

**A57 Link Roads**

**TR010034**

**9.86 Supplementary Air Quality  
Assessment for Brookfield**

Rule 8(1)(k)

Infrastructure Planning (Examination Procedure) Rules 2010

May 2022

# Infrastructure Planning Planning Act 2008

## The Infrastructure Planning (Examination Procedure) Rules 2010

### A57 Link Roads Scheme Development Consent Order 2022

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#### 9.86 SUPPLEMENTARY AIR QUALITY ASSESSMENT FOR BROOKFIELD

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# 1. Introduction

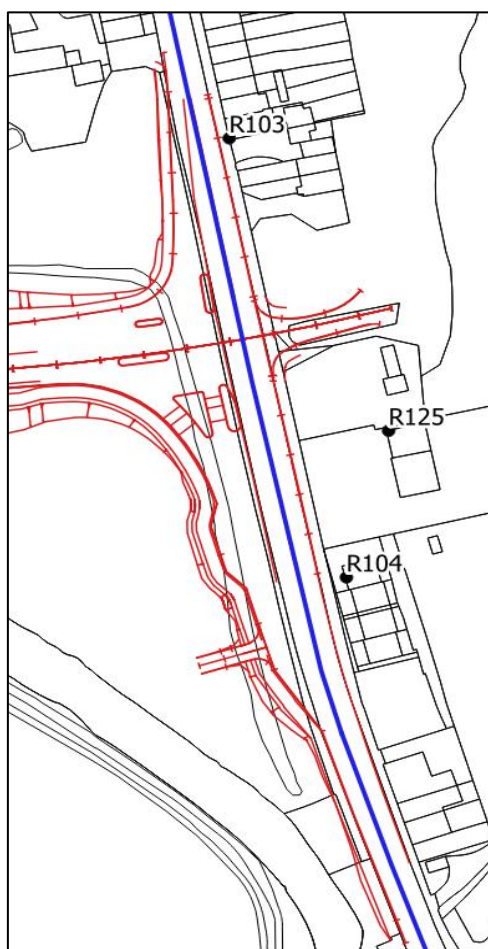
- 1.1.1 This document presents a supplementary assessment of the air quality impacts at a number of sensitive receptors identified in the area of Brookfield, located within administrative boundary of High Peak Borough Council (HPBC) Local Authority. The receptors were included in the air quality assessment presented in the Environmental Statement (ES) Chapter 5 'Air Quality' (APP-061) as qualifying feature receptors within the compliance risk assessment for the Scheme, undertaken in line with the National Highways DMRB LA 105 Air Quality guidance (DMRB LA 105).
- 1.1.2 DMRB LA 105 requires the compliance risk assessment to be undertaken at the qualifying features and public access locations adjacent to Defra's Pollution Climate Mapping (PCM) links that coincide with the Affected Road Network (ARN) of the Scheme. The assessment of impacts at the qualifying features and public access receptors included in the compliance risk assessment undertaken for the Scheme and presented in the ES, followed Defra's Technical Guidance (TG.16) method of estimating future year annual mean NO<sub>2</sub> concentrations to align the assessment with Defra's reporting on compliance with EU Limit Values (DMRB LA105 paragraph 2.54).
- 1.1.3 Defra's method for the calculation of future year annual mean NO<sub>2</sub> concentrations represents a less conservative approach compared to the application of the National Highways alternative Long Term Annual Projection Factors (LTTE6) as detailed in DMRB LA 105 and as used in the assessment of the impact of the Scheme on human health.
- 1.1.4 During the Development Consent Order (DCO) Issue Specific Hearing 3 (ISH3), High Peak Borough Council (HPBC) requested a supplementary assessment of the compliance risk assessment qualifying features identified in Brookfield be undertaken using the DMRB LA 105 LTTE6 method. The outcomes of this supplementary assessment are presented in this document.

## 2. Methodology

### 2.1 Human Health Assessment

- 2.1.1 The air quality assessment of the impacts of the Scheme at human health receptors identified in Brookfield has been undertaken in line with the methodology detailed in Chapter 5 'Air Quality' of the ES (APP-061). The discrete sensitive receptors representative of human health exposure have been selected in proximity of the roads that trigger the DMRB LA105 scoping criteria and were chosen to ensure that receptors with both the highest pollutant concentration (those closest to roads and junctions) or anticipated to have the largest change in concentration with the Scheme were represented. In Brookfield, south of the new A57 link road, receptor R104 was selected as a likely worst-case location due to its proximity to the A57 and the new bypass, as shown in Figure 2.1 below.

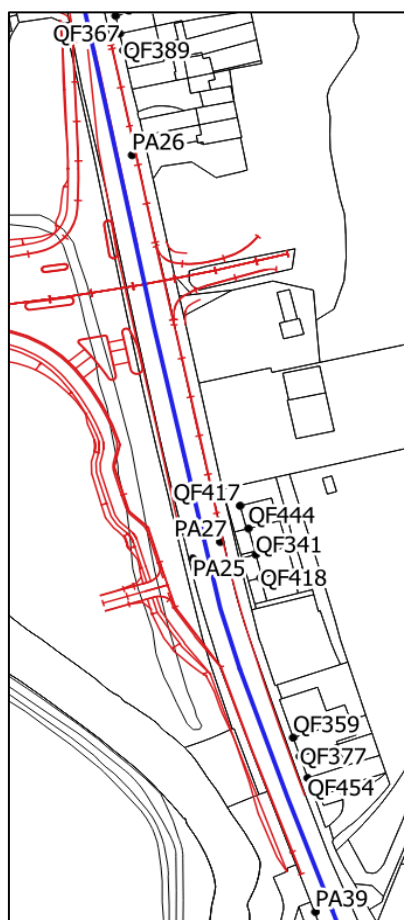
**Figure 2.1 - Modelled Human Health Receptors in Brookfield**



## 2.2 Compliance Risk Assessment

- 2.2.1 In line with DMRB LA 105, where PCM Links coincide with the ARN, the nearest qualifying features to each PCM link were included in the compliance risk assessment. This assessment includes a larger number of receptors that those included in the human health assessment. The selected qualifying features and public access in Brookfield as included in the air quality assessment presented in the ES are shown in Figure 2.2 below. Receptors labelled QF are qualifying features which includes residential properties. Receptors labelled PA are public access locations such as pavements and footpaths.
- 2.2.2 Both human health receptors and qualifying features were modelled at the property façade with the aim to minimise the distance from the road sources and, therefore, to estimate worst case pollutant concentrations.

**Figure 2.2 - Selected Qualifying Features and Public Access in Brookfield**



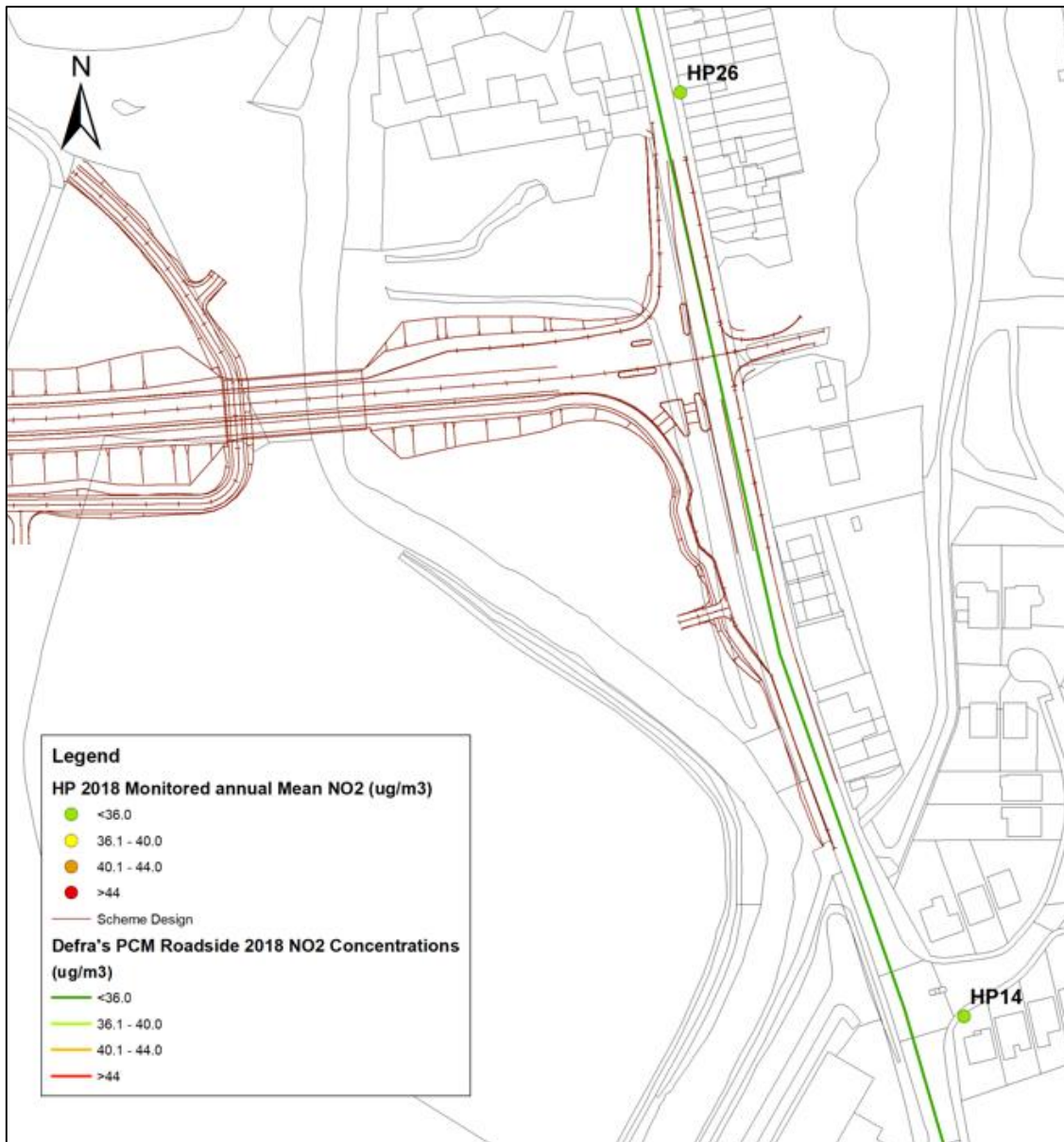
## 2.3 Supplementary Assessment

- 2.3.1 While DMRB LA105 requires the assessment of the impact at qualifying features following Defra's TG.16 method to allow comparison with Defra's reporting on compliance with the EU Limit Value, for the purpose of this supplementary assessment, the annual mean NO<sub>2</sub> concentrations modelled at the qualifying features in Brookfield were adjusted using the gap factors derived in accordance with National Highways LTTE6 projection factors, which represent a more conservative approach to future year annual mean NO<sub>2</sub> concentrations.

### 3. Baseline Information in Brookfield

- 3.1.1 Properties adjacent to the A57 in Brookfield are not located within an Air Quality Management Area (AQMA). High Peak Borough Council currently undertakes diffusion tube monitoring at two sites in Brookfield, HP26, located adjacent to the A57 Woolley Bridge at a roadside location to the north of the new A57 Link Road, and HP14, located adjacent to the A57 Woolley Bridge at the junction with Tavern Road. The 2018 monitored annual mean NO<sub>2</sub> concentrations at HP26 and HP14 was 34.5 µg/m<sup>3</sup> and 24.1 µg/m<sup>3</sup> respectively, which is below the AQS objective for annual mean NO<sub>2</sub> of 40 µg/m<sup>3</sup>.
- 3.1.2 Defra's modelled PCM roadside NO<sub>2</sub> concentration for the A57 through Brookfield was 23.2 µg/m<sup>3</sup> in 2018, again below the AQS objective for annual mean NO<sub>2</sub>. The baseline information in Brookfield is shown in Figure 3.1. The review of the baseline information in Brookfield therefore has not identified this area as a location where AQS objectives are exceeded.

**Figure 3.1 - Baseline Information in Brookfield**



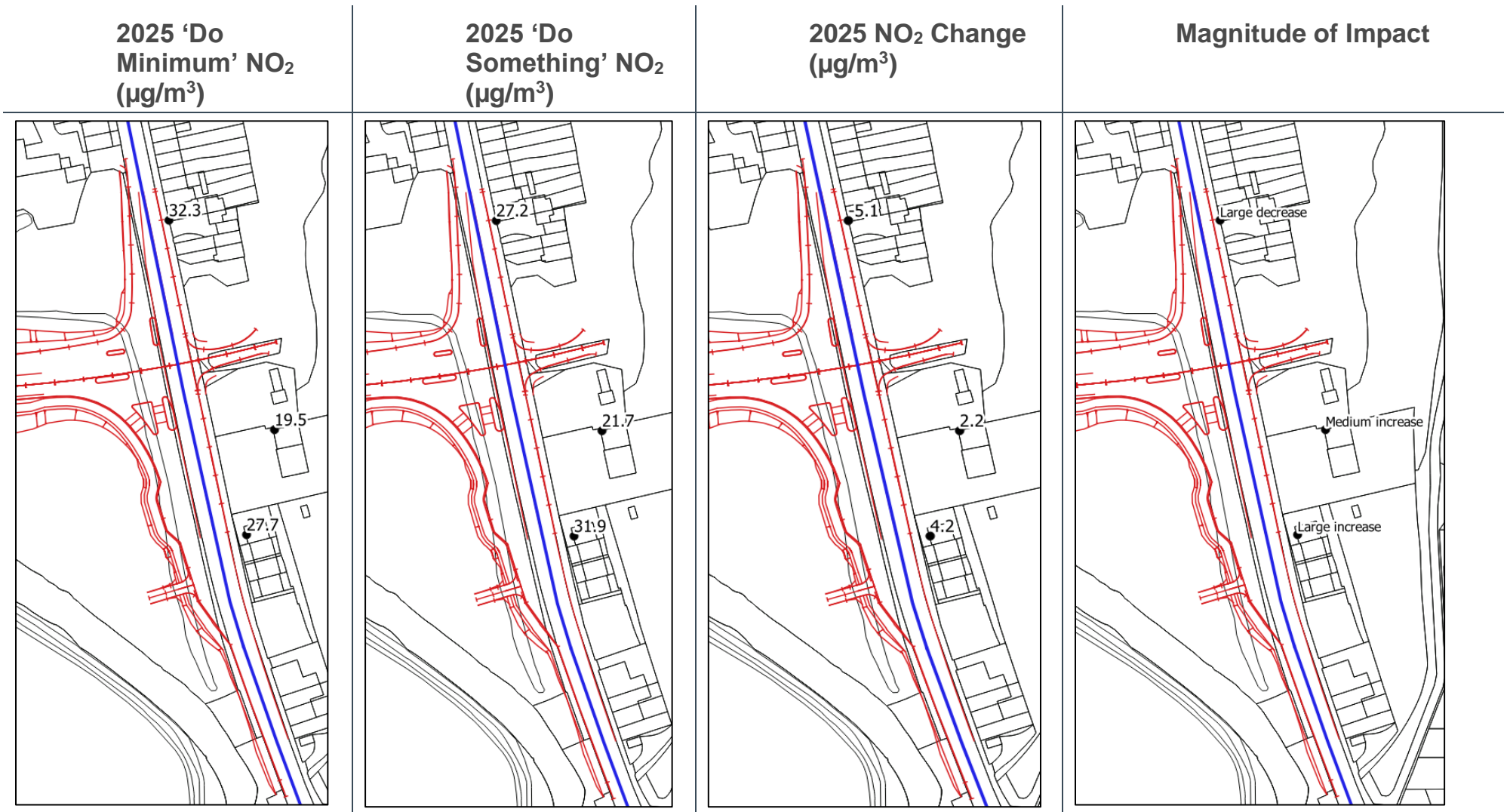
## 4. Environmental Statement Results

### 4.1 Human Health Receptors

- 4.1.1 Pollutant concentrations were estimated for the Scheme opening year of 2025 at the human health receptors located within the air quality study area. The modelled annual mean NO<sub>2</sub> concentrations were then adjusted following verification, details of which are provided in Appendix 5.3 Section 1.3 of the ES (APP-175). The future year concentrations were then adjusted using Highways England LTTE6 projection factors.
- 4.1.2 No exceedances of the AQS objective for annual mean NO<sub>2</sub> were modelled at the selected human health receptors in Brookfield. The highest modelled annual mean NO<sub>2</sub> concentration with the Scheme was 31.9 µg/m<sup>3</sup> at receptor R104. The maximum change with the Scheme was 4.2 µg/m<sup>3</sup> corresponding to a 'large' increase, also at R104. The modelled results at human health receptors in Brookfield with and without the Scheme are geographically presented in Figure 4.1.



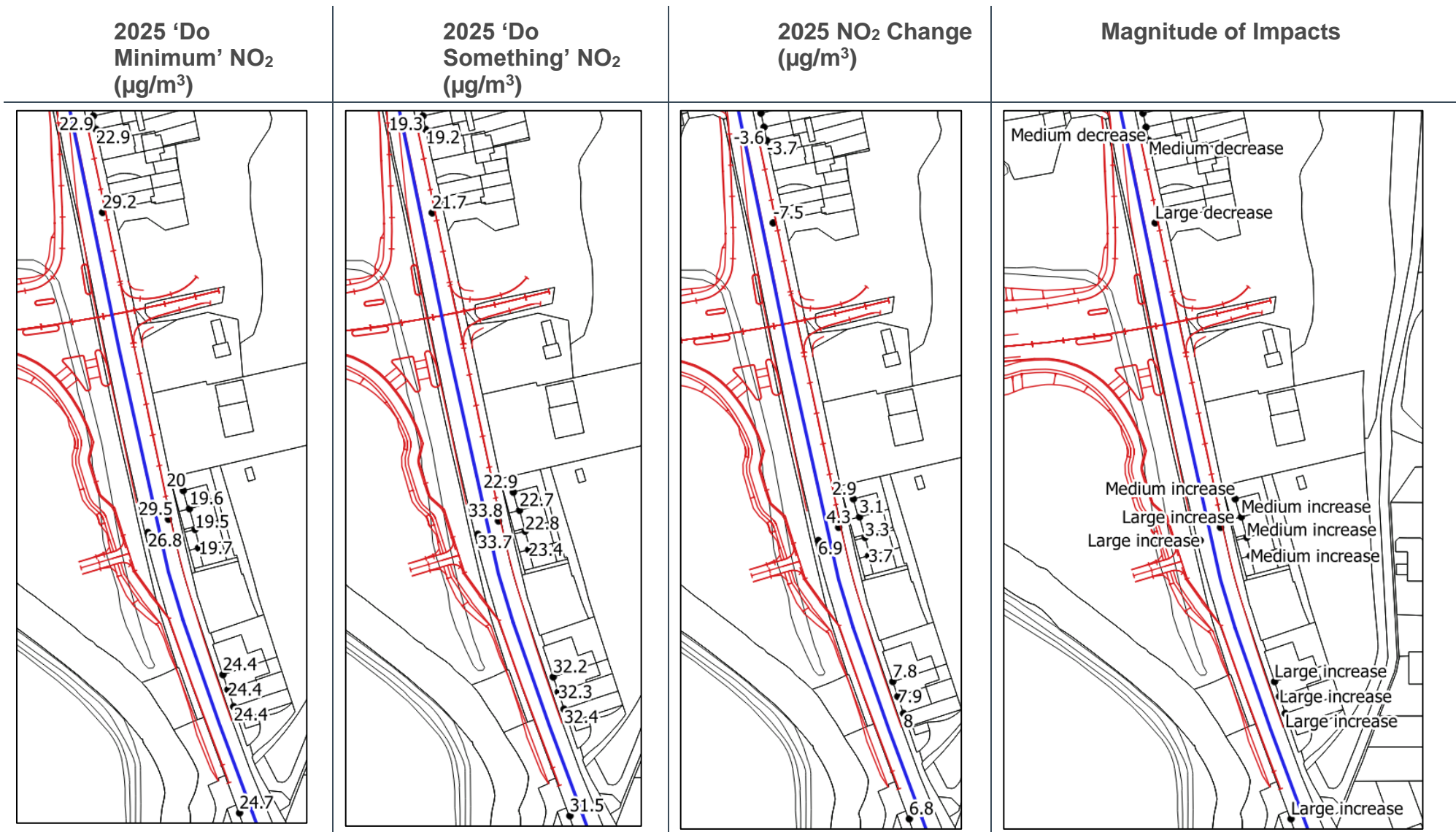
**Figure 4.1 - Estimated Annual Mean NO<sub>2</sub> Concentrations for Human Health Receptors (ES Assessment)**



## 4.2 Compliance Risk Assessment

- 4.2.1 Compliance with the Air Quality Directive has been undertaken in line with DMRB LA105 (paragraph 2.64 and 2.87) where Defra PCM model links coincide with the ARN. The ARN link, A57 Woolley Bridge in Brookfield, coincides with the PCM link, Census ID: 802006564. The modelled NO<sub>2</sub> concentrations were estimated at qualifying features and public access receptors located along this link following Defra's TG.16 method then adjusted following model verification.
- 4.2.2 With reference to the selected qualifying features, which are relevant for long term exposure, no exceedances of the AQS objective for annual mean NO<sub>2</sub> were modelled in Brookfield. The highest estimated annual mean NO<sub>2</sub> concentration with the Scheme was 32.4 µg/m<sup>3</sup> at the qualifying feature receptor QF454 (southern corner of residential property 4 Woolley Bridge). The maximum change with the Scheme was 8 µg/m<sup>3</sup> corresponding to a 'large' increase. The modelled results at the qualifying features in Brookfield with and without the Scheme are geographically presented in Figure 4.2.

**Figure 4.2 - Estimated Annual Mean NO<sub>2</sub> Concentrations for Compliance Risk Assessment Qualifying Feature Receptors (ES Assessment)**



## 4.3 Further Air Quality Modelling

- 4.3.1 Further investigation undertaken for qualifying features QF359, QF377 and QF454 highlighted that the discrete model receptor points were erroneously within the road width in the ‘Do Something’ scenario, as the road width in the air quality with Scheme (Do Something) scenario was amended to reflect the road width of the A57 at the , junction with the new A57 Link Road Scheme design.
- 4.3.2 The modelled road section adjacent to these receptors was therefore split to allow the refinement of the geometry at this location to better represent the road width and the source-receptor distance. Refinement of the road width was made to both the ‘Do Minimum’ scenario, to reflect the road width immediately adjacent to QF359, QF377 and QF454 rather than the average road width of the longer link and ‘Do Something’ scenario, to reflect the localised road width in the Scheme design. It should be noted that this change in geometry only affects the modelled concentrations at receptors QF359, QF377 and QF454 and, therefore, a review of the model verification was not required.
- 4.3.3 The annual mean NO<sub>2</sub> results following the model refinement show that there would be lower concentrations and smaller changes with the Scheme at the qualifying feature receptors, as presented in Table 4.1. The highest annual mean NO<sub>2</sub> concentration with the Scheme is 28.3µg/m<sup>3</sup> at receptor QF454, which is expected to have a ‘large’ increase with the Scheme of 4.4 µg/m<sup>3</sup>. The increase in concentrations at this location are due to an increase in daily traffic with Scheme of +4,641 AADT (Annual Average Daily Traffic) of which 261 AADT are heavy duty vehicles (HDV) and an increase in congestion (from “light congestion” to “heavy congestion”) in the inter peak period for northbound traffic on the adjacent A57.

**Table 4.1- Estimated Annual Mean NO<sub>2</sub> Concentrations at Qualifying Feature Receptors in Brookfield Following Model Refinement (Compliance Risk Assessment - Defra’s TG.16 method)**

ES Report ID	Modelled ID	X	Y	Revised 2025 DM NO <sub>2</sub>	Revised 2025 DS NO <sub>2</sub>	2025 NO <sub>2</sub> Change	Magnitude of Impact
QF359	QF653	401070	395475	23.7	28.1	4.4	Large increase
QF377	QF673	401071	395471	23.8	28.2	4.4	Large increase
QF454	QF760	401073	395465	23.9	28.3	4.4	Large increase

## 5. Supplementary Assessment in Brookfield

### 5.1 Application of the National Highways LTTE6 Projection Factors to Compliance Risk Assessment Receptors

5.1.1 As requested by HPBC during the DCO ISH3, the modelled concentrations at the selected qualifying feature receptors in Brookfield have been adjusted using the gap factors based on the National Highways LTTE6 projection factors, to give a more conservative estimate of the concentrations at this location. The derivation of the gap factor and the results at the qualifying features in Brookfield with the highest modelled annual mean NO<sub>2</sub> concentrations with the Scheme are provided in Table 5.1 and Table 5.2 respectively.

**Table 5.1 - Derivation of Gap Factor for Compliance Risk Assessment Qualifying Feature Receptors in Accordance with National Highways LTTE6 Projection Factors**

ES Report ID	Modelled ID	X	Y	Address	2018 Base NO <sub>2</sub> (µg/m <sup>3</sup> )	Projected Base NO <sub>2</sub> (µg/m <sup>3</sup> )	Projected Base NO <sub>2</sub> / Base 2018 NO <sub>2</sub> (Ratio A)	LTTE6 2025 Factor / 2018 Factor (Ratio B)	LTTE6 Gap Factor (Ratio B/ Ratio A)
QF359	QF653	401070	395475	8 Woolley Bridge, south corner	39.9	23.2	0.58	0.83	1.42
QF377	QF673	401071	395471	6 Woolley Bridge, south corner	40.0	23.3	0.58	0.83	1.42
QF454	QF760	401073	395465	4 Woolley Bridge, south corner	<b>40.1</b>	23.4	0.58	0.83	1.42

Values in **bold** exceed the annual mean AQS objective

**Table 5.2 - Estimated Annual Mean NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>) for Compliance Risk Assessment Qualifying Feature Receptors, National Highways LTTE6 Projection Factors**

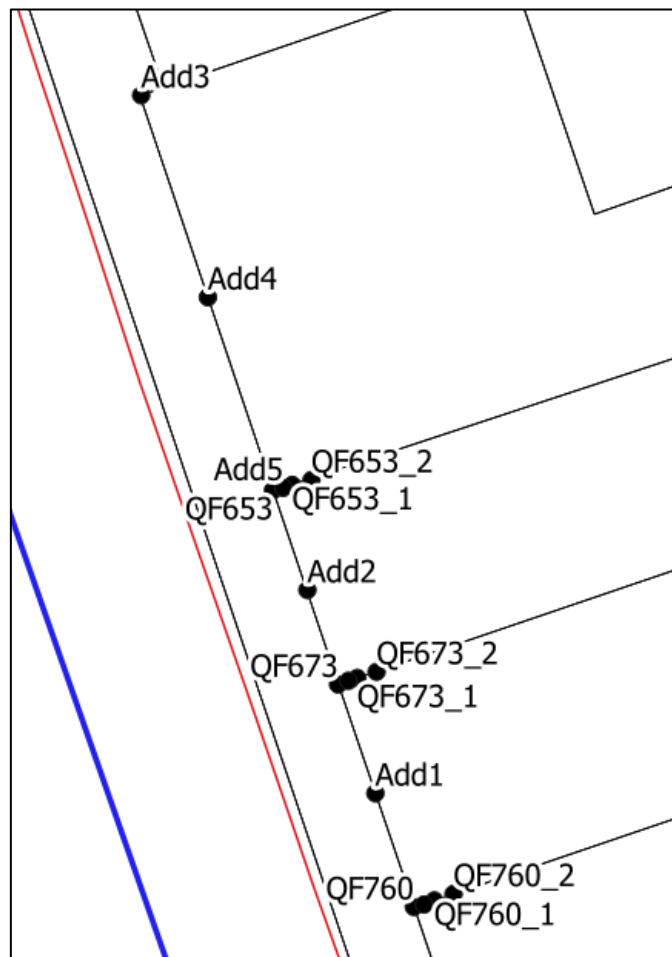
ES Report ID	Modelled ID	X	Y	Address	2018 Base NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 'Do Minimum' NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 'Do Something' NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 NO <sub>2</sub> Change (µg/m <sup>3</sup> )	Magnitude of Impact
QF359	QF653	401070	395475	8 Woolley Bridge, south corner	39.9	33.7	39.8	6.1	Large increase
QF377	QF673	401071	395471	6 Woolley Bridge, south corner	40.0	33.8	40.0	6.2	Large increase
QF454	QF760	401073	395465	4 Woolley Bridge, south corner	<b>40.1</b>	33.9	<b>40.1</b>	6.2	Large increase

Values in **bold** exceed the annual mean AQS objective

- 5.1.2 The results show that there is a marginal exceedance of the AQS objective for annual mean NO<sub>2</sub> at receptor QF454 in the base year and with the Scheme in 2025 (40.1 µg/m<sup>3</sup> i.e. 0.1 µg/m<sup>3</sup> above the AQS objective). The change at this receptor is 6.2 µg/m<sup>3</sup> corresponding to a 'large' increase with the Scheme.
- 5.1.3 It should be noted that receptor R104, included as the human health receptor in the air quality assessment presented in the ES, is located adjacent to the same modelled road link as the compliance risk assessment qualifying feature receptor QF454. The estimated annual mean NO<sub>2</sub> concentration with the Scheme at R104 is 31.9 µg/m<sup>3</sup>. The change at this receptor is 4.2 µg/m<sup>3</sup> corresponding to a 'large' increase with the Scheme, as shown in section 4.1 above.
- 5.1.4 R104 is located at 10.2m from the existing A57 road centreline and 65m from the new A57 link road, while QF454 is a roadside receptor located at 6.2m distance from the existing A57 road centreline and 132m from the new A57 link road. The difference in the modelled concentrations at these receptors, both adjacent to the same link, is therefore due to the difference in their proximity to the existing A57 road centreline, combined with the effect of local meteorology and road alignment, however, such a large difference in modelled concentrations (8.2 µg/m<sup>3</sup>) was not anticipated.
- 5.1.5 An additional investigation was therefore undertaken to better understand the extent of the exceedance at the property and how the concentrations would vary with distance from the road. Additional receptor points were included in the air quality model at the mid-point and the northern corner of each property façade, together with transects from the façade at 0.25m, 0.5m and 1m distance.
- 5.1.6 The results show that the modelled annual mean NO<sub>2</sub> concentration at QF454 drops below the AQS objective at a distance of 0.25m from the southern corner of the property façade, with a reduction of 2.2 µg/m<sup>3</sup> at 1m distance from the façade compared to the concentration at the southern corner of the façade. The additional receptor points at the mid point and the northern corner of the QF454

property façade (receptors Add1 and QF673) also do not exceed the AQS objective. The estimated annual mean NO<sub>2</sub> concentration in the Scheme opening year therefore only exceed the AQS objective in the southern most corner of the property façade. The additional model receptor points are shown in Figure 5.1 labelled by their modelled IDs<sup>1</sup>, while details of the air quality results at these locations are presented in Table 5.3.

**Figure 5.1 - Additional Model Receptor Points**



<sup>1</sup> Note: these differ from the IDs used in the ES reporting.

**Table 5.3 - Estimated Annual Mean NO<sub>2</sub> Concentrations (µg/m<sup>3</sup>) for Additional Model Receptor Points, National Highways LTTE6 Projection Factors**

ES Report ID	Modelled ID	Address	2018 Base NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 'Do Minimum' NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 'Do Something' NO <sub>2</sub> (µg/m <sup>3</sup> )	2025 NO <sub>2</sub> Change (µg/m <sup>3</sup> )	Magnitude of Impact
QF359	QF653	8 Woolley Bridge, south corner	39.9	33.7	39.8	6.1	Large increase
QF359_1	Add5	8 Woolley Bridge, south corner, 0.25m	39.3	33.2	39.2	6.0	Large increase
QF359_2	QF653_1	8 Woolley Bridge, south corner, 0.5m	38.8	32.8	38.7	5.9	Large increase
QF359_3	QF653_2	8 Woolley Bridge, south corner, 1m	37.9	32.0	37.7	5.7	Large increase
QF377	QF673	6 Woolley Bridge, south corner	40.0	33.8	40.0	6.2	Large increase
QF377_1	Add6	6 Woolley Bridge, south corner, 0.25m	39.4	33.3	39.3	6.0	Large increase
QF377_2	QF673_1	6 Woolley Bridge, south corner, 0.5m	38.9	32.9	38.8	5.9	Large increase
QF377_3	QF673_2	6 Woolley Bridge, south corner, 1m	38.0	32.0	37.8	5.8	Large increase
QF454	QF760	4 Woolley Bridge, south corner	<b>40.1</b>	33.9	<b>40.1</b>	6.2	Large increase
QF454_1	QF760_1	4 Woolley Bridge, south corner, 0.5m back	39.0	32.9	38.9	6.0	Large increase
QF454_2	Add7	4 Woolley Bridge, south corner, 0.25m back	39.6	33.4	39.5	6.1	Large increase
QF454_3	QF760_2	4 Woolley Bridge, south corner, 1m back	38.0	32.1	37.9	5.8	Large increase
New1	Add1	mid point 4 Woolley Bridge, facade	40.0	33.8	40.0	6.2	Large increase
New2	Add2	mid point 6 Woolley Bridge, facade	39.9	33.7	39.8	6.1	Large increase
New3	Add3	8 Woolley Bridge, north corner, facade	39.5	33.4	39.4	6.0	Large increase
New4	Add4	mid point 8 Woolley Bridge, facade	39.8	33.6	39.7	6.1	Large increase

Values in **bold** exceed the annual mean AQS objective

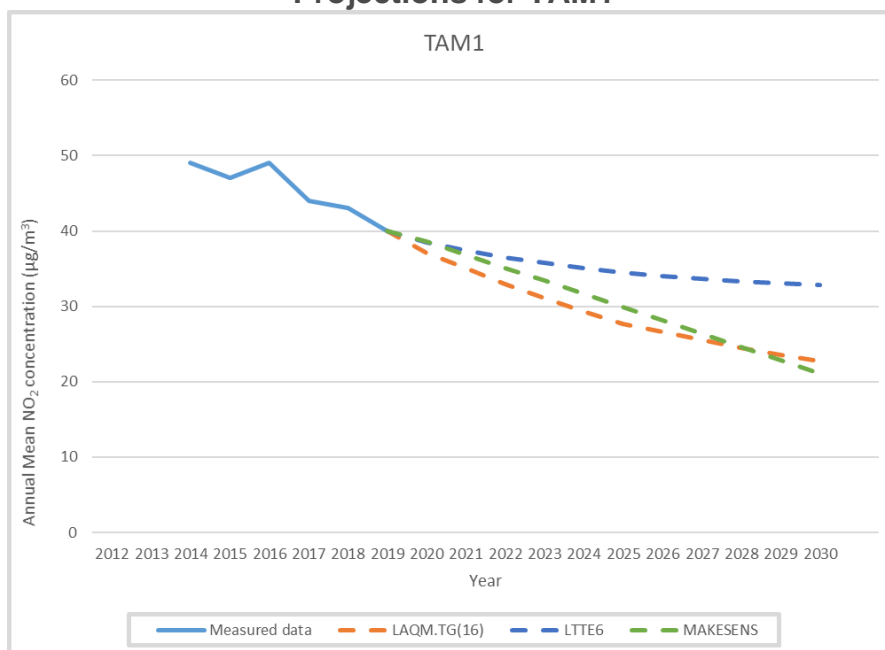


- 5.1.7 Finally, it should be noted that a minor exceedance of  $40.1 \mu\text{g}/\text{m}^3$  is also estimated at receptor QF454 in the base year (2018). The closest monitoring site representative of this property is HPBC diffusion tube HP26 (located at 6.7m from the existing A57 road centreline), which measured an annual mean  $\text{NO}_2$  concentration of  $34.6 \mu\text{g}/\text{m}^3$  in 2018, does not indicate an existing exceedance. The base year modelled concentration at QF454 is  $5.6 \mu\text{g}/\text{m}^3$  higher than the concentration monitored at HP26, indicating that the high modelled concentrations in the Scheme opening year may be due to the several conservative assumptions built into the air quality assessment. For example, the use of the National Highways gap factors could be considered too conservative. This is evidenced in the trend analysis of annual mean  $\text{NO}_2$  concentrations undertaken using the Finnish Meteorological Institute MAKESENS (v1) spreadsheet and based on the annual mean time series data for the roadside CMS (TAM1, operated by Tameside Metropolitan Borough Council), presented in Appendix 5.3 of the ES (APP-173) and reproduced below in Figure 5.2, which shows that the Defra's TG.16 projections are more representative of the monitoring trend.
- 5.1.8 A conservative approach is also incorporated in the emission factors used in the assessment which are based on Defra's Emission Factor Toolkit (EFT) v10.1, the latest version available at the time of the assessment, which does not account for the most recent government policy such as the Department for Transport (DfT) Transport Decarbonisation Plan<sup>2</sup>.
- 5.1.9 It should also be noted that there are no monitoring sites at the qualifying feature receptor QF454, which would allow the minimisation of assumptions through further refinement of model verification. Discussions are ongoing with HPBC to identify the appropriate mechanism for the National Highways to support HPBC to gain a clearer understanding of the existing baseline concentrations at this location.

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<sup>2</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf)

**Figure 5.2 - Annual Mean NO<sub>2</sub> Future Year Roadside Concentration Projections for TAM1**



## 5.2 Sensitivity Test – 2026 Emission Factors

5.2.1 An additional sensitivity test has been undertaken using 2026 emission factors and background concentrations in order to estimate the concentrations in 2026, one year after the Scheme opening. The results of this sensitivity test are shown in Table 5.4 below, which show that the annual mean NO<sub>2</sub> concentrations with the Scheme would be below the AQS objective within one year of the Scheme opening year (2025).

**Table 5.4 - Estimated 2026 Annual Mean NO<sub>2</sub> Results (µg/m<sup>3</sup>) for Compliance Risk Assessment Qualifying Feature Receptors, National Highways LTTE6 Projection Factors**

ES Report ID	Modelled ID	X	Y	Address	2018 Base NO <sub>2</sub> (µg/m <sup>3</sup> )	2026 'Do Minimum' NO <sub>2</sub> (µg/m <sup>3</sup> )	2026 'Do Something' NO <sub>2</sub> (µg/m <sup>3</sup> )	2026 NO <sub>2</sub> Change (µg/m <sup>3</sup> )	Magnitude of Impact
QF359	QF653	401070	395475	8 Woolley Bridge, south corner	39.9	33.2	39.3	6.1	Large increase
QF377	QF673	401071	395471	6 Woolley Bridge, south corner	40.0	33.3	39.4	6.1	Large increase
QF454	QF760	401073	395465	4 Woolley Bridge, south corner	<b>40.1</b>	33.4	39.6	6.2	Large increase

Values in **bold** exceed the annual mean AQS objective

## 6. Assessment of Likely Significant Effects - Operational Human Health

6.1.1 DMRB LA 105 Table 2.92N provides guidance on the number of properties experiencing worsening and improvement when considering evaluation of significance, whilst paragraph 2.95.1 provides guidance on the assessment of significance where the number of properties resides between the lower and upper guideline bands provided in Table 2.92N. With the inclusion of the additional qualifying feature receptor QF454 the human health receptors informing the significance of effect on air quality are presented in Table 6.1 below (update to ES Table 5 12).

**Table 6.1 - Significance for Human Health**

Magnitude of Change in Annual Average NO <sub>2</sub> (µg/m <sup>3</sup> )	Total Receptors with:	
	Worsening of air quality objective already above objective or creation of new exceedance	Improvement of air quality objective already above objective or the removal of an existing exceedance
Large (>4)	1 (0 in total)	66 (66 in total)
Medium (>2)	0 (0 in total)	9 (75 in total)
Small (>0.4)	1 (1 in total)	0 (75 in total)

6.1.2 Given the number of receptors (75 receptors) that experience a decrease in concentrations with the Scheme, it is still considered that this outweighs the one receptor with a 'small' increase in concentration and one receptor with a 'large' increase in concentration (QF454) with the Scheme. Overall, as reported in the ES, the impact of the Scheme is an improvement in air quality for human health receptors and there is not a significant adverse effect due to the Scheme.

## 7. Conclusions

7.1.1 As per the request from HPBC during the A57 Link Roads DCO Issue Specific Hearing 3, a supplementary assessment has been undertaken in order to assess the impact of the Scheme at the compliance risk assessment qualifying feature receptors located in Brookfield using the more conservative National Highways Long Term Annual Projection Factors (LTTE6).

7.1.2 The sensitivity test identified a single receptor point (QF454), representative of a kerbside residential property, which would experience a large increase in concentrations (>4 µg/m<sup>3</sup>) resulting in a marginal exceedance of the annual mean NO<sub>2</sub> AQS objective in both the base year (2018) and the with Scheme opening year (2025) scenario (40.1 µg/m<sup>3</sup>) at the most southerly corner of the receptor façade.

7.1.3 Monitoring data for a location representative of QF454, HPBC diffusion tube HP26, does not however indicate that there was likely to be an exceedance of the AQS objective at the location in the model base year (2018 monitored annual

mean of 34.5  $\mu\text{g}/\text{m}^3$ ). It is therefore important to better understand existing air quality at the location of the property representative of QF454.

- 7.1.4 Given the balance of improvements and worsening in air quality, the inclusion of QF454 in the assessment of likely significant effects of the Scheme on human health would not change the overall conclusion as reported in the ES being that the impact of the Scheme is an overall improvement in air quality for human health receptors and there is not a significant adverse effect due to the Scheme.
- 7.1.5 The results of the supplementary assessment have been reviewed with HPBC (virtual meeting held 27 April 2022) and discussions are ongoing regarding a mechanism for the National Highways to support HPBC to better understand the baseline air quality at the property.

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