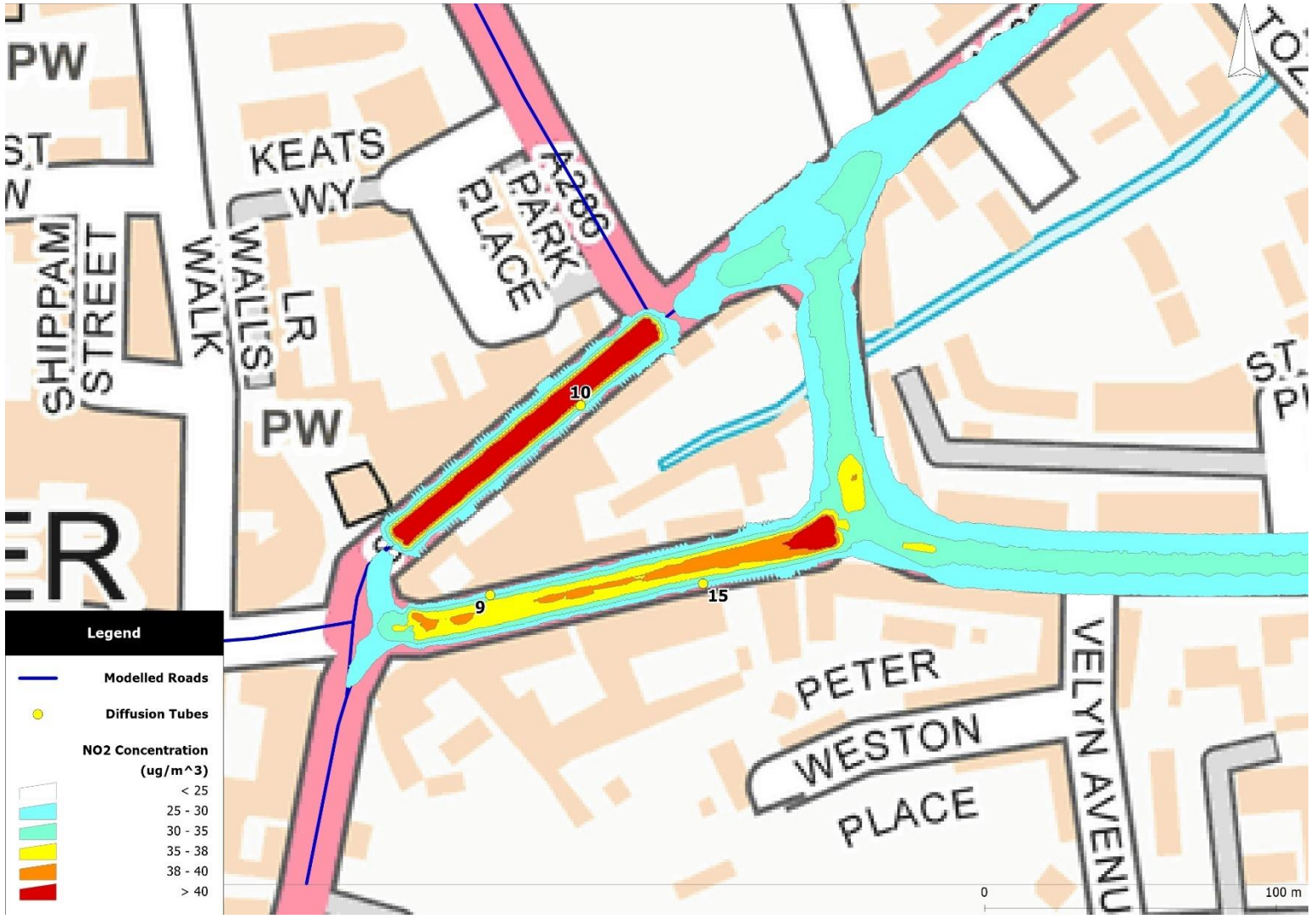


Figure 11: Oving Rd/A27 Intersection – Bus LEZ annual mean NO_2 concentration contours.

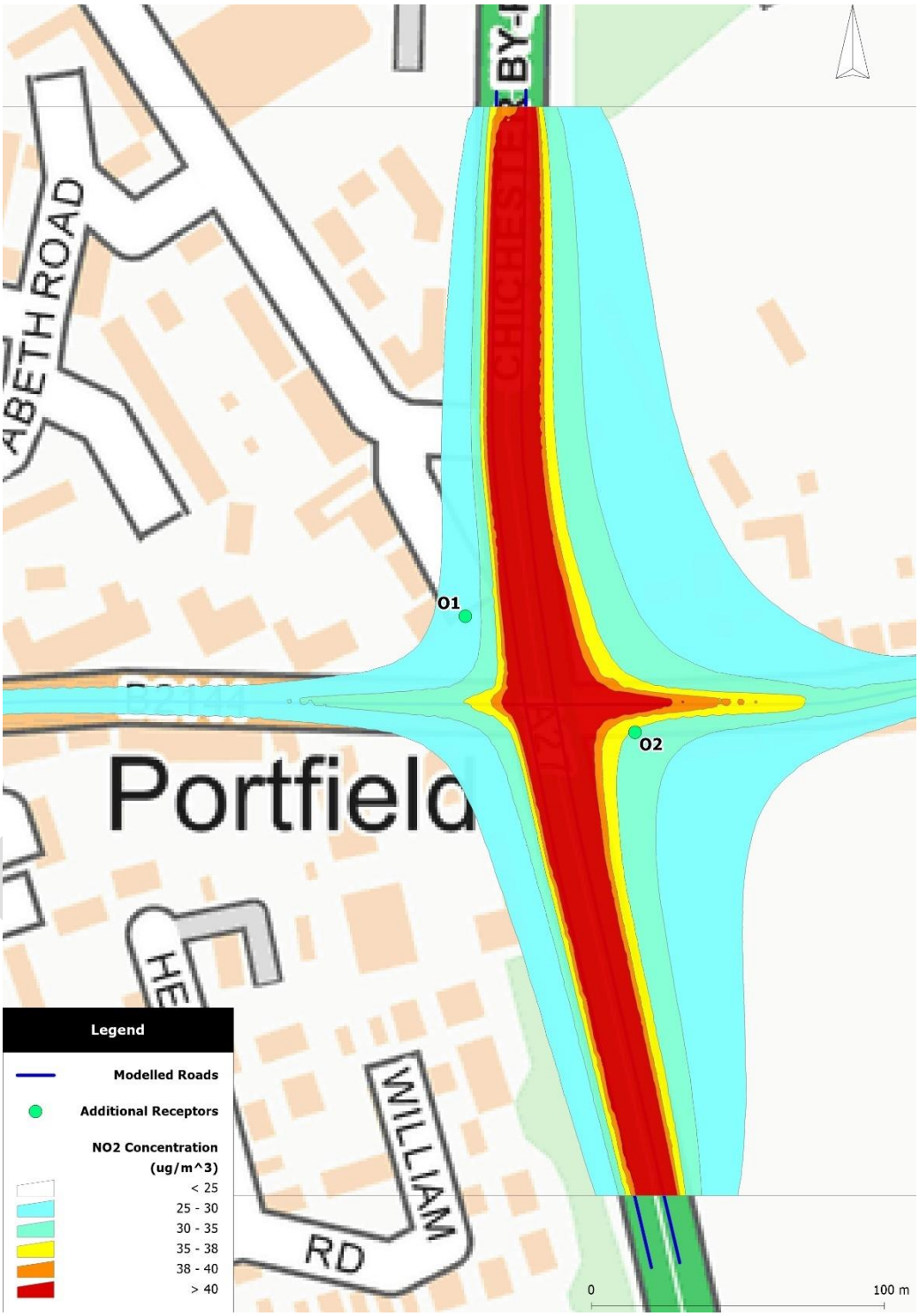


Figure 12: Oving Rd/A27 Intersection – 5% Modal Shift annual mean NO_2 concentration contours.

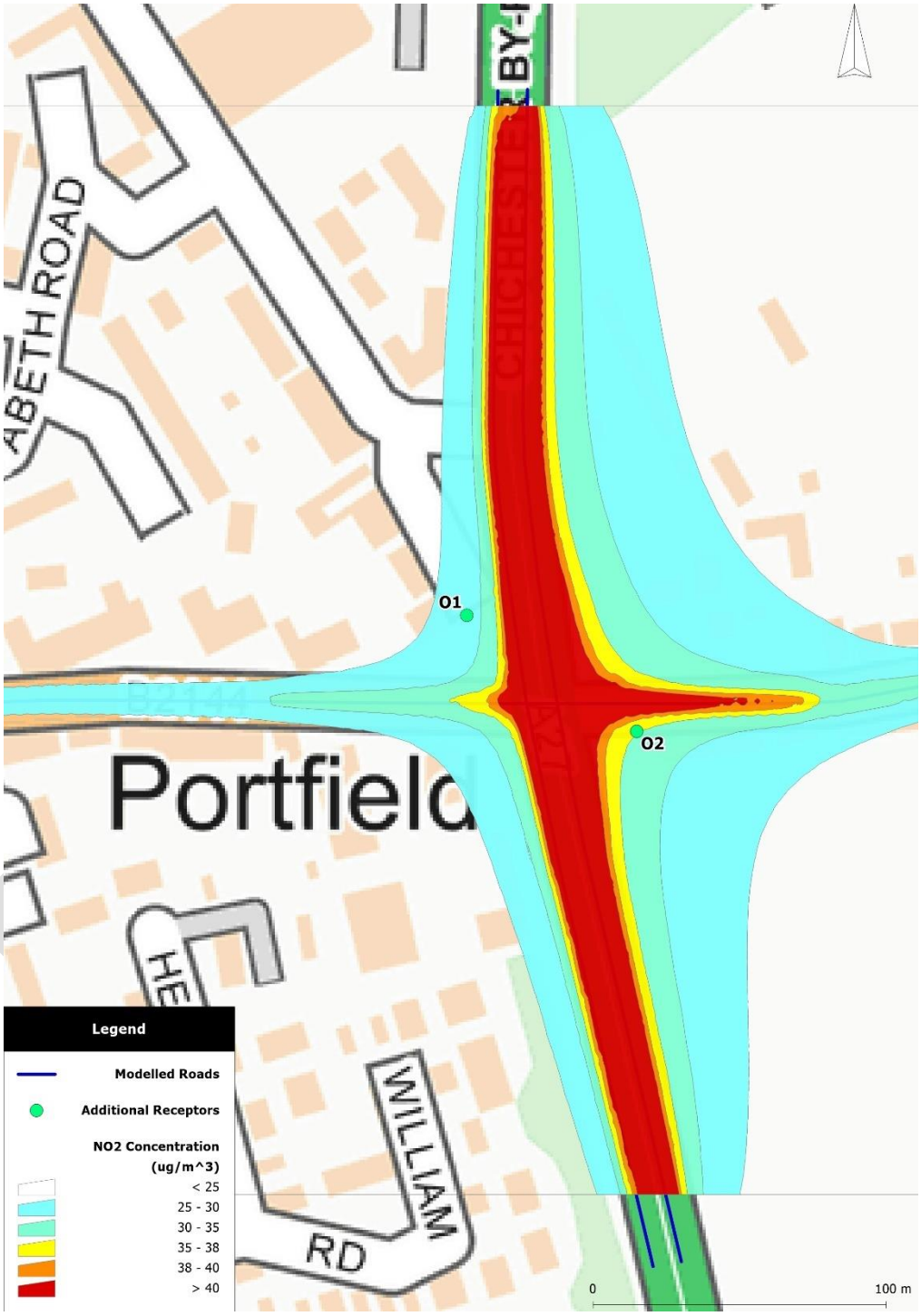


Figure 13: Stockbridge AQMA – Bus LEZ annual mean NO_2 concentration contours.

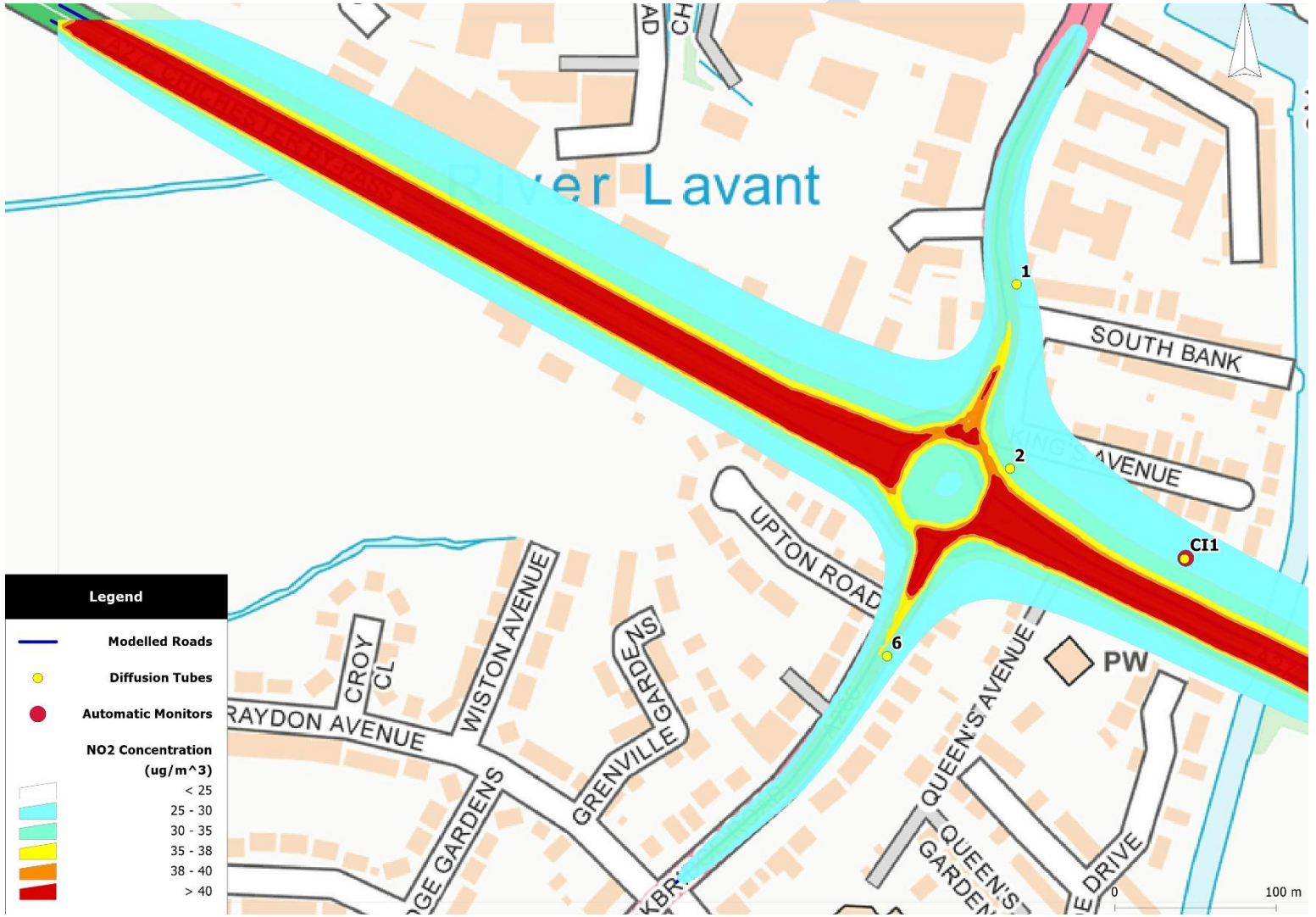


Figure 14: Stockbridge AQMA – 5% Modal Shift annual mean NO_2 concentration contours.

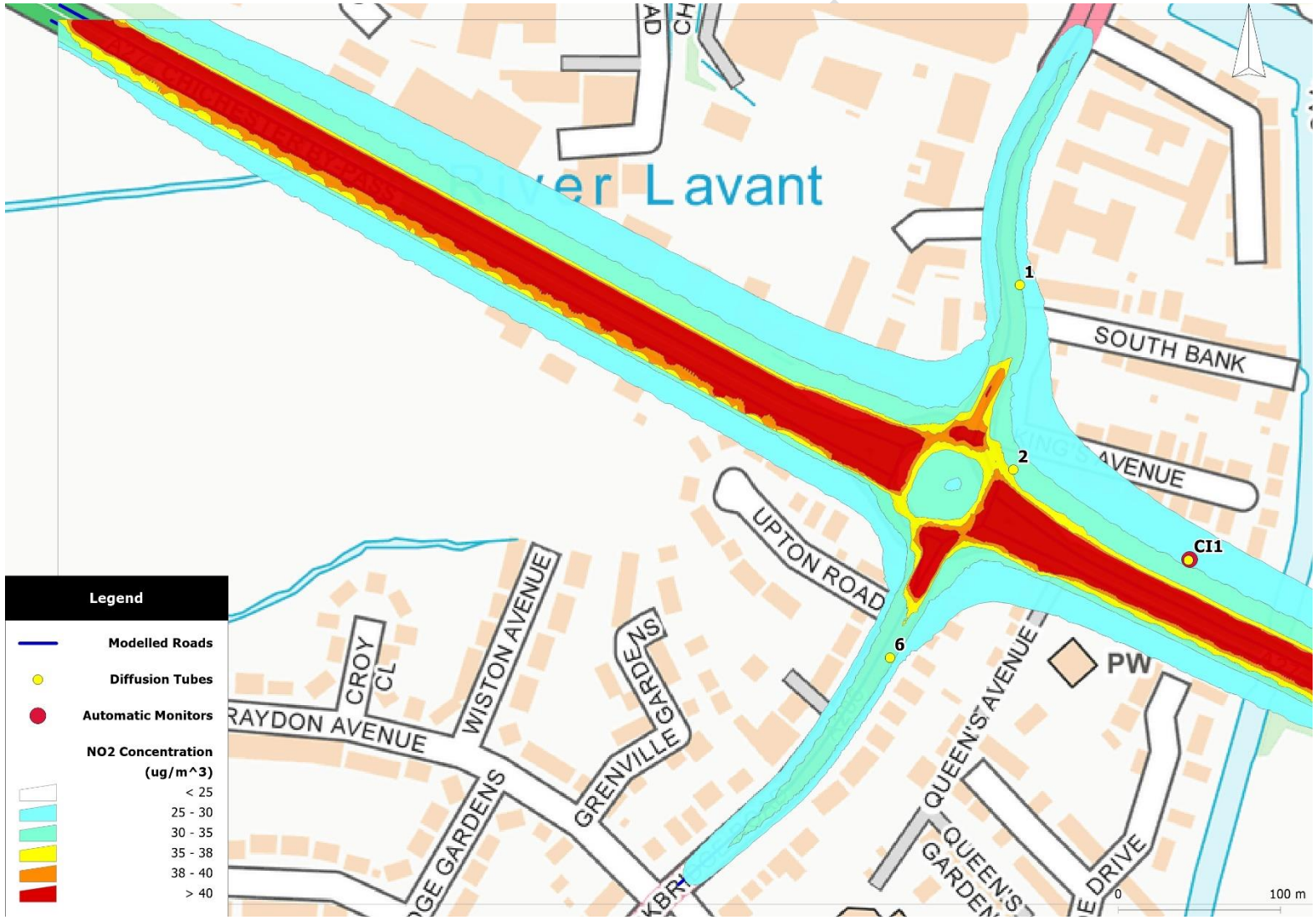


Figure 15: Whyke Roundabout – Bus LEZ annual mean NO_2 concentration contours.

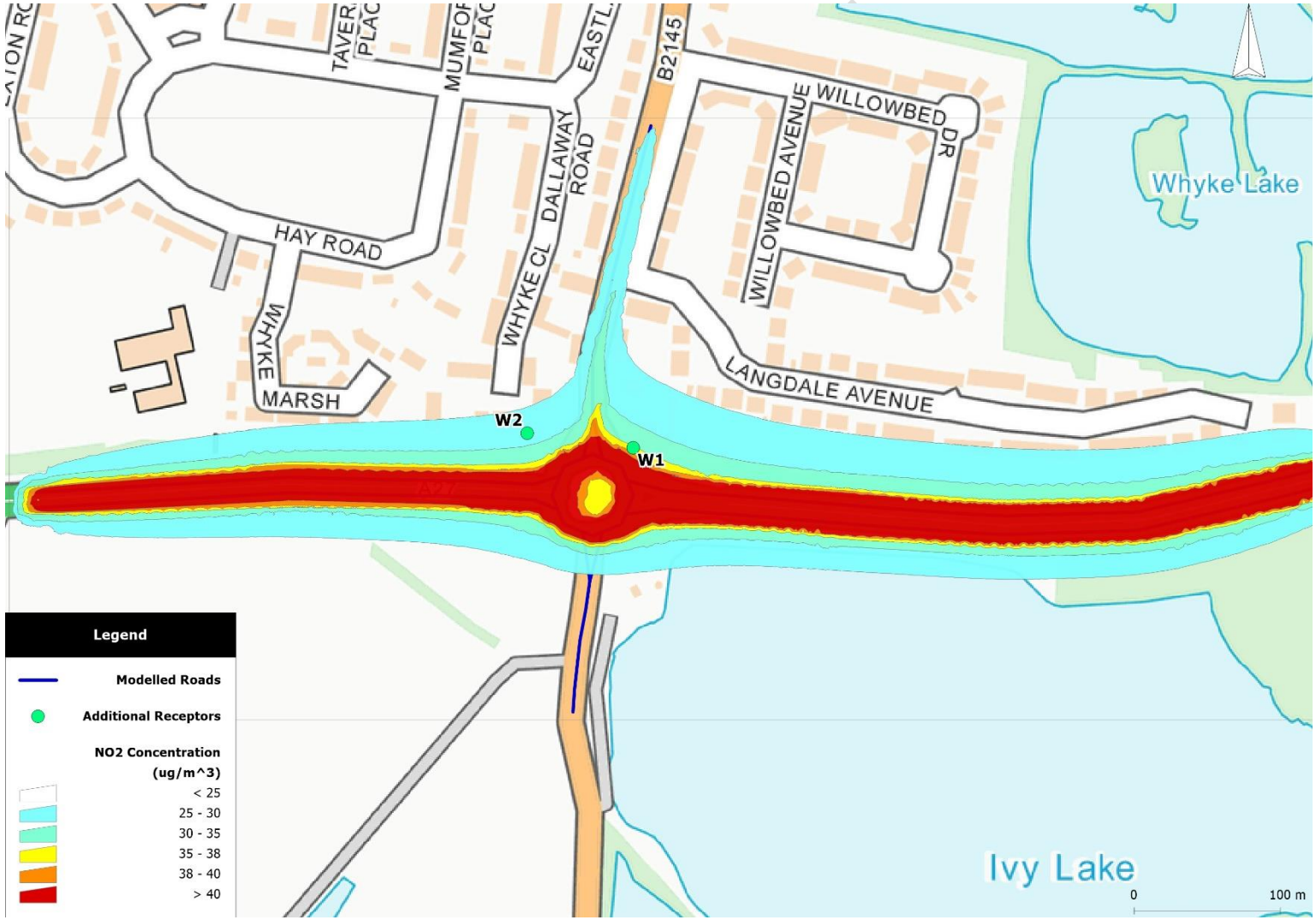


Figure 16: Whyke Roundabout – 5% Modal Shift annual mean NO_2 concentration contours.

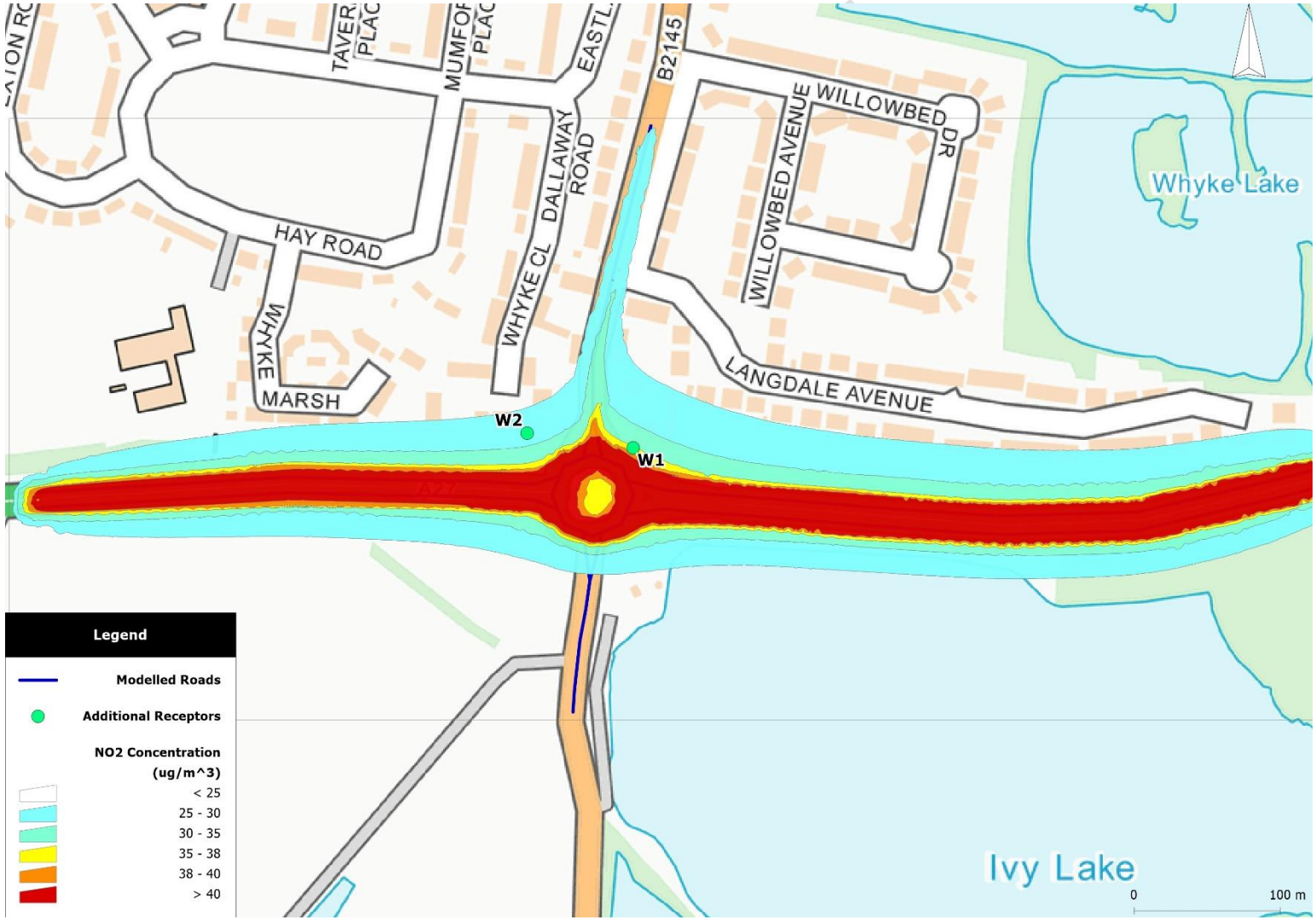
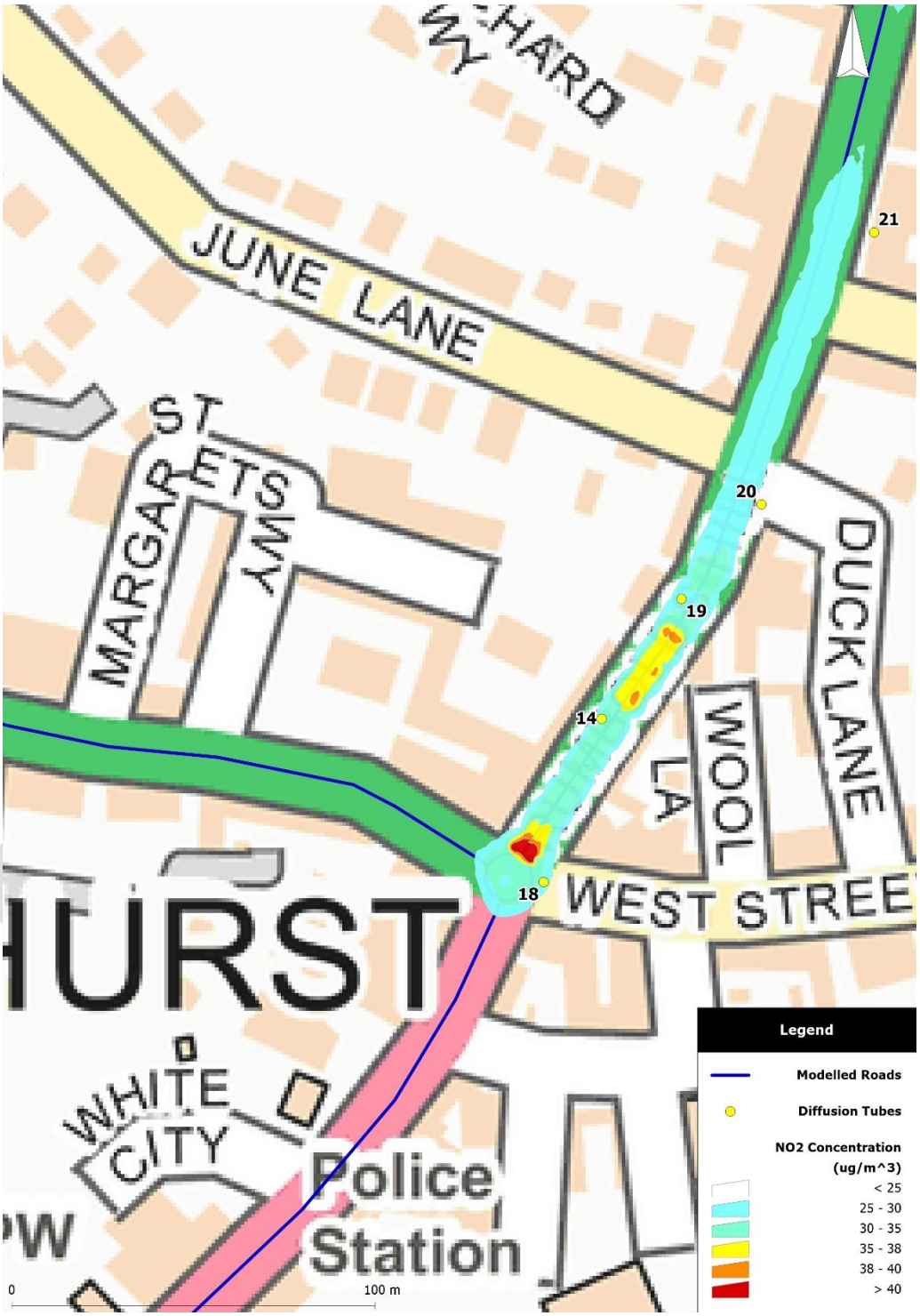


Figure 17: Midhurst – 5% Modal Shift annual mean NO_2 concentration contours.



Appendix A: Receptor locations

Receptor locations

Discrete model receptors were positioned at the façades of buildings at selected locations and modelled at "breathing height", which is, by convention, 1.5 metres above ground (or floor) level.

Table A.1: Receptor locations.

Receptor ID	Concentration NO_2 – annual mean ($\mu g.m^{-3}$)			
	x	y	Location	
Chichester				
1	485773.91	103960.26	Kings Ave/ Southbank Junction	Stockbridge Roundabout AQMA
2	485771.47	103847.47	Claremont Court	Stockbridge Roundabout AQMA
(3,4,5)	485880.84	103791.63	AQMS on Chichester Bypass (A27) and Stockbridge Roundabout	Stockbridge Roundabout AQMA
6	485695.78	103730.9	Stockbridge Rd South (A286)	Stockbridge Roundabout AQMA
8	487340.41	105474.71	Westhampnett Rd	-
9	486502.25	104793.87	The Hornet	(South of) St Pancras AQMA
10	486532.97	104860.06	St Pancras	St Pancras AQMA
12	485913.44	105186.34	174 Orchard St	Orchard St AQMA
CI1	485880.84	103791.63	Stockbridge, near to the Chichester Bypass and Stockbridge R'about	Stockbridge Roundabout AQMA
CI4	485981.41	105222.45	Orchard St	Orchard St AQMA
15	486575.92	104799.25	32 The Hornet	(South of) St Pancras AQMA
Additional receptor locations in Chichester (not diffusion tubes)				
W1	486916.28	103709.01	Nursing Home, Whyke Rd (B2135)	NE of Whyke/A27 roundabout
W2	486843.81	103719.1	22/23 Whyke Close	NW of Whyke/A27 roundabout
O1	487745.06	105015.62	Church Rd property	NW of Oving Rd/A27 intersection
O2	487803.03	104975.94	187/188 Oving Rd property	SE of Oving Rd/A27 intersection
Midhurst				
14	488559.88	121478.29	Rumbold's Hill	

Receptor ID	Concentration NO_2 – annual mean ($\mu g.m^{-3}$)		
	x	y	Location
18	488544.69	121434.01	Rumbold's Hill (Stationary Shop)
19	488583.53	121511.69	Rumbold's Hill (Natwest)
20	488601.94	121538.76	Rumbold's Hill (Nationwide)
21	488629.56	121614.62	North Street (BHF)

Note: Receptor IDs correspond to those in the Chichester District Council's LAQM Annual Status Report (2019); AQMS = (Automatic) Air Quality Monitoring Station.

Appendix B: Modelling results for PM_{10} and $PM_{2.5}$

Table B.1: PM_{10} baseline results

Receptor	Concentration PM_{10} – annual mean ($\mu g.m^{-3}$)						
	2018	2020	2021	2022	2023	2024	2025
Chichester							
1	19.6	19.5	19.5	19.5	19.5	19.5	19.5
2	20.7	20.6	20.6	20.6	20.6	20.6	20.6
(3,4,5)	19.2	19.1	19.0	19.0	19.0	19.0	19.0
6	19.3	19.2	19.2	19.2	19.2	19.2	19.2
8	18.7	18.6	18.6	18.6	18.6	18.6	18.6
9	20.6	20.5	20.5	20.5	20.5	20.5	20.5
10	23.0	22.8	22.8	22.7	22.7	22.7	22.7
12	19.7	19.7	19.7	19.6	19.6	19.7	19.7
CI1	19.2	19.1	19.0	19.0	19.0	19.0	19.0
CI4	17.2	17.2	17.2	17.2	17.2	17.2	17.2
15	20.3	20.2	20.2	20.2	20.2	20.2	20.2
W1	21.7	21.6	21.6	21.6	21.6	21.6	21.7
W2	19.0	18.9	18.9	18.9	18.9	18.9	18.9
O1	18.6	18.5	18.5	18.5	18.5	18.6	18.6
O2	22.0	21.9	21.9	21.9	21.9	21.9	22.0
Midhurst							
14	17.3	17.2	17.1	17.1	17.1	17.1	17.2
18	16.9	16.8	16.7	16.7	16.7	16.8	16.8
19	17.0	16.9	16.8	16.8	16.8	16.9	16.9
20	16.6	16.5	16.4	16.4	16.4	16.5	16.5
21	16.3	16.3	16.2	16.2	16.2	16.2	16.3

Table B.2: $PM_{2.5}$ baseline results

Receptor	Concentration PM_{10} – annual mean ($\mu g.m^{-3}$)						
	2018	2020	2021	2022	2023	2024	2025
Chichester							
1	12.6	12.5	12.5	12.4	12.4	12.4	12.4
2	13.3	13.2	13.1	13.1	13.1	13.0	13.1
(3,4,5)	12.4	12.3	12.2	12.2	12.2	12.2	12.2
6	12.5	12.4	12.3	12.3	12.3	12.3	12.3
8	12.5	12.4	12.3	12.3	12.3	12.3	12.3
9	13.7	13.6	13.5	13.5	13.5	13.5	13.5
10	15.1	14.9	14.8	14.8	14.7	14.7	14.7
12	13.1	13.0	13.0	12.9	12.9	12.9	12.9
CI1	12.4	12.3	12.2	12.2	12.2	12.2	12.2
CI4	11.6	11.6	11.6	11.5	11.5	11.5	11.5

15	13.5	13.4	13.4	13.3	13.3	13.3	13.3
W1	13.8	13.6	13.6	13.5	13.5	13.5	13.5
W2	12.2	12.1	12.1	12.0	12.0	12.0	12.0
O1	12.4	12.3	12.3	12.2	12.2	12.2	12.3
O2	14.7	14.6	14.5	14.5	14.5	14.5	14.5
Midhurst							
14	11.6	11.5	11.4	11.4	11.4	11.4	11.4
18	11.4	11.3	11.2	11.1	11.1	11.1	11.2
19	11.4	11.3	11.2	11.2	11.2	11.2	11.3
20	11.2	11.1	11.0	11.0	11.0	11.0	11.0
21	11.0	10.9	10.9	10.8	10.8	10.8	10.9

Table B.3: PM_{10} Bus LEZ scenario results

Receptor	Concentration PM_{10} – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	19.5	19.5	19.5	19.5
2	20.6	20.6	20.6	20.6
(3,4,5)	19.0	19.0	19.0	19.0
6	19.2	19.2	19.2	19.2
8	18.6	18.6	18.6	18.6
9	20.5	20.5	20.5	20.5
10	22.8	22.7	22.7	22.7
12	19.6	19.6	19.6	19.7
CI1	19.0	19.0	19.0	19.0
CI4	17.2	17.2	17.2	17.2
15	20.2	20.2	20.2	20.2
W1	21.6	21.6	21.6	21.6
W2	18.9	18.9	18.9	18.9
O1	18.5	18.5	18.5	18.6
O2	21.9	21.9	21.9	21.9

Table B.4: $PM_{2.5}$ Bus LEZ scenario results

Receptor	Concentration $PM_{2.5}$ – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	12.5	12.4	12.4	12.4
2	13.1	13.1	13.1	13.1
(3,4,5)	12.2	12.2	12.2	12.2
6	12.3	12.3	12.3	12.3

8	12.3	12.3	12.3	12.3
9	13.5	13.5	13.5	13.5
10	14.8	14.8	14.7	14.8
12	13.0	12.9	12.9	12.9
CI1	12.2	12.2	12.2	12.2
CI4	11.6	11.5	11.5	11.5
15	13.4	13.3	13.3	13.3
W1	13.6	13.5	13.5	13.5
W2	12.1	12.0	12.0	12.0
O1	12.3	12.2	12.2	12.2
O2	14.5	14.5	14.5	14.5

Table B.5: PM_{10} Modal Shift (2%) scenario results

Receptor	Concentration PM_{10} – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	19.4	19.4	19.4	19.4
2	20.5	20.5	20.5	20.5
(3,4,5)	19.0	19.0	19.0	19.0
6	19.1	19.1	19.1	19.1
8	18.6	18.5	18.5	18.5
9	20.4	20.4	20.4	20.4
10	22.6	22.6	22.6	22.5
12	19.6	19.6	19.6	19.6
CI1	19.0	19.0	19.0	19.0
CI4	17.1	17.1	17.1	17.1
15	20.1	20.1	20.1	20.1
W1	21.5	21.5	21.5	21.5
W2	18.9	18.9	18.9	18.9
O1	18.5	18.5	18.5	18.5
O2	21.8	21.8	21.8	21.9
Midhurst				
14	17.1	17.0	17.1	17.1
18	16.7	16.7	16.7	16.7
19	16.8	16.8	16.8	16.8
20	16.4	16.4	16.4	16.4
21	16.2	16.2	16.2	16.2

Table B.6: $PM_{2.5}$ Modal Shift (2%) scenario results

Receptor	Concentration $PM_{2.5}$ – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	12.4	12.4	12.4	12.4
2	13.1	13.0	13.0	13.0
(3,4,5)	12.2	12.2	12.1	12.1
6	12.3	12.3	12.3	12.2
8	12.3	12.3	12.3	12.3
9	13.5	13.5	13.5	13.4
10	14.8	14.7	14.7	14.6
12	12.9	12.9	12.9	12.9
CI1	12.2	12.2	12.1	12.1
CI4	11.5	11.5	11.5	11.5
15	13.3	13.3	13.3	13.3
W1	13.5	13.5	13.5	13.5
W2	12.0	12.0	12.0	12.0
O1	12.2	12.2	12.2	12.2
O2	14.5	14.5	14.5	14.5
Midhurst				
14	11.4	11.3	11.3	11.3
18	11.2	11.1	11.1	11.1
19	11.2	11.2	11.2	11.1
20	11.0	11.0	10.9	10.9
21	10.8	10.8	10.8	10.8

Table B.7: PM_{10} Modal Shift (5%) scenario results

Receptor	Concentration PM_{10} – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	19.3	19.3	19.3	19.4
2	20.4	20.4	20.4	20.5
(3,4,5)	18.9	18.9	18.9	18.9
6	19.1	19.0	19.0	19.1
8	18.5	18.5	18.5	18.5
9	20.3	20.3	20.3	20.3
10	22.5	22.4	22.4	22.4
12	19.5	19.5	19.5	19.5
CI1	18.9	18.9	18.9	18.9

CI4	17.1	17.1	17.1	17.1
15	20.0	20.0	20.0	20.0
W1	21.4	21.4	21.4	21.4
W2	18.8	18.8	18.8	18.8
O1	18.4	18.4	18.4	18.5
O2	21.7	21.7	21.7	21.8
Midhurst				
14	17.0	17.0	17.0	17.1
18	16.6	16.6	16.6	16.7
19	16.7	16.7	16.7	16.8
20	16.4	16.4	16.4	16.5
21	16.1	16.1	16.1	16.2

Table B.8: $PM_{2.5}$ Modal Shift (5%) scenario results

Receptor	Concentration $PM_{2.5}$ – annual mean ($\mu g.m^{-3}$)			
	2021	2022	2023	2024
Chichester				
1	12.4	12.4	12.4	12.4
2	13.0	13.0	13.0	13.0
(3,4,5)	12.1	12.1	12.1	12.1
6	12.2	12.2	12.2	12.2
8	12.3	12.2	12.2	12.2
9	13.4	13.4	13.4	13.4
10	14.7	14.6	14.6	14.6
12	12.9	12.8	12.8	12.8
CI1	12.1	12.1	12.1	12.1
CI4	11.5	11.5	11.5	11.5
15	13.3	13.2	13.2	13.2
W1	13.5	13.4	13.4	13.4
W2	12.0	12.0	12.0	12.0
O1	12.2	12.2	12.2	12.2
O2	14.4	14.4	14.4	14.4
Midhurst				
14	11.3	11.3	11.3	11.3
18	11.1	11.1	11.1	11.1
19	11.2	11.1	11.1	11.1
20	11.0	10.9	10.9	10.9
21	10.8	10.8	10.8	10.8

Phlorum Limited

Head Office & Registered Office:
Unit 12
Hunns Mere Way
Woodingdean
Brighton
East Sussex
BN2 6AH
T: 01273 307 167

Northern Office:
Ground Floor
Adamson House
Towers Business Park
Wilmslow Road
Didsbury
Manchester
M20 2YY
T: 0161 955 4250

Western Office:
One Caspian Point
Pierhead Street
Cardiff Bay
Cardiff
CF10 4DQ
T: 029 2092 0820

info@phlorum.com
www.phlorum.com

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