

# **M25 junction 28 improvement scheme TR010029**

## **6.3 Environmental Statement Appendix 5.1: Air quality**

APFP Regulation 5(2)(a)  
Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



## **Infrastructure Planning**

### **Planning Act 2008**

### **The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009**

### **M25 junction 28 scheme Development Consent Order 202[x ]**

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#### **6.3 ENVIRONMENTAL STATEMENT APPENDIX 5.1: AIR QUALITY**

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|------------------------------------------------|-------------------------------------------------------------------|
| <b>Regulation Number:</b>                      | Regulation 5(2)(a)                                                |
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# **Appendix 5.1 Air quality**



## 5. Air quality

### 5.1 PM<sub>2.5</sub>

- 5.1.1 At the closest PM<sub>2.5</sub> monitoring station to the Scheme, the Rainham roadside site in the London Borough of Havering, located approximately 10 km from M25 junction 28, concentrations between 2014 and 2018 were below the annual mean air quality criterion of 25 µg/m<sup>3</sup>, ranging between 11 µg/m<sup>3</sup> and 12 µg/m<sup>3</sup>.
- 5.1.2 Highways England has calculated that a large increase in 10,000 vehicles a day at a point very close to the edge of a motorway (5m), would lead to an increase in PM<sub>2.5</sub> of approximately 0.5 µg/m<sup>3</sup>, and even allowing for an uncertainty estimate of a factor of 2, would result in a maximum change of 1 µg/m<sup>3</sup>.
- 5.1.3 Combining a maximum increase in PM<sub>2.5</sub> roadside concentrations of 1 µg/m<sup>3</sup> with a measured concentration of 12 µg/m<sup>3</sup>, as recorded at Rainham roadside monitoring site in 2017, would result in a concentration of 13 µg/m<sup>3</sup>, which is 12 µg/m<sup>3</sup> below the limit value. On this basis there is not considered to be a risk that the Scheme would exceed the PM<sub>2.5</sub> air quality criterion and consequently an assessment of PM<sub>2.5</sub> has not been undertaken for this Scheme.

### 5.2 Receptors

**Table 5.1: Discrete receptors included in the air quality assessment**

| Receptor ID | Name                                      | X      | Y      | Local Authority |
|-------------|-------------------------------------------|--------|--------|-----------------|
| R1          | Residential Property at Wingrave Crescent | 557404 | 192814 | Brentwood       |
| R2          | Residential Property at Leonard Way       | 557441 | 192940 | Brentwood       |
| R3          | Residential Property at Nags Head Lane    | 557175 | 192055 | Brentwood       |
| R4          | Residential Property at Wingrave Crescent | 557417 | 192769 | Brentwood       |
| R5          | Residential Property at Nags Head Lane    | 556981 | 191814 | Brentwood       |
| R6          | Property at Grove Farm                    | 556606 | 192447 | Havering        |
| R7          | Residential Property at Nags Head Lane    | 557113 | 191984 | Brentwood       |
| R8          | Residential Property at Wingrave Crescent | 557394 | 192862 | Brentwood       |
| R9          | Residential Property at Wingrave Crescent | 557432 | 192865 | Brentwood       |
| R10         | Residential Property at Nags Head Lane    | 557154 | 192032 | Brentwood       |
| R11         | Residential Property at Wingrave Crescent | 557409 | 192916 | Brentwood       |
| R12         | Residential Property at Wingrave Crescent | 557409 | 192916 | Brentwood       |
| R13         | Residential Property at Nags Head Lane    | 557022 | 191871 | Brentwood       |

| Receptor ID | Name                                      | X      | Y      | Local Authority |
|-------------|-------------------------------------------|--------|--------|-----------------|
| R14         | Residential Property at Wingrave Crescent | 557436 | 192869 | Brentwood       |
| R15         | Residential Property at Leonard Way       | 557440 | 192924 | Brentwood       |
| R16         | Residential Property at Nags Head Lane    | 557011 | 191858 | Brentwood       |
| R17         | Residential Property at Wingrave Crescent | 557409 | 192916 | Brentwood       |
| R18         | Residential Property at Colchester Road   | 556042 | 191916 | Havering        |
| R19         | Residential Property at Nags Head Lane    | 556998 | 191832 | Brentwood       |
| R20         | Residential Property at Wingrave Crescent | 557399 | 192857 | Brentwood       |
| R21         | Residential Property at Leonard Way       | 557441 | 192934 | Brentwood       |
| R22         | Residential Property at Wingrave Crescent | 557410 | 192791 | Brentwood       |
| R23         | Residential Property at Nags Head Lane    | 557162 | 192043 | Brentwood       |
| R24         | Residential Property at Tern Way          | 557451 | 192856 | Brentwood       |
| R25         | Residential Property at Wingrave Crescent | 557410 | 192786 | Brentwood       |
| R26         | Residential Property at Nags Head Lane    | 557183 | 192075 | Brentwood       |
| R27         | Residential Property at Wingrave Crescent | 557414 | 192774 | Brentwood       |
| R28         | Residential Property at Wingrave Crescent | 557409 | 192916 | Brentwood       |
| R29         | Residential Property at Brook Street      | 557029 | 192500 | Brentwood       |
| R30         | Residential Property at Wingrave Crescent | 557413 | 192781 | Brentwood       |
| R31         | Residential Property at Wingrave Crescent | 557387 | 192897 | Brentwood       |
| R32         | Residential Property at Tern Way          | 557453 | 192851 | Brentwood       |
| R33         | Residential Property at Nags Head Lane    | 556956 | 191810 | Brentwood       |
| R34         | Residential Property at Brook Street      | 556961 | 192282 | Brentwood       |
| R35         | Residential Property at Nags Head Lane    | 556989 | 191826 | Brentwood       |
| R36         | Residential Property at Nags Head Lane    | 556974 | 191808 | Brentwood       |
| R37         | Residential Property at Tern Way          | 557450 | 192799 | Brentwood       |
| R38         | Residential Property at Wingrave Crescent | 557384 | 192893 | Brentwood       |
| R39         | Residential Property at Nags Head Lane    | 557206 | 192117 | Brentwood       |
| R40         | Residential Property at Wingrave Crescent | 557409 | 192916 | Brentwood       |

| Receptor ID | Name                                                              | X      | Y      | Local Authority |
|-------------|-------------------------------------------------------------------|--------|--------|-----------------|
| R41         | Residential Property at Wingrave Crescent                         | 557383 | 192879 | Brentwood       |
| R42         | Residential Property at Wingrave Crescent                         | 557409 | 192916 | Brentwood       |
| R43         | Residential Property at Nags Head Lane                            | 557131 | 191989 | Brentwood       |
| R44         | Residential Property at Nags Head Lane                            | 557037 | 191875 | Brentwood       |
| R45         | Residential Property at Wingrave Crescent                         | 557428 | 192860 | Brentwood       |
| R46         | Residential Property at Leonard Way                               | 557441 | 192919 | Brentwood       |
| R47*        | Holiday Inn at Brook Street                                       | 557183 | 192614 | Brentwood       |
| R48         | Residential Property at Leonard Way                               | 557440 | 192929 | Brentwood       |
| R49         | Residential Property at Nags Head Lane                            | 557200 | 192105 | Brentwood       |
| R50         | Residential Property at Wingrave Crescent                         | 557409 | 192916 | Brentwood       |
| R51         | Residential Property at Wingrave Crescent                         | 557395 | 192907 | Brentwood       |
| R52         | Residential Property at Nags Head Lane                            | 557031 | 191797 | Brentwood       |
| R53         | Residential Property at Nags Head Lane                            | 557020 | 191794 | Brentwood       |
| R54         | Residential Property at Wingrave Crescent                         | 557412 | 192837 | Brentwood       |
| R55         | Residential Property at Wingrave Crescent                         | 557406 | 192799 | Brentwood       |
| R56         | Residential Property at River Road                                | 557442 | 192913 | Brentwood       |
| R57         | Residential Property at Wingrave Crescent                         | 557392 | 192868 | Brentwood       |
| R58         | Residential Property at Nags Head Lane                            | 557152 | 192026 | Brentwood       |
| R59         | Farm / Non-Residential Associated Building at Putwell Bridge Farm | 556645 | 192207 | Brentwood       |
| R60         | Residential Property at Wingrave Crescent                         | 557425 | 192856 | Brentwood       |
| R61         | Residential Property at Wingrave Crescent                         | 557388 | 192873 | Brentwood       |
| R62         | Residential Property at Wingrave Crescent                         | 557409 | 192916 | Brentwood       |
| R63         | Residential Property at Nags Head Lane                            | 557143 | 192020 | Brentwood       |
| R64         | Residential Property at Colchester Road                           | 556047 | 191919 | Haverling       |
| R65         | Residential Property at Nags Head Lane                            | 557184 | 192067 | Brentwood       |
| R66         | Residential Property at Wingrave Crescent                         | 557409 | 192916 | Brentwood       |

| Receptor ID                                                                                                                 | Name                                                              | X      | Y      | Local Authority |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------|--------|-----------------|
| R67                                                                                                                         | Residential Property at Nags Head Lane                            | 557191 | 192091 | Brentwood       |
| R68                                                                                                                         | Residential Property at Wingrave Crescent                         | 557418 | 192761 | Brentwood       |
| R69                                                                                                                         | Residential Property at Brook Street                              | 557021 | 192497 | Brentwood       |
| R70                                                                                                                         | Farm / Non-Residential Associated Building at Putwell Bridge Farm | 556630 | 192228 | Havering        |
| R71                                                                                                                         | Property at Grove Farm                                            | 556627 | 192397 | Havering        |
| R72                                                                                                                         | Property at Grove Farm                                            | 556624 | 192389 | Havering        |
| R73                                                                                                                         | Property at Grove Farm                                            | 556616 | 192417 | Havering        |
| R74                                                                                                                         | Property at Grove Farm                                            | 556611 | 192448 | Havering        |
| R75                                                                                                                         | Boundary of Travelers Site South of A12                           | 556443 | 192148 | Havering        |
| R76                                                                                                                         | Property at Travelers Site South of A12                           | 556430 | 192141 | Havering        |
| R77                                                                                                                         | Property at Travelers Site South of A12                           | 556426 | 192126 | Havering        |
| R78                                                                                                                         | Property at Travelers Site South of A12                           | 556450 | 192120 | Havering        |
| R79*                                                                                                                        | Maylands Golf Club                                                | 556149 | 192515 | Havering        |
| *Selected for comparison with 1-hour mean NO <sub>2</sub> AQS objective, and/or 24-hour mean PM <sub>10</sub> AQS objective |                                                                   |        |        |                 |

## 5.3 Further details on dispersion modelling

- 5.3.1 The dispersion model was set up based on the following key inputs and assumptions:
- Road sources were modelled using the ADMS-Roads source representation tool.
  - Ordnance Survey Master Map topography base mapping was used to define the road geometry.
  - A single centreline was entered in the model for modelled roads with the exception of dual carriageways and motorway links which have a centreline included for both carriageway directions.
  - Road widths assumed a standard single carriageway width of 3.65 m where obtaining distinct widths was not possible from Ordnance Survey Master Map data.
- 5.3.2 Hourly sequential meteorological data for 2015 London City meteorological station was used. The parameters required by the model included: date, time, wind direction (angle wind blowing from), wind speed (at 10 metres above ground level), surface air temperature (degrees Celsius), and cloud cover (oktas – or eighths of sky covered).
- 5.3.3 A latitude of 51.5 degrees was selected. This determines times of sunrise and sunset for each day throughout the year, which in turn affects stability calculations.



- 5.3.4 Surface roughness coefficients have been defined as 0.5 metres (representative of parkland, open suburbia) for the air quality study area and 1.0 for the meteorological site (representative of cities and woodlands). The surface roughness is important in the approximation of turbulent conditions within the atmospheric boundary layer and thus in the estimation of pollutant concentrations at receptors.
- 5.3.5 Minimum Monin-Obukhov length (to reasonably limit the occurrence of very stable atmospheric conditions) has been defined as 10 metres at the meteorological site (representative of small towns) and as 30 at the dispersion site (representative of mixed urban/industrial). This parameter limits the occurrence of very stable boundary layer conditions (i.e. when the air is still) to a degree that is appropriate to the general land-use. In general the potential for very stable conditions is lowest in large urban areas where the 'heat island' effect promoting turbulent motion in the boundary layer is strongest.

## 5.4 Comparison of background concentrations

**Table 5.2: Comparison of measured and mapped background NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) at monitoring sites within 3 km of the Scheme**

| Site name             | Local Authority | Site type* | Grid reference | Measured concentration 2015 | Mapped concentration 2015 | % difference |
|-----------------------|-----------------|------------|----------------|-----------------------------|---------------------------|--------------|
| BRW 1^                | Brentwood       | UB         | 559500,193500  | 24.0                        | 17.9                      | -25%         |
| BRW 16                | Brentwood       | UB         | 557500,192500  | 27.2                        | 18.6                      | -32%         |
| BRW 18                | Brentwood       | R          | 557500,193500  | 23.5                        | 18.0                      | -23%         |
| BRW 32                | Brentwood       | UB         | 556500,192500  | 32.6                        | 24.1                      | -26%         |
| BRW 33                | Brentwood       | UB         | 559500,195500  | 23.5                        | 16.9                      | -28%         |
| BRW 36                | Brentwood       | R          | 556500,194500  | 15.8                        | 13.9                      | -12%         |
| HAV 22, HAV 23, HAV24 | Havering        | UB         | 553500,190500  | 26.6                        | 20.5                      | -23%         |
| HAV25                 | Havering        | UB         | 553500,193500  | 22.9                        | 13.3                      | -42%         |
| HAV35                 | Havering        | UB         | 554500,193500  | 24.2                        | 14.1                      | -42%         |
| HAV 53, HAV           | Havering        | UB         | 553500,192500  | 22.9                        | 14.9                      | -35%         |

| Site name                                         | Local Authority | Site type* | Grid reference | Measured concentration 2015 | Mapped concentration 2015 | % difference |
|---------------------------------------------------|-----------------|------------|----------------|-----------------------------|---------------------------|--------------|
| 54, HAV55                                         |                 |            |                |                             |                           |              |
| M25J28I_025_0116                                  | Havering        | B          | 553500,191500  | 22.5                        | 16.3                      | -27%         |
| Average difference for 11 sites: -30%             |                 |            |                |                             |                           |              |
| *UB = urban background; R = Rural; B = Background |                 |            |                |                             |                           |              |
| ^ Continuous Monitoring Site                      |                 |            |                |                             |                           |              |

## 5.5 Verification

**Table 5.3: Diffusion tube sites excluded from model verification**

| Site ID          | X, Y           | Reason for exclusion from verification                                                                                                                                                                                                                |
|------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BRW 7            | 557118, 191978 | It is likely this tube is screened by vegetation which results in lower than expected concentrations (it is noted as being located on a fence trellis in the LAQM report). In the interest of conservative model results, this tube has been removed. |
| M25J28I_001_0116 | 557030, 192496 | Located at a kerbside location, where a more representative diffusion tube is available in BRW 6                                                                                                                                                      |
| HAV37            | 555723, 191750 | Located on the edge of the air quality model domain and therefore not all sources are represented in this location                                                                                                                                    |
| M25J28I_005_0116 | 556788, 191618 |                                                                                                                                                                                                                                                       |
| M25J28I_013_0116 | 556000, 191900 |                                                                                                                                                                                                                                                       |
| M25J28I_015_0116 | 555801, 191784 |                                                                                                                                                                                                                                                       |
| M25J28I_024_0116 | 557177, 193141 |                                                                                                                                                                                                                                                       |

**Table 5.4: Comparison of unadjusted modelled and measured NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) for study area**

| Site ID          | Modelled NO <sub>2</sub> | Measured NO <sub>2</sub> | Modelled – Measured | Modelled / Measured | % Difference |
|------------------|--------------------------|--------------------------|---------------------|---------------------|--------------|
| BRW 5            | 28.7                     | 42.7                     | -14.0               | 0.67                | -32.8%       |
| BRW 6            | 25.1                     | 38.1                     | -13.0               | 0.66                | -34.1%       |
| BRW 16           | 21.9                     | 27.2                     | -5.3                | 0.81                | -19.5%       |
| BRW 32           | 23.1                     | 32.6                     | -9.5                | 0.71                | -29.1%       |
| M25J28I_002_0116 | 24.9                     | 36.9                     | -12.0               | 0.67                | -32.5%       |
| M25J28I_003_0116 | 21.9                     | 27.9                     | -6.0                | 0.78                | -21.5%       |
| M25J28I_004_0116 | 21.0                     | 28.2                     | -7.2                | 0.74                | -25.5%       |

| Site ID          | Modelled NO <sub>2</sub> | Measured NO <sub>2</sub> | Modelled – Measured | Modelled / Measured | % Difference |
|------------------|--------------------------|--------------------------|---------------------|---------------------|--------------|
| M25J28I_023_0116 | 20.1                     | 29.3                     | -9.2                | 0.69                | -31.4%       |
| CP7              | 30.3                     | 40.8                     | -10.5               | 0.74                | -25.7%       |
| M25J28I_022_0116 | 27.0                     | 45.4                     | -18.4               | 0.59                | -40.5%       |

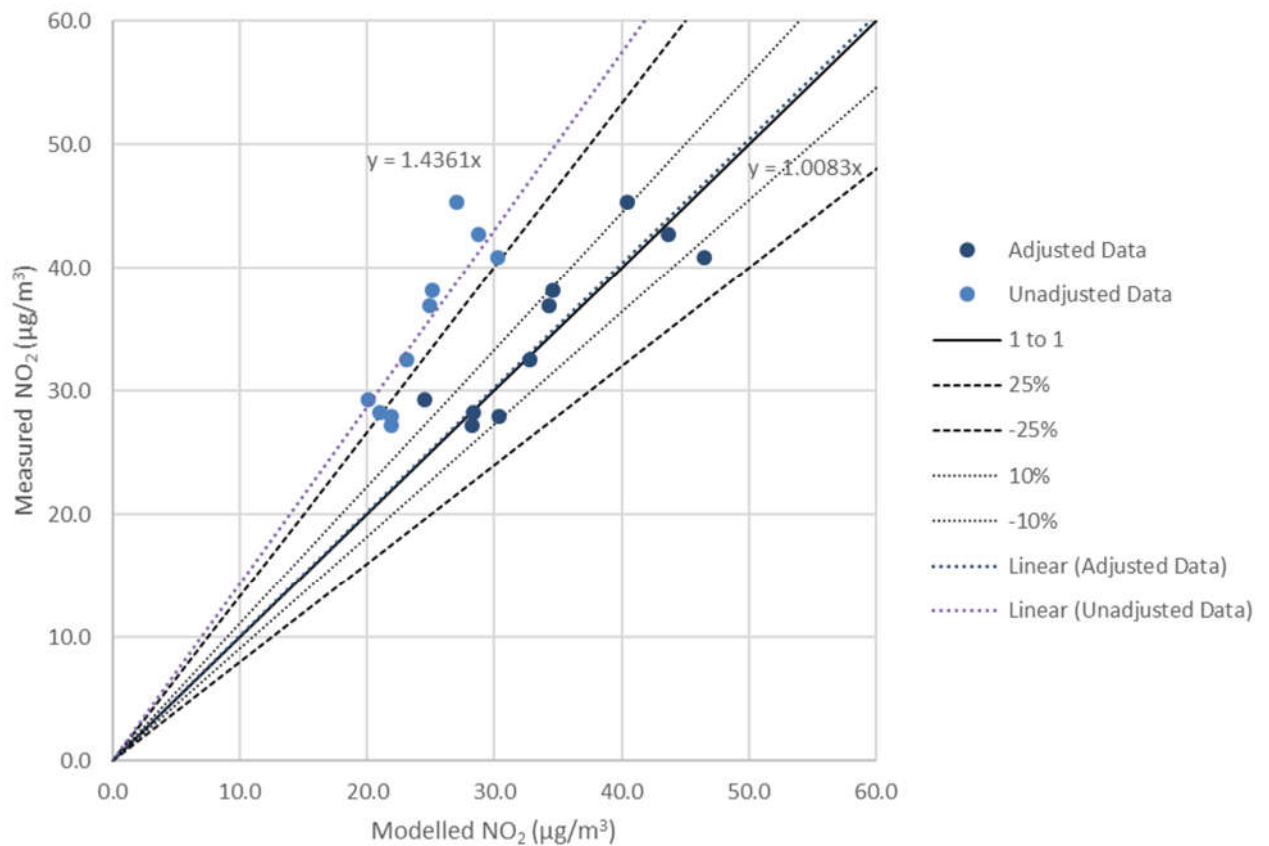
**Table 5.5: Comparison of modelled and measured NO<sub>x</sub> concentrations (µg/m<sup>3</sup>) for study area**

| Site ID          | Modelled Road NO <sub>x</sub> | Measured Road NO <sub>x</sub> | Modelled – Measured | Modelled / Measured | % Difference |
|------------------|-------------------------------|-------------------------------|---------------------|---------------------|--------------|
| BRW 5            | 28.9                          | 60.8                          | -31.9               | 0.48                | -52.5%       |
| BRW 6            | 17.1                          | 45.3                          | -28.2               | 0.38                | -62.3%       |
| BRW 16           | 10.8                          | 21.3                          | -10.5               | 0.51                | -49.3%       |
| BRW 32           | 17.3                          | 37.2                          | -19.9               | 0.47                | -53.5%       |
| M25J28I_002_0116 | 16.7                          | 42.4                          | -25.7               | 0.39                | -60.6%       |
| M25J28I_003_0116 | 14.6                          | 26.9                          | -12.3               | 0.54                | -45.7%       |
| M25J28I_004_0116 | 12.7                          | 27.5                          | -14.8               | 0.46                | -53.8%       |
| M25J28I_023_0116 | 7.2                           | 25.8                          | -18.6               | 0.28                | -72.1%       |
| CP7              | 32.2                          | 56.2                          | -24.0               | 0.57                | -42.7%       |
| M25J28I_022_0116 | 25.3                          | 67.4                          | -42.1               | 0.38                | -62.5%       |

**Table 5.6: RMSE and adjustment factors used in air quality NO<sub>2</sub> verification for study area**

| Number of monitoring sites included in verification | Number of monitoring sites within ±25% of the monitored concentration pre-adjustment | Raw RMSE (pre-adjustment µg/m <sup>3</sup> ) | Model adjustment factor | Adjusted model RMSE | Fractional bias (post adjustment) | Number of monitoring sites within ±25% of the monitored concentration post-adjustment |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------|-------------------------|---------------------|-----------------------------------|---------------------------------------------------------------------------------------|
| 10                                                  | 2                                                                                    | 11.16                                        | 2.18                    | 3.27                | 0.02                              | 10                                                                                    |

**Figure 5.1: Comparison of modelled and measured NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) before and after adjustment for study area**



**Table 5.7: Comparison of adjusted modelled and measured NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) for study area**

| Site ID           | Adjusted modelled total NO <sub>2</sub> | Measured NO <sub>2</sub> | Modelled - Measured | Modelled / Measured | % Difference |
|-------------------|-----------------------------------------|--------------------------|---------------------|---------------------|--------------|
| BRW 5             | 43.7                                    | 42.7                     | 1.0                 | 1.02                | +2.3%        |
| BRW 6             | 34.6                                    | 38.1                     | -3.5                | 0.91                | -9.2%        |
| BRW 16            | 28.2                                    | 27.2                     | 1.0                 | 1.04                | +3.7%        |
| BRW 32            | 32.8                                    | 32.6                     | 0.2                 | 1.01                | +0.6%        |
| M25J28I_002_011 6 | 34.3                                    | 36.9                     | -2.6                | 0.93                | -7.0%        |
| M25J28I_003_011 6 | 30.3                                    | 27.9                     | 2.4                 | 1.09                | +8.6%        |
| M25J28I_004_011 6 | 28.4                                    | 28.2                     | 0.2                 | 1.01                | +0.7%        |
| M25J28I_023_011 6 | 24.5                                    | 29.3                     | -4.8                | 0.84                | -16.4%       |
| CP7               | 46.5                                    | 40.8                     | 5.7                 | 1.14                | +14.0%       |
| M25J28I_022_011 6 | 40.5                                    | 45.4                     | -4.9                | 0.89                | -10.8%       |

## 5.6 Trend analysis

**Table 5.8: Summary of annual mean NO<sub>2</sub> trend analysis**

| Site ID             | Site type* | Monitoring type^ | Local Authority | Within air quality study area? | Number of data points | S value | Sen's slope | Significant (Y/N) |
|---------------------|------------|------------------|-----------------|--------------------------------|-----------------------|---------|-------------|-------------------|
| BRW 16              | UB         | DT               | Brentwood       | Y                              | 7                     | +1      | +0.3        | N                 |
| BRW 32              | UB         | DT               | Brentwood       | Y                              | 7                     | -1      | -0.1        | N                 |
| BRW 5               | Rd         | DT               | Brentwood       | Y                              | 7                     | +1      | 0.0         | N                 |
| BRW 6               | Rd         | DT               | Brentwood       | Y                              | 7                     | -1      | 0.0         | N                 |
| BRW 7               | Rd         | DT               | Brentwood       | Y                              | 7                     | +1      | +0.2        | N                 |
| BRW 18              | UB         | DT               | Brentwood       | N                              | 7                     | -1      | 0.0         | N                 |
| BRW 28              | UB         | DT               | Brentwood       | N                              | 7                     | +5      | +1.4        | N                 |
| BRW 33              | UB         | DT               | Brentwood       | N                              | 7                     | -3      | -0.7        | N                 |
| BRW 36              | R          | DT               | Brentwood       | N                              | 7                     | -1      | 0.0         | N                 |
| HAV2, HAV5, HAV6    | UC         | DT               | Havering        | N                              | 7                     | -9      | -1.5        | N                 |
| HAV1, HAV7, HAV8    | UC         | DT               | Havering        | N                              | 7                     | -7      | -0.6        | N                 |
| HAV3                | UB         | DT               | Havering        | N                              | 7                     | -3      | -0.4        | N                 |
| HAV4                | UB         | DT               | Havering        | N                              | 7                     | -2      | -0.4        | N                 |
| HAV9, HAV10, HAV11  | UC         | DT               | Havering        | N                              | 6                     | -8      | -0.8        | Y+                |
| HAV22, HAV23, HAV24 | UB         | DT               | Havering        | N                              | 6                     | +2      | +1.0        | N                 |
| HAV25               | UB         | DT               | Havering        | N                              | 6                     | 0       | +0.2        | N                 |
| HAV26               | UB         | DT               | Havering        | N                              | 6                     | +4      | +1.2        | N                 |
| HAV30               | UB         | DT               | Havering        | N                              | 6                     | 0       | +0.5        | N                 |
| HAV35               | UB         | DT               | Havering        | N                              | 6                     | +4      | +0.8        | N                 |
| HAV36               | R          | DT               | Havering        | N                              | 6                     | +4      | +1.1        | N                 |
| HAV48               | UB         | DT               | Havering        | N                              | 5                     | 0       | +0.6        | N                 |



| Site ID                                                                                                                                         | Site type* | Monitoring type^ | Local Authority | Within air quality study area? | Number of data points | S value | Sen's slope | Significant (Y/N) |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|-----------------|--------------------------------|-----------------------|---------|-------------|-------------------|
| HAV51                                                                                                                                           | UB         | DT               | Havering        | N                              | 5                     | -2      | -0.3        | N                 |
| HAV53, HAV54, HAV55                                                                                                                             | UB         | DT               | Havering        | N                              | 3                     | +1      | +0.7        | N                 |
| HAV57                                                                                                                                           | UC         | DT               | Havering        | N                              | 5                     | +4      | +1.5        | N                 |
| HAV58, HAV59, HAV60                                                                                                                             | UC         | DT               | Havering        | N                              | 5                     | -2      | -0.8        | N                 |
| BRW1                                                                                                                                            | UB         | CMS              | Brentwood       | N                              | 6                     | -4      | -0.3        | N                 |
| HV1                                                                                                                                             | Rd         | CMS              | Havering        | N                              | 7                     | -1      | -0.1        | N                 |
| HV3                                                                                                                                             | Rd         | CMS              | Havering        | N                              | 7                     | +5      | +0.9        | N                 |
| * UB = Urban background; R = Rural; Rd = Roadside; UC = Urban Centre<br>^ DT = Diffusion Tube; CMS = Continuous Monitoring Station<br>+ p = 0.1 |            |                  |                 |                                |                       |         |             |                   |

## 5.7 Results

### Gap factor calculations

**Table 5.9: Derivation of GAP factor in accordance with Highways England IAN 170/12v3 for human health receptors**

| Receptor ID | Base 2015 NO <sub>2</sub> | Projected base NO <sub>2</sub> | 2022 Long term adjustment factor / 2015 long term adjustment factor (Ratio B) | Projected base NO <sub>2</sub> / base 2015 NO <sub>2</sub> (Ratio A) | Gap factor (Ratio B/ Ratio A) |
|-------------|---------------------------|--------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------|
| R1          | 24.0                      | 16.1                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R2          | 25.9                      | 17.2                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R3          | 27.0                      | 16.7                           | 0.95                                                                          | 0.62                                                                 | 1.53                          |
| R4          | 24.2                      | 16.4                           | 0.95                                                                          | 0.68                                                                 | 1.41                          |
| R5          | 23.3                      | 14.8                           | 0.95                                                                          | 0.64                                                                 | 1.49                          |
| R6          | 30.3                      | 18.1                           | 0.95                                                                          | 0.60                                                                 | 1.59                          |
| R7          | 36.1                      | 20.2                           | 0.95                                                                          | 0.56                                                                 | 1.70                          |
| R8          | 25.0                      | 16.7                           | 0.95                                                                          | 0.67                                                                 | 1.43                          |
| R9          | 23.6                      | 15.9                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R10         | 28.8                      | 17.4                           | 0.95                                                                          | 0.61                                                                 | 1.57                          |
| R11         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R12         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |

| Receptor ID | Base 2015 NO <sub>2</sub> | Projected base NO <sub>2</sub> | 2022 Long term adjustment factor / 2015 long term adjustment factor (Ratio B) | Projected base NO <sub>2</sub> / base 2015 NO <sub>2</sub> (Ratio A) | Gap factor (Ratio B/ Ratio A) |
|-------------|---------------------------|--------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------|
| R13         | 28.1                      | 16.6                           | 0.95                                                                          | 0.59                                                                 | 1.61                          |
| R14         | 23.6                      | 15.9                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R15         | 25.0                      | 16.7                           | 0.95                                                                          | 0.67                                                                 | 1.43                          |
| R16         | 25.8                      | 15.6                           | 0.95                                                                          | 0.61                                                                 | 1.57                          |
| R17         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R18         | 26.6                      | 18.0                           | 0.95                                                                          | 0.68                                                                 | 1.40                          |
| R19         | 24.7                      | 15.4                           | 0.95                                                                          | 0.62                                                                 | 1.52                          |
| R20         | 24.7                      | 16.5                           | 0.95                                                                          | 0.67                                                                 | 1.42                          |
| R21         | 25.5                      | 17.0                           | 0.95                                                                          | 0.66                                                                 | 1.43                          |
| R22         | 23.9                      | 16.1                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R23         | 27.8                      | 17.0                           | 0.95                                                                          | 0.61                                                                 | 1.55                          |
| R24         | 23.1                      | 15.6                           | 0.95                                                                          | 0.68                                                                 | 1.41                          |
| R25         | 24.0                      | 16.2                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R26         | 26.2                      | 16.4                           | 0.95                                                                          | 0.63                                                                 | 1.52                          |
| R27         | 24.1                      | 16.3                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R28         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R29         | 37.9                      | 24.6                           | 0.95                                                                          | 0.65                                                                 | 1.46                          |
| R30         | 24.0                      | 16.2                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R31         | 27.3                      | 18.0                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R32         | 23.0                      | 15.5                           | 0.95                                                                          | 0.68                                                                 | 1.41                          |
| R33         | 22.2                      | 14.4                           | 0.95                                                                          | 0.65                                                                 | 1.47                          |
| R34         | 34.0                      | 19.7                           | 0.95                                                                          | 0.58                                                                 | 1.64                          |
| R35         | 24.0                      | 15.1                           | 0.95                                                                          | 0.63                                                                 | 1.51                          |
| R36         | 22.9                      | 14.7                           | 0.95                                                                          | 0.64                                                                 | 1.49                          |
| R37         | 23.3                      | 15.8                           | 0.95                                                                          | 0.68                                                                 | 1.40                          |
| R38         | 27.3                      | 18.0                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R39         | 24.9                      | 15.9                           | 0.95                                                                          | 0.64                                                                 | 1.49                          |
| R40         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R41         | 26.5                      | 17.5                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R42         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R43         | 31.6                      | 18.2                           | 0.95                                                                          | 0.58                                                                 | 1.65                          |
| R44         | 31.4                      | 18.0                           | 0.95                                                                          | 0.57                                                                 | 1.66                          |

| Receptor ID | Base 2015 NO <sub>2</sub> | Projected base NO <sub>2</sub> | 2022 Long term adjustment factor / 2015 long term adjustment factor (Ratio B) | Projected base NO <sub>2</sub> / base 2015 NO <sub>2</sub> (Ratio A) | Gap factor (Ratio B/ Ratio A) |
|-------------|---------------------------|--------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------|
| R45         | 23.6                      | 15.9                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R46         | 24.8                      | 16.5                           | 0.95                                                                          | 0.67                                                                 | 1.43                          |
| R47*        | 27.3                      | 18.0                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R48         | 25.3                      | 16.8                           | 0.95                                                                          | 0.66                                                                 | 1.43                          |
| R49         | 25.2                      | 16.0                           | 0.95                                                                          | 0.64                                                                 | 1.50                          |
| R50         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R51         | 27.4                      | 18.0                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R52         | 25.7                      | 15.7                           | 0.95                                                                          | 0.61                                                                 | 1.56                          |
| R53         | 24.5                      | 15.2                           | 0.95                                                                          | 0.62                                                                 | 1.54                          |
| R54         | 23.8                      | 16.0                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R55         | 23.9                      | 16.1                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R56         | 24.5                      | 16.4                           | 0.95                                                                          | 0.67                                                                 | 1.42                          |
| R57         | 25.3                      | 16.9                           | 0.95                                                                          | 0.67                                                                 | 1.43                          |
| R58         | 29.1                      | 17.6                           | 0.95                                                                          | 0.60                                                                 | 1.58                          |
| R59         | 24.6                      | 16.0                           | 0.95                                                                          | 0.65                                                                 | 1.46                          |
| R60         | 23.7                      | 15.9                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R61         | 25.8                      | 17.1                           | 0.95                                                                          | 0.66                                                                 | 1.43                          |
| R62         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R63         | 30.1                      | 18.0                           | 0.95                                                                          | 0.60                                                                 | 1.59                          |
| R64         | 26.6                      | 18.1                           | 0.95                                                                          | 0.68                                                                 | 1.40                          |
| R65         | 26.4                      | 16.5                           | 0.95                                                                          | 0.63                                                                 | 1.52                          |
| R66         | 26.8                      | 17.7                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R67         | 25.6                      | 16.2                           | 0.95                                                                          | 0.63                                                                 | 1.51                          |
| R68         | 24.5                      | 16.5                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R69         | 36.2                      | 23.5                           | 0.95                                                                          | 0.65                                                                 | 1.47                          |
| R70         | 28.2                      | 18.4                           | 0.95                                                                          | 0.65                                                                 | 1.46                          |
| R71         | 30.0                      | 18.4                           | 0.95                                                                          | 0.61                                                                 | 1.55                          |
| R72         | 29.2                      | 18.0                           | 0.95                                                                          | 0.62                                                                 | 1.54                          |
| R73         | 29.4                      | 17.9                           | 0.95                                                                          | 0.61                                                                 | 1.56                          |
| R74         | 31.2                      | 18.6                           | 0.95                                                                          | 0.60                                                                 | 1.60                          |
| R75         | 31.9                      | 21.1                           | 0.95                                                                          | 0.66                                                                 | 1.44                          |
| R76         | 31.0                      | 20.6                           | 0.95                                                                          | 0.66                                                                 | 1.43                          |

| Receptor ID                                                                                                                 | Base 2015 NO <sub>2</sub> | Projected base NO <sub>2</sub> | 2022 Long term adjustment factor / 2015 long term adjustment factor (Ratio B) | Projected base NO <sub>2</sub> / base 2015 NO <sub>2</sub> (Ratio A) | Gap factor (Ratio B/ Ratio A) |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------|
| R77                                                                                                                         | 26.1                      | 17.5                           | 0.95                                                                          | 0.67                                                                 | 1.42                          |
| R78                                                                                                                         | 23.1                      | 15.6                           | 0.95                                                                          | 0.67                                                                 | 1.41                          |
| R79*                                                                                                                        | 17.3                      | 12.0                           | 0.95                                                                          | 0.69                                                                 | 1.37                          |
| *Selected for comparison with 1-hour mean NO <sub>2</sub> AQS objective, and/or 24-hour mean PM <sub>10</sub> AQS objective |                           |                                |                                                                               |                                                                      |                               |

**Table 5.10: Estimated annual mean NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) for human health receptors, Highways England IAN 170/12v3 method**

| Receptor ID | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R1          | 16.3                            | 24.0                      | 11.9                            | 23.6                    | 23.7                    | +0.1                        | Imperceptible                        |
| R2          | 16.3                            | 25.9                      | 11.9                            | 25.5                    | 25.6                    | +0.1                        | Imperceptible                        |
| R3          | 16.3                            | 27.0                      | 11.9                            | 26.9                    | 26.9                    | <0.1                        | Imperceptible                        |
| R4          | 16.3                            | 24.2                      | 11.9                            | 24.1                    | 24.1                    | <0.1                        | Imperceptible                        |
| R5          | 15.2                            | 23.3                      | 11.3                            | 23.0                    | 23.0                    | <0.1                        | Imperceptible                        |
| R6          | 14.1                            | 30.3                      | 10.6                            | 30.3                    | 31.0                    | +0.7                        | Small increase                       |
| R7          | 14.3                            | 36.1                      | 10.7                            | 36.8                    | 36.9                    | +0.1                        | Imperceptible                        |
| R8          | 16.3                            | 25.0                      | 11.9                            | 24.7                    | 24.8                    | +0.1                        | Imperceptible                        |
| R9          | 16.3                            | 23.6                      | 11.9                            | 23.2                    | 23.3                    | +0.1                        | Imperceptible                        |
| R10         | 16.3                            | 28.8                      | 11.9                            | 28.8                    | 28.8                    | <0.1                        | Imperceptible                        |
| R11         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R12         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R13         | 14.3                            | 28.1                      | 10.7                            | 28.1                    | 28.1                    | <0.1                        | Imperceptible                        |
| R14         | 16.3                            | 23.6                      | 11.9                            | 23.2                    | 23.2                    | <0.1                        | Imperceptible                        |
| R15         | 16.3                            | 25.0                      | 11.9                            | 24.7                    | 24.7                    | <0.1                        | Imperceptible                        |
| R16         | 14.3                            | 25.8                      | 10.7                            | 25.7                    | 25.7                    | <0.1                        | Imperceptible                        |
| R17         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R18         | 15.2                            | 26.6                      | 11.3                            | 26.5                    | 26.6                    | +0.1                        | Imperceptible                        |
| R19         | 15.2                            | 24.7                      | 11.3                            | 24.4                    | 24.4                    | <0.1                        | Imperceptible                        |
| R20         | 16.3                            | 24.7                      | 11.9                            | 24.4                    | 24.4                    | <0.1                        | Imperceptible                        |
| R21         | 16.3                            | 25.5                      | 11.9                            | 25.2                    | 25.2                    | <0.1                        | Imperceptible                        |
| R22         | 16.3                            | 23.9                      | 11.9                            | 23.6                    | 23.7                    | +0.1                        | Imperceptible                        |
| R23         | 16.3                            | 27.8                      | 11.9                            | 27.8                    | 27.8                    | <0.1                        | Imperceptible                        |

| Receptor ID | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R24         | 16.3                            | 23.1                      | 11.9                            | 22.7                    | 22.7                    | <0.1                        | Imperceptible                        |
| R25         | 16.3                            | 24.0                      | 11.9                            | 23.7                    | 23.8                    | +0.1                        | Imperceptible                        |
| R26         | 16.3                            | 26.2                      | 11.9                            | 26.0                    | 26.0                    | <0.1                        | Imperceptible                        |
| R27         | 16.3                            | 24.1                      | 11.9                            | 23.9                    | 24.0                    | +0.1                        | Imperceptible                        |
| R28         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R29         | 16.3                            | 37.9                      | 11.9                            | 38.7                    | 38.9                    | +0.2                        | Imperceptible                        |
| R30         | 16.3                            | 24.0                      | 11.9                            | 23.8                    | 23.8                    | <0.1                        | Imperceptible                        |
| R31         | 16.3                            | 27.3                      | 11.9                            | 27.1                    | 27.1                    | <0.1                        | Imperceptible                        |
| R32         | 16.3                            | 23.0                      | 11.9                            | 22.6                    | 22.6                    | <0.1                        | Imperceptible                        |
| R33         | 15.2                            | 22.2                      | 11.3                            | 21.8                    | 21.9                    | +0.1                        | Imperceptible                        |
| R34         | 14.1                            | 34.0                      | 10.6                            | 34.6                    | 34.8                    | +0.2                        | Imperceptible                        |
| R35         | 15.2                            | 24.0                      | 11.3                            | 23.7                    | 23.7                    | <0.1                        | Imperceptible                        |
| R36         | 15.2                            | 22.9                      | 11.3                            | 22.6                    | 22.6                    | <0.1                        | Imperceptible                        |
| R37         | 16.3                            | 23.3                      | 11.9                            | 23.0                    | 23.1                    | +0.1                        | Imperceptible                        |
| R38         | 16.3                            | 27.3                      | 11.9                            | 27.0                    | 27.1                    | +0.1                        | Imperceptible                        |
| R39         | 16.3                            | 24.9                      | 11.9                            | 24.7                    | 24.7                    | <0.1                        | Imperceptible                        |
| R40         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R41         | 16.3                            | 26.5                      | 11.9                            | 26.2                    | 26.3                    | +0.1                        | Imperceptible                        |
| R42         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R43         | 14.3                            | 31.6                      | 10.7                            | 32.0                    | 32.0                    | <0.1                        | Imperceptible                        |
| R44         | 14.3                            | 31.4                      | 10.7                            | 31.6                    | 31.6                    | <0.1                        | Imperceptible                        |
| R45         | 16.3                            | 23.6                      | 11.9                            | 23.3                    | 23.3                    | <0.1                        | Imperceptible                        |
| R46         | 16.3                            | 24.8                      | 11.9                            | 24.4                    | 24.4                    | <0.1                        | Imperceptible                        |
| R47*        | 16.3                            | 27.3                      | 11.9                            | 27.2                    | 27.3                    | N/A                         | N/A                                  |
| R48         | 16.3                            | 25.3                      | 11.9                            | 24.9                    | 25.0                    | +0.1                        | Imperceptible                        |
| R49         | 16.3                            | 25.2                      | 11.9                            | 25.0                    | 25.0                    | <0.1                        | Imperceptible                        |
| R50         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R51         | 16.3                            | 27.4                      | 11.9                            | 27.1                    | 27.2                    | +0.1                        | Imperceptible                        |
| R52         | 14.3                            | 25.7                      | 10.7                            | 25.6                    | 25.6                    | <0.1                        | Imperceptible                        |
| R53         | 14.3                            | 24.5                      | 10.7                            | 24.4                    | 24.4                    | <0.1                        | Imperceptible                        |
| R54         | 16.3                            | 23.8                      | 11.9                            | 23.5                    | 23.5                    | <0.1                        | Imperceptible                        |
| R55         | 16.3                            | 23.9                      | 11.9                            | 23.7                    | 23.7                    | <0.1                        | Imperceptible                        |
| R56         | 16.3                            | 24.5                      | 11.9                            | 24.1                    | 24.1                    | <0.1                        | Imperceptible                        |

| Receptor ID                                                                                                                 | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R57                                                                                                                         | 16.3                            | 25.3                      | 11.9                            | 25.0                    | 25.1                    | +0.1                        | Imperceptible                        |
| R58                                                                                                                         | 16.3                            | 29.1                      | 11.9                            | 29.1                    | 29.1                    | <0.1                        | Imperceptible                        |
| R59                                                                                                                         | 14.1                            | 24.6                      | 10.6                            | 24.6                    | 24.3                    | -0.3                        | Imperceptible                        |
| R60                                                                                                                         | 16.3                            | 23.7                      | 11.9                            | 23.3                    | 23.4                    | +0.1                        | Imperceptible                        |
| R61                                                                                                                         | 16.3                            | 25.8                      | 11.9                            | 25.5                    | 25.5                    | <0.1                        | Imperceptible                        |
| R62                                                                                                                         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R63                                                                                                                         | 16.3                            | 30.1                      | 11.9                            | 30.2                    | 30.2                    | <0.1                        | Imperceptible                        |
| R64                                                                                                                         | 15.2                            | 26.6                      | 11.3                            | 26.5                    | 26.7                    | +0.2                        | Imperceptible                        |
| R65                                                                                                                         | 16.3                            | 26.4                      | 11.9                            | 26.3                    | 26.3                    | <0.1                        | Imperceptible                        |
| R66                                                                                                                         | 16.3                            | 26.8                      | 11.9                            | 26.5                    | 26.5                    | <0.1                        | Imperceptible                        |
| R67                                                                                                                         | 16.3                            | 25.6                      | 11.9                            | 25.4                    | 25.4                    | <0.1                        | Imperceptible                        |
| R68                                                                                                                         | 16.3                            | 24.5                      | 11.9                            | 24.4                    | 24.4                    | <0.1                        | Imperceptible                        |
| R69                                                                                                                         | 16.3                            | 36.2                      | 11.9                            | 36.9                    | 37.1                    | +0.2                        | Imperceptible                        |
| R70                                                                                                                         | 14.1                            | 28.2                      | 10.6                            | 28.5                    | 28.1                    | -0.4                        | Imperceptible                        |
| R71                                                                                                                         | 14.1                            | 30.0                      | 10.6                            | 30.2                    | 30.9                    | +0.7                        | Small increase                       |
| R72                                                                                                                         | 14.1                            | 29.2                      | 10.6                            | 29.3                    | 30.3                    | +1.0                        | Small increase                       |
| R73                                                                                                                         | 14.1                            | 29.4                      | 10.6                            | 29.5                    | 30.0                    | +0.5                        | Small increase                       |
| R74                                                                                                                         | 14.1                            | 31.2                      | 10.6                            | 31.3                    | 32.0                    | +0.7                        | Small increase                       |
| R75                                                                                                                         | 14.1                            | 31.9                      | 10.6                            | 32.4                    | 30.6                    | -1.8                        | Small decrease                       |
| R76                                                                                                                         | 14.1                            | 31.0                      | 10.6                            | 31.4                    | 29.9                    | -1.5                        | Small decrease                       |
| R77                                                                                                                         | 14.1                            | 26.1                      | 10.6                            | 26.2                    | 25.3                    | -0.9                        | Small decrease                       |
| R78                                                                                                                         | 14.1                            | 23.1                      | 10.6                            | 22.9                    | 22.4                    | -0.5                        | Small decrease                       |
| R79*                                                                                                                        | 14.1                            | 17.3                      | 10.6                            | 16.7                    | 17.5                    | N/A                         | N/A                                  |
| *Selected for comparison with 1-hour mean NO <sub>2</sub> AQS objective, and/or 24-hour mean PM <sub>10</sub> AQS objective |                                 |                           |                                 |                         |                         |                             |                                      |



**Table 5.11: Estimated annual mean NO<sub>2</sub> concentrations (µg/m<sup>3</sup>) for human health receptors, Defra TG16 method**

| Receptor ID | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R1          | 11.9                            | 24.0                      | 11.9                            | 16.7                    | 16.8                    | +0.1                        | Imperceptible                        |
| R2          | 11.9                            | 25.9                      | 11.9                            | 17.8                    | 17.8                    | <0.1                        | Imperceptible                        |
| R3          | 11.9                            | 27.0                      | 11.9                            | 17.5                    | 17.5                    | <0.1                        | Imperceptible                        |
| R4          | 11.9                            | 24.2                      | 11.9                            | 17.1                    | 17.1                    | <0.1                        | Imperceptible                        |
| R5          | 11.3                            | 23.3                      | 11.3                            | 15.4                    | 15.4                    | <0.1                        | Imperceptible                        |
| R6          | 10.6                            | 30.3                      | 10.6                            | 19.1                    | 19.5                    | +0.4                        | Imperceptible                        |
| R7          | 10.7                            | 36.1                      | 10.7                            | 21.7                    | 21.8                    | +0.1                        | Imperceptible                        |
| R8          | 11.9                            | 25.0                      | 11.9                            | 17.3                    | 17.4                    | +0.1                        | Imperceptible                        |
| R9          | 11.9                            | 23.6                      | 11.9                            | 16.4                    | 16.5                    | +0.1                        | Imperceptible                        |
| R10         | 11.9                            | 28.8                      | 11.9                            | 18.3                    | 18.3                    | <0.1                        | Imperceptible                        |
| R11         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R12         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R13         | 10.7                            | 28.1                      | 10.7                            | 17.5                    | 17.5                    | <0.1                        | Imperceptible                        |
| R14         | 11.9                            | 23.6                      | 11.9                            | 16.4                    | 16.4                    | <0.1                        | Imperceptible                        |
| R15         | 11.9                            | 25.0                      | 11.9                            | 17.3                    | 17.3                    | <0.1                        | Imperceptible                        |
| R16         | 10.7                            | 25.8                      | 10.7                            | 16.4                    | 16.4                    | <0.1                        | Imperceptible                        |
| R17         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R18         | 11.3                            | 26.6                      | 11.3                            | 18.9                    | 19.0                    | +0.1                        | Imperceptible                        |
| R19         | 11.3                            | 24.7                      | 11.3                            | 16.0                    | 16.0                    | <0.1                        | Imperceptible                        |
| R20         | 11.9                            | 24.7                      | 11.9                            | 17.1                    | 17.2                    | +0.1                        | Imperceptible                        |
| R21         | 11.9                            | 25.5                      | 11.9                            | 17.6                    | 17.6                    | <0.1                        | Imperceptible                        |
| R22         | 11.9                            | 23.9                      | 11.9                            | 16.8                    | 16.8                    | <0.1                        | Imperceptible                        |
| R23         | 11.9                            | 27.8                      | 11.9                            | 17.9                    | 17.9                    | <0.1                        | Imperceptible                        |
| R24         | 11.9                            | 23.1                      | 11.9                            | 16.1                    | 16.1                    | <0.1                        | Imperceptible                        |
| R25         | 11.9                            | 24.0                      | 11.9                            | 16.8                    | 16.9                    | +0.1                        | Imperceptible                        |
| R26         | 11.9                            | 26.2                      | 11.9                            | 17.1                    | 17.2                    | +0.1                        | Imperceptible                        |
| R27         | 11.9                            | 24.1                      | 11.9                            | 17.0                    | 17.0                    | <0.1                        | Imperceptible                        |
| R28         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R29         | 11.9                            | 37.9                      | 11.9                            | 26.5                    | 26.6                    | +0.1                        | Imperceptible                        |
| R30         | 11.9                            | 24.0                      | 11.9                            | 16.9                    | 16.9                    | <0.1                        | Imperceptible                        |
| R31         | 11.9                            | 27.3                      | 11.9                            | 18.7                    | 18.8                    | +0.1                        | Imperceptible                        |
| R32         | 11.9                            | 23.0                      | 11.9                            | 16.1                    | 16.1                    | <0.1                        | Imperceptible                        |

| Receptor ID | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R33         | 11.3                            | 22.2                      | 11.3                            | 14.9                    | 14.9                    | <0.1                        | Imperceptible                        |
| R34         | 10.6                            | 34.0                      | 10.6                            | 21.1                    | 21.2                    | +0.1                        | Imperceptible                        |
| R35         | 11.3                            | 24.0                      | 11.3                            | 15.7                    | 15.7                    | <0.1                        | Imperceptible                        |
| R36         | 11.3                            | 22.9                      | 11.3                            | 15.2                    | 15.2                    | <0.1                        | Imperceptible                        |
| R37         | 11.9                            | 23.3                      | 11.9                            | 16.4                    | 16.4                    | <0.1                        | Imperceptible                        |
| R38         | 11.9                            | 27.3                      | 11.9                            | 18.7                    | 18.8                    | +0.1                        | Imperceptible                        |
| R39         | 11.9                            | 24.9                      | 11.9                            | 16.6                    | 16.6                    | <0.1                        | Imperceptible                        |
| R40         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R41         | 11.9                            | 26.5                      | 11.9                            | 18.3                    | 18.3                    | <0.1                        | Imperceptible                        |
| R42         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R43         | 10.7                            | 31.6                      | 10.7                            | 19.4                    | 19.5                    | +0.1                        | Imperceptible                        |
| R44         | 10.7                            | 31.4                      | 10.7                            | 19.1                    | 19.1                    | <0.1                        | Imperceptible                        |
| R45         | 11.9                            | 23.6                      | 11.9                            | 16.5                    | 16.5                    | <0.1                        | Imperceptible                        |
| R46         | 11.9                            | 24.8                      | 11.9                            | 17.1                    | 17.1                    | <0.1                        | Imperceptible                        |
| R47*        | 11.9                            | 27.3                      | 11.9                            | 18.9                    | 19.0                    | N/A                         | N/A                                  |
| R48         | 11.9                            | 25.3                      | 11.9                            | 17.4                    | 17.5                    | +0.1                        | Imperceptible                        |
| R49         | 11.9                            | 25.2                      | 11.9                            | 16.7                    | 16.7                    | <0.1                        | Imperceptible                        |
| R50         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R51         | 11.9                            | 27.4                      | 11.9                            | 18.8                    | 18.8                    | <0.1                        | Imperceptible                        |
| R52         | 10.7                            | 25.7                      | 10.7                            | 16.4                    | 16.4                    | <0.1                        | Imperceptible                        |
| R53         | 10.7                            | 24.5                      | 10.7                            | 15.9                    | 15.9                    | <0.1                        | Imperceptible                        |
| R54         | 11.9                            | 23.8                      | 11.9                            | 16.6                    | 16.6                    | <0.1                        | Imperceptible                        |
| R55         | 11.9                            | 23.9                      | 11.9                            | 16.8                    | 16.8                    | <0.1                        | Imperceptible                        |
| R56         | 11.9                            | 24.5                      | 11.9                            | 16.9                    | 17.0                    | +0.1                        | Imperceptible                        |
| R57         | 11.9                            | 25.3                      | 11.9                            | 17.5                    | 17.6                    | +0.1                        | Imperceptible                        |
| R58         | 11.9                            | 29.1                      | 11.9                            | 18.5                    | 18.5                    | <0.1                        | Imperceptible                        |
| R59         | 10.6                            | 24.6                      | 10.6                            | 16.9                    | 16.7                    | -0.2                        | Imperceptible                        |
| R60         | 11.9                            | 23.7                      | 11.9                            | 16.5                    | 16.5                    | <0.1                        | Imperceptible                        |
| R61         | 11.9                            | 25.8                      | 11.9                            | 17.8                    | 17.8                    | <0.1                        | Imperceptible                        |
| R62         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R63         | 11.9                            | 30.1                      | 11.9                            | 19.0                    | 19.0                    | <0.1                        | Imperceptible                        |
| R64         | 11.3                            | 26.6                      | 11.3                            | 19.0                    | 19.1                    | +0.1                        | Imperceptible                        |
| R65         | 11.9                            | 26.4                      | 11.9                            | 17.3                    | 17.3                    | <0.1                        | Imperceptible                        |

| Receptor ID | Background 2015 NO <sub>2</sub> | 2015 base NO <sub>2</sub> | Background 2022 NO <sub>2</sub> | 2022 DM NO <sub>2</sub> | 2022 DS NO <sub>2</sub> | 2022 NO <sub>2</sub> change | 2022 NO <sub>2</sub> change criteria |
|-------------|---------------------------------|---------------------------|---------------------------------|-------------------------|-------------------------|-----------------------------|--------------------------------------|
| R66         | 11.9                            | 26.8                      | 11.9                            | 18.4                    | 18.4                    | <0.1                        | Imperceptible                        |
| R67         | 11.9                            | 25.6                      | 11.9                            | 16.9                    | 16.9                    | <0.1                        | Imperceptible                        |
| R68         | 11.9                            | 24.5                      | 11.9                            | 17.3                    | 17.4                    | +0.1                        | Imperceptible                        |
| R69         | 11.9                            | 36.2                      | 11.9                            | 25.2                    | 25.3                    | +0.1                        | Imperceptible                        |
| R70         | 10.6                            | 28.2                      | 10.6                            | 19.5                    | 19.2                    | -0.3                        | Imperceptible                        |
| R71         | 10.6                            | 30.0                      | 10.6                            | 19.5                    | 20.0                    | +0.5                        | Small increase                       |
| R72         | 10.6                            | 29.2                      | 10.6                            | 19.1                    | 19.7                    | +0.6                        | Small increase                       |
| R73         | 10.6                            | 29.4                      | 10.6                            | 18.9                    | 19.3                    | +0.4                        | Small increase                       |
| R74         | 10.6                            | 31.2                      | 10.6                            | 19.6                    | 20.1                    | +0.5                        | Small increase                       |
| R75         | 10.6                            | 31.9                      | 10.6                            | 22.6                    | 21.3                    | -1.3                        | Small decrease                       |
| R76         | 10.6                            | 31.0                      | 10.6                            | 21.9                    | 20.9                    | -1.0                        | Small decrease                       |
| R77         | 10.6                            | 26.1                      | 10.6                            | 18.4                    | 17.8                    | -0.6                        | Small decrease                       |
| R78         | 10.6                            | 23.1                      | 10.6                            | 16.3                    | 15.9                    | -0.4                        | Imperceptible                        |
| R79*        | 10.6                            | 17.3                      | 10.6                            | 12.2                    | 12.8                    | N/A                         | N/A                                  |

\*Selected for comparison with 1-hour mean NO<sub>2</sub> AQS objective, and/or 24-hour mean PM<sub>10</sub> AQS objective

**Table 5.12: Estimated annual mean PM<sub>10</sub> concentrations (µg/m<sup>3</sup>) for human health receptors**

| Receptor ID | Background 2015 PM <sub>10</sub> | 2015 base PM <sub>10</sub> | Background 2022 PM <sub>10</sub> | 2022 DM PM <sub>10</sub> | 2022 DS PM <sub>10</sub> | 2022 PM <sub>10</sub> change | 2022 PM <sub>10</sub> change criteria |
|-------------|----------------------------------|----------------------------|----------------------------------|--------------------------|--------------------------|------------------------------|---------------------------------------|
| R1          | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R2          | 16.8                             | 18.3                       | 16.1                             | 17.5                     | 17.5                     | <0.1                         | Imperceptible                         |
| R3          | 16.8                             | 18.1                       | 16.1                             | 17.2                     | 17.2                     | <0.1                         | Imperceptible                         |
| R4          | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R5          | 14.9                             | 15.9                       | 14.2                             | 15.0                     | 15.0                     | <0.1                         | Imperceptible                         |
| R6          | 16.9                             | 18.9                       | 16.3                             | 17.9                     | 18.0                     | +0.1                         | Imperceptible                         |
| R7          | 17.2                             | 19.8                       | 16.6                             | 18.8                     | 18.8                     | <0.1                         | Imperceptible                         |
| R8          | 16.8                             | 18.1                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R9          | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |

| Receptor ID | Background 2015 PM <sub>10</sub> | 2015 base PM <sub>10</sub> | Background 2022 PM <sub>10</sub> | 2022 DM PM <sub>10</sub> | 2022 DS PM <sub>10</sub> | 2022 PM <sub>10</sub> change | 2022 PM <sub>10</sub> change criteria |
|-------------|----------------------------------|----------------------------|----------------------------------|--------------------------|--------------------------|------------------------------|---------------------------------------|
| R10         | 16.8                             | 18.3                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R11         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R12         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R13         | 17.2                             | 18.8                       | 16.6                             | 17.9                     | 17.9                     | <0.1                         | Imperceptible                         |
| R14         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R15         | 16.8                             | 18.1                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R16         | 17.2                             | 18.5                       | 16.6                             | 17.7                     | 17.7                     | <0.1                         | Imperceptible                         |
| R17         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R18         | 14.9                             | 16.9                       | 14.2                             | 16.1                     | 16.2                     | +0.1                         | Imperceptible                         |
| R19         | 14.9                             | 16.0                       | 14.2                             | 15.2                     | 15.2                     | <0.1                         | Imperceptible                         |
| R20         | 16.8                             | 18.0                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R21         | 16.8                             | 18.2                       | 16.1                             | 17.4                     | 17.4                     | <0.1                         | Imperceptible                         |
| R22         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R23         | 16.8                             | 18.2                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R24         | 16.8                             | 17.8                       | 16.1                             | 17.0                     | 17.0                     | <0.1                         | Imperceptible                         |
| R25         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R26         | 16.8                             | 18.0                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R27         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R28         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R29         | 16.8                             | 20.0                       | 16.1                             | 19.0                     | 19.0                     | <0.1                         | Imperceptible                         |
| R30         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R31         | 16.8                             | 18.5                       | 16.1                             | 17.7                     | 17.7                     | <0.1                         | Imperceptible                         |
| R32         | 16.8                             | 17.7                       | 16.1                             | 17.0                     | 17.0                     | <0.1                         | Imperceptible                         |
| R33         | 14.9                             | 15.7                       | 14.2                             | 14.9                     | 14.9                     | <0.1                         | Imperceptible                         |
| R34         | 16.9                             | 19.4                       | 16.3                             | 18.3                     | 18.3                     | <0.1                         | Imperceptible                         |
| R35         | 14.9                             | 15.9                       | 14.2                             | 15.1                     | 15.1                     | <0.1                         | Imperceptible                         |
| R36         | 14.9                             | 15.8                       | 14.2                             | 15.0                     | 15.0                     | <0.1                         | Imperceptible                         |
| R37         | 16.8                             | 17.8                       | 16.1                             | 17.0                     | 17.0                     | <0.1                         | Imperceptible                         |
| R38         | 16.8                             | 18.5                       | 16.1                             | 17.7                     | 17.7                     | <0.1                         | Imperceptible                         |
| R39         | 16.8                             | 17.8                       | 16.1                             | 17.0                     | 17.0                     | <0.1                         | Imperceptible                         |
| R40         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R41         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R42         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |

| Receptor ID | Background 2015 PM <sub>10</sub> | 2015 base PM <sub>10</sub> | Background 2022 PM <sub>10</sub> | 2022 DM PM <sub>10</sub> | 2022 DS PM <sub>10</sub> | 2022 PM <sub>10</sub> change | 2022 PM <sub>10</sub> change criteria |
|-------------|----------------------------------|----------------------------|----------------------------------|--------------------------|--------------------------|------------------------------|---------------------------------------|
| R43         | 17.2                             | 19.3                       | 16.6                             | 18.3                     | 18.3                     | <0.1                         | Imperceptible                         |
| R44         | 17.2                             | 19.2                       | 16.6                             | 18.3                     | 18.3                     | <0.1                         | Imperceptible                         |
| R45         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R46         | 16.8                             | 18.1                       | 16.1                             | 17.3                     | 17.3                     | <0.1                         | Imperceptible                         |
| R47*        | 16.8                             | 18.3                       | 16.1                             | 17.5                     | 17.5                     | N/A                          | N/A                                   |
| R48         | 16.8                             | 18.2                       | 16.1                             | 17.4                     | 17.4                     | <0.1                         | Imperceptible                         |
| R49         | 16.8                             | 17.9                       | 16.1                             | 17.0                     | 17.0                     | <0.1                         | Imperceptible                         |
| R50         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R51         | 16.8                             | 18.5                       | 16.1                             | 17.7                     | 17.7                     | <0.1                         | Imperceptible                         |
| R52         | 17.2                             | 18.6                       | 16.6                             | 17.7                     | 17.7                     | <0.1                         | Imperceptible                         |
| R53         | 17.2                             | 18.4                       | 16.6                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R54         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R55         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R56         | 16.8                             | 18.0                       | 16.1                             | 17.2                     | 17.2                     | <0.1                         | Imperceptible                         |
| R57         | 16.8                             | 18.2                       | 16.1                             | 17.4                     | 17.4                     | <0.1                         | Imperceptible                         |
| R58         | 16.8                             | 18.3                       | 16.1                             | 17.4                     | 17.4                     | <0.1                         | Imperceptible                         |
| R59         | 16.9                             | 18.4                       | 16.3                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R60         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R61         | 16.8                             | 18.2                       | 16.1                             | 17.4                     | 17.4                     | <0.1                         | Imperceptible                         |
| R62         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R63         | 16.8                             | 18.4                       | 16.1                             | 17.5                     | 17.5                     | <0.1                         | Imperceptible                         |
| R64         | 14.9                             | 16.9                       | 14.2                             | 16.1                     | 16.2                     | +0.1                         | Imperceptible                         |
| R65         | 16.8                             | 18.0                       | 16.1                             | 17.2                     | 17.2                     | <0.1                         | Imperceptible                         |
| R66         | 16.8                             | 18.4                       | 16.1                             | 17.6                     | 17.6                     | <0.1                         | Imperceptible                         |
| R67         | 16.8                             | 17.9                       | 16.1                             | 17.1                     | 17.1                     | <0.1                         | Imperceptible                         |
| R68         | 16.8                             | 18.0                       | 16.1                             | 17.2                     | 17.2                     | <0.1                         | Imperceptible                         |
| R69         | 16.8                             | 19.7                       | 16.1                             | 18.7                     | 18.7                     | <0.1                         | Imperceptible                         |
| R70         | 16.9                             | 19.0                       | 16.3                             | 18.2                     | 18.2                     | <0.1                         | Imperceptible                         |
| R71         | 16.9                             | 18.9                       | 16.3                             | 18.0                     | 18.2                     | +0.2                         | Imperceptible                         |
| R72         | 16.9                             | 18.8                       | 16.3                             | 17.9                     | 18.1                     | +0.2                         | Imperceptible                         |
| R73         | 16.9                             | 18.8                       | 16.3                             | 17.9                     | 18.0                     | +0.1                         | Imperceptible                         |
| R74         | 16.9                             | 19.0                       | 16.3                             | 18.0                     | 18.1                     | +0.1                         | Imperceptible                         |
| R75         | 16.9                             | 19.9                       | 16.3                             | 19.2                     | 18.9                     | -0.3                         | Imperceptible                         |

| Receptor ID                                                                                                                 | Background 2015 PM <sub>10</sub> | 2015 base PM <sub>10</sub> | Background 2022 PM <sub>10</sub> | 2022 DM PM <sub>10</sub> | 2022 DS PM <sub>10</sub> | 2022 PM <sub>10</sub> change | 2022 PM <sub>10</sub> change criteria |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------|----------------------------------|--------------------------|--------------------------|------------------------------|---------------------------------------|
| R76                                                                                                                         | 16.9                             | 19.8                       | 16.3                             | 19.0                     | 18.8                     | -0.2                         | Imperceptible                         |
| R77                                                                                                                         | 16.9                             | 18.9                       | 16.3                             | 18.1                     | 18.0                     | -0.1                         | Imperceptible                         |
| R78                                                                                                                         | 16.9                             | 18.3                       | 16.3                             | 17.6                     | 17.5                     | -0.1                         | Imperceptible                         |
| R79*                                                                                                                        | 16.9                             | 17.3                       | 16.3                             | 16.6                     | 16.7                     | N/A                          | N/A                                   |
| *Selected for comparison with 1-hour mean NO <sub>2</sub> AQS objective, and/or 24-hour mean PM <sub>10</sub> AQS objective |                                  |                            |                                  |                          |                          |                              |                                       |

**Table 5.13: Estimated number of 24hr mean PM<sub>10</sub> exceedances for human health receptors**

| Receptor ID | Number of 24hr mean PM <sub>10</sub> exceedances 2015 | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DM | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DS | 2022 number of exceedances PM <sub>10</sub> change |
|-------------|-------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|
| R1          | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R2          | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R3          | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R4          | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R5          | 0                                                     | 0                                                        | 0                                                        | <1                                                 |
| R6          | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R7          | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R8          | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R9          | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R10         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R11         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R12         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R13         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R14         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R15         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R16         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R17         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R18         | 1                                                     | 0                                                        | 0                                                        | <1                                                 |
| R19         | 0                                                     | 0                                                        | 0                                                        | <1                                                 |
| R20         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R21         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |



| Receptor ID | Number of 24hr mean PM <sub>10</sub> exceedances 2015 | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DM | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DS | 2022 number of exceedances PM <sub>10</sub> change |
|-------------|-------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|
| R22         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R23         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R24         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R25         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R26         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R27         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R28         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R29         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R30         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R31         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R32         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R33         | 0                                                     | 0                                                        | 0                                                        | <1                                                 |
| R34         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R35         | 0                                                     | 0                                                        | 0                                                        | <1                                                 |
| R36         | 0                                                     | 0                                                        | 0                                                        | <1                                                 |
| R37         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R38         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R39         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R40         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R41         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R42         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R43         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R44         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R45         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R46         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R47*        | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R48         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R49         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R50         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R51         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R52         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |

| Receptor ID                                                                                                                 | Number of 24hr mean PM <sub>10</sub> exceedances 2015 | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DM | Number of 24hr mean PM <sub>10</sub> exceedances 2022 DS | 2022 number of exceedances PM <sub>10</sub> change |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|
| R53                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R54                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R55                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R56                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R57                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R58                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R59                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R60                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R61                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R62                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R63                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R64                                                                                                                         | 1                                                     | 0                                                        | 0                                                        | <1                                                 |
| R65                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R66                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R67                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R68                                                                                                                         | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| R69                                                                                                                         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R70                                                                                                                         | 2                                                     | 2                                                        | 2                                                        | <1                                                 |
| R71                                                                                                                         | 2                                                     | 1                                                        | 2                                                        | <1                                                 |
| R72                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R73                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R74                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R75                                                                                                                         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R76                                                                                                                         | 3                                                     | 2                                                        | 2                                                        | <1                                                 |
| R77                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R78                                                                                                                         | 2                                                     | 1                                                        | 1                                                        | <1                                                 |
| R79*                                                                                                                        | 1                                                     | 1                                                        | 1                                                        | <1                                                 |
| *Selected for comparison with 1-hour mean NO <sub>2</sub> AQS objective, and/or 24-hour mean PM <sub>10</sub> AQS objective |                                                       |                                                          |                                                          |                                                    |

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