M6 J33

Options report – Addendum_1

Public Transport Only Route - Air Quality Sensitivity Test

07 May 2020

Lancashire County Council

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Contents

1. Introduction

Further to the air quality assessment undertaken to support the Options Appraisal for the proposed M6 Junction 33 scheme, Jacobs was commissioned to undertake a sensitivity test to consider the potential effects on local air quality in future years as a result of the redistribution of road traffic due to the introduction of a public transport only connection between the Bailrigg Spine Road and Ashford Road. This report is therefore a supplementary Addendum to Chapter 6 of the M6 Junction 33 Options Appraisal report.

This Addendum describes the assessment undertaken and the potential air quality effects arising from the public transport only connection addition to the Proposed Scheme. In order to do so, an operational air quality assessment has been undertaken to determine resulting pollutant concentrations at human health receptors, as well as an assessment on compliance with EU Limit Values, using air dispersion modelling. Potential effects on Designated Ecological Sites have not been considered in this assessment as they are to be considered separately in a subsequent assessment.

For the purposes of this assessment, a sensitivity test has been undertaken for the "Central 1" route option as this option was shown previously to have the greatest potential to alleviate congestion on the A6 through the Galgate AQMA (the area of primary concern in terms of air quality).

It should be noted that the traffic data used in this assessment are for the Design Year (2040) but have been modelled using vehicle emission factors and mapped background concentrations for 2030, as these are the latest currently available from Defra. As such, the results presented herein are worst-case.

2. Methodology

2.1 Assessment Approach

This assessment has utilised the modelled receptors, model adjustment factor[1], study area and Affected Road Network (ARN) from the previous air quality assessment, which followed guidance detailed within DMRB LA 105 (Highways England, 2019) and Local Air Quality Management Technical Guidance (LAQM.TG16) (Defra, 2018).

In accordance with DMRB LA 105 (Highways England, 2019), a compliance risk assessment was undertaken for the roads identified in the PCM model which are within the ARN. DMRB LA 105 (Highways England, 2019) guidance requires annual mean NO_2 concentrations to be modelled at 4m from the roadside and at 2m in height, but not within 25m of a junction, for comparison to PCM model outputs.

Data from traffic modelling was used in the previous assessment to define the study area in accordance with Highways England air quality guidance, the extent of which is shown in Figure 1 and Figure 2 of Appendix B.

2.2 Modelled Scenarios

The local air quality assessment for this study has considered the effects of design option "Central 1" in the design year only (2040). The following scenarios have been included in the assessment:

- 2040 Design Year 'without scheme' referred to as Do-Minimum (DM 2040); and
- 2040 Design Year 'with scheme' referred to as Do-Something (DS 2040).

It is worth noting that Defra background mapping and the Emission Factors Toolkit (EFT) only provide information as far as 2030. Hence, the assessment for 2040 incorporates 2030 background pollutant

[1] The comparison of modelled concentrations (during the Base Year) with local monitored concentrations to account for discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions.

concentrations, vehicle emission rates, fleet make-up (including the proportion of electric vehicles) and Euro standard compositions. As such, the result presented herein are worst-case.

2.3 Assessment of Significance

Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations were compared to the relevant Air Quality Objectives (AQOs) for each of the scenarios modelled in this assessment. The relevant AQOs are detailed in Table 2.1. In order to convey the level of impact of the Proposed Scheme, it is necessary to determine its significance. The 'significance' of an environmental impact is a function of the 'sensitivity' of the receptor and the 'scale' of the impact.

Table 2.1: Relevant National Air Quality Objectives

Pollutant	Threshold Concentration (µg/m^3)	Averaging Period
NO_2 (for human-health)	40	Annual Mean
	200	1-hour mean, not to be exceeded more than 18 times per year (equivalent to the 99.79th percentile of 1-hour means)
Particulate Matter (PM_{10}) (for human health)	40	Annual Mean
	50	24-hour mean, not to be exceeded more than 35 times per year (equivalent to the 90.08th percentile of 24-hour means)
Particulate Matter ($PM_{2.5}$) (for human health)	25	Annual Mean

The model results were used to assess whether there are any significant effects as a result of the Proposed Scheme. Highways England's approach to evaluating significant air quality effects is set out in DMRB LA 105 (Highways England, 2019).

Highways England's approach to air quality assessment identifies and assesses sensitive receptors near roads where air quality might be affected. Consequently, areas where AQOs are exceeded or are close to being exceeded are considered, such as AQMAs. The model results were used to identify receptors in exceedance of the relevant AQOs in either the Do Minimum (DM) or Do Something (DS) scenarios. These are the only receptors which are considered in the judgement of significance. The change in predicted concentration is then calculated as the difference between DS and DM model results at these receptors.

Where the difference in concentrations are less than or equal to 1 % of the AQO (e.g. less than or equal to 0.4 µg/m^3 for annual average NO_2) then the change at these receptors is considered to be imperceptible and can be scoped out of the judgement on significance.

A receptor with a predicted change in concentration greater than 'imperceptible' (i.e. greater than a magnitude of 0.4 µg/m^3) is assigned to one of six categories (large, medium and small for either worsening or improvement) where there is a predicted AQO exceedance. If any exceedances are predicted, the number of receptors in each category are compared to guideline ranges provided in DMRB LA 105 (Highways England, 2019), as presented in Table 2.2.

Table 2.2: Guideline band for the number of properties informing a judgement of significant air quality effects

Magnitude of change in annual mean NO_2 or PM_{10} concentration ($\mu g/m^3$)	Total number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

Where the number of receptors falls below, or equal to, the lower value of the range in a given category, it is considered that the Proposed Scheme is likely to have a 'not significant' effect. Where values are equal to or greater than the upper limit of the range for a given category, it has been considered that the potential impact of the Proposed Scheme is likely to cause a 'significant' effect. Where values lie between the guideline ranges for a given category, further consideration based on a balanced judgement of the overall impacts across the whole study area has been undertaken, including consideration of both worsening and improvement.

2.4 Assumptions and Limitations

The main limitation to this assessment is that detailed modelling has only been undertaken for one design option, and not all six. The sensitivity testing does therefore not provide a comparison of potential air quality effects resulting from all design options for the Proposed Scheme, which may be somewhat different. The results for the option selected are however considered likely to be representative of those for the other options.

In addition to this, using the previous assessment's study area for this sensitivity test means that some impacts resulting from the introduction of the public transport only connection may not have been considered. For example, the introduction of the public transport only connection could result in impacts over a larger area than was considered previously. However, given the scale and extent of the study area considered previously (which was defined based on traffic changes resulting from six different options), it is considered that the study area assessed is sufficiently large to have covered all significant impacts.

With available data from Defra background mapping and the EFT only available up to 2030, it consequently means that the 2040 pollutant concentrations presented in this assessment are worst-case as they do not account for improvements in background concentrations and vehicle emissions between 2030 and 2040 (e.g. the increasing use of renewable energy sources and proportions of electric vehicles).

3. Impact of the Schemes on Air Quality

3.1 Human Health Receptors

Modelled annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at selected human health receptors for the Design Year (2040) DM and DS scenarios are presented below. Modelled pollutant concentrations at all modelled human health receptors can be found in full in Appendix A.

The local air quality assessment results for the selected receptors (i.e. those locations where modelled concentrations were highest and/or where the largest changes in pollutant concentrations were modelled to occur) for the Central 1 option are provided in Table 3.1 and illustrated in Figure 3 of Appendix B.

Table 3.1: Local Air Quality Assessment Results – Central 1

Receptor ID	Modelled Annual Mean Concentrations (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R1	15.8	16.5	0.6	11.0	11.2	0.2	7.2	7.3	0.1
R2	17.7	17.3	-0.3	12.6	12.5	-0.1	8.0	8.0	0.0
R3	10.7	10.1	-0.6	10.0	9.9	-0.1	6.6	6.5	-0.1
R4	22.4	17.3	-5.1	13.8	12.7	-1.1	8.7	8.1	-0.6
R5	26.3	19.6	-6.8	14.5	13.1	-1.4	9.1	8.3	-0.8
R6	7.6	8.0	0.4	10.1	10.2	0.1	6.7	6.8	0.1
R7	37.5	24.1	-13.5	15.9	14.4	-1.5	10.2	9.3	-0.9
R8	40.0	28.8	-11.1	16.0	14.8	-1.2	10.3	9.6	-0.7
R9	**44.5**	34.7	-9.8	16.6	15.6	-1.0	10.6	10.0	-0.6
R10	15.6	14.7	-0.9	13.4	13.4	0.0	8.7	8.7	0.0
R11	11.0	11.1	0.1	9.9	9.9	0.0	6.5	6.6	0.1
R12	7.3	6.9	-0.4	9.4	9.3	-0.1	6.3	6.3	0.0
R13	11.6	24.9	13.3	12.2	14.2	2.0	7.7	9.0	1.3
R14	12.5	16.3	3.8	12.3	12.9	0.6	7.8	8.1	0.3
R15	9.9	12.4	2.5	12.5	13.1	0.6	7.9	8.2	0.3
R16	5.9	6.0	0.0	9.3	9.3	0.0	6.2	6.2	0.0
R17	12.6	14.5	1.8	12.6	13.0	0.4	7.9	8.1	0.2
R18	9.8	10.2	0.4	9.9	10.0	0.1	6.5	6.5	0.0
R19	13.7	14.4	0.7	12.8	12.9	0.1	8.0	8.0	0.0
R20	20.2	21.2	1.0	13.1	13.3	0.2	8.2	8.4	0.2
R21	19.2	15.8	-3.4	13.4	12.6	-0.8	8.6	8.1	-0.5
R22	21.6	22.5	0.9	14.9	15.1	0.2	9.3	9.4	0.1
R23	13.4	11.9	-1.4	11.4	11.0	-0.4	7.3	7.1	-0.2
R24	39.6	**41.7**	2.1	15.5	15.7	0.2	9.9	10.0	0.1
R25	**41.1**	**43.1**	2.0	15.5	15.5	0.0	9.8	9.8	0.0

Note: Exceedances of annual mean NO_2 AQO (40 µg/m³) shown in **bold** type.

Values presented above rounded to 1 d.p.

The results indicate that annual mean NO_2 concentrations are likely to exceed the relevant AQO (40 µg/m³) in the DM scenario at receptors R9 (41.1 µg/m³) and R25 (41.1 µg/m³) and at receptors R24 (41.7 µg/m³) and R25 (43.1 µg/m³) in the DS scenario. It should be noted that annual mean NO_2 concentrations at all of these receptors are modelled to be higher in the 2040 DM scenario than in the 2025 DM scenario modelled previously. This indicates that increases in emissions as a result of increased traffic flows and / or congestion between 2025 and 2040 outweigh the assumed improvement in vehicle emissions and background

concentrations over the same period. As noted previously, however, the modelling for 2040 incorporates vehicle emission factors and background concentration for 2030 (the latest year for which data are available), and therefore modelled concentrations in 2040 are worst-case.

Receptor R9 is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for Central 1 suggest, however, that a large reduction in NO_2 concentrations (i.e. -9.8 $\mu g/m^3$) will occur at this receptor, thus achieving compliance with the AQO. Receptors R7 and R8 (also located within the Galgate AQMA), although not in exceedance, are also modelled to experience large decreases in NO_2 concentration in the DS scenario (i.e. -13.5 $\mu g/m^3$ and 11.1 $\mu g/m^3$ respectively).

The modelled exceedance at R25, a single isolated residential property (which is currently vacant) located approximately 5km north of the Proposed Scheme at M6 Junction 34, is modelled to worsen in the DS scenario with an increase of 2.0 $\mu g/m^3$. This increase is as a result of an increase in traffic on both the M6 at Junction 34 and the adjacent A683 as a result of the Proposed Scheme and public transport only connection (as shown in Figure 4 of Appendix B).

In addition to this, receptor R24 is also modelled to exceed the NO_2 AQO in the DS scenario (41.7 $\mu g/m^3$) as a result of an increase of 2.1 $\mu g/m^3$. This receptor is located on Newlands Road, adjacent to the M6 between J33 and J34. This modelled increase is as a result of an increase in traffic flows along the M6 as a result of the proposed scheme and public transport only connection (which is modelled to be substantially larger in 2040 than in 2025).

The elevated concentrations modelled to occur at receptors R24 and R25 are as a result of the proximity of these receptors to the M6. However, the modelled concentrations adjacent to the M6 presented in this assessment are considered worst-case because:

- the M6 is elevated relative to these receptors, which will increase the dispersion and dilution of road traffic emissions. This effect however cannot be readily replicated in the dispersion model;
- receptor R24 is behind a vegetation screen, which is likely to act as a 'barrier' to emissions from the motorway at this location; and
- the dispersion model has been verified and adjusted primarily against monitoring undertaken in urban areas with street canyon like features and congested traffic conditions. As such, the model adjustment factor applied to model outputs so as to correspond to these conditions is likely to result in pollutant concentrations adjacent to the M6, where traffic is freer flowing and the dispersion environment more open, being substantially overestimated.

Receptor R13 is modelled to experience the largest increase in NO_2 concentration (13.3 $\mu g/m^3$) between the DM and the DS scenario. This is largely due to the contribution from the section of the Proposed Scheme adjacent to this receptor, coupled with a much larger volume of traffic using this section of the Proposed Scheme in 2040 than in 2025. This increase in traffic flow is as a result of the public transport only connection causing traffic to redistribute (i.e. vehicles which would previously have accessed the A588 to the northwest of the Proposed Scheme would now access the A6 and M6 to the South of the Proposed Scheme). However, the annual mean NO_2 concentration at receptor R13 (24.9 $\mu g/m^3$) is still modelled to be well within the AQO in the DS scenario.

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the Central 1 option in 2040.

In accordance with the criteria described in Table 2.2, as the Proposed Scheme is modelled to result in a large reduction in annual mean NO_2 concentrations at a single receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact. As a medium increase is modelled to occur at less than 10 receptors where the AQO is exceeded, these changes can be considered not significant in accordance with the criteria described in Table 2.2, particularly as annual mean NO_2 concentrations are thought likely to be overestimated at these receptors.

3.2 Compliance Risk Assessment

No PCM links were modelled to have roadside concentrations in exceedance of the annual mean NO_2 EU Limit Value in 2040. As such, the impact of the Proposed Scheme on national compliance with the EU Limit Value is concluded to be not significant.

4. Conclusions

A conservative assessment has been undertaken to ascertain the potential impact of the Proposed Scheme on local air quality in 2040, following the implementation of the public transport only connection. Detailed air dispersion modelling has been undertaken for the Central 1 scenario, taking into account both human health and compliance risk receptors within 200m of the Affected Road Network.

The Proposed Scheme is modelled to result in both improvements and reductions in local air quality. A total of two exceedances of the NO_2 AQO (40 $\mu g/m^3$) were modelled to occur at human health receptors in the DM scenario – one of which, is located within an AQMA and is modelled to become compliant with the annual mean NO_2 AQO following implementation of the Proposed Scheme. However, the DS scenario is modelled to result in one new exceedance of the annual mean NO_2 AQO (resulting in two exceedances in total in this scenario). Both of these receptors are however adjacent to the M6 and it is considered likely that modelled NO_2 concentrations are likely to be overestimated adjacent to the M6 in this assessment for a number of reasons.

Furthermore, it is also important to note that the modelled NO_2 concentrations presented in this assessment for 2040 are worst case as they incorporate vehicle emission factors and background concentrations for 2030 (the latest year for which data are currently available), which is likely to have resulted in pollutant concentrations being substantially overestimated at all receptors.

The results of the compliance risk assessment indicate that the Proposed Scheme is unlikely to have a significant effect on national compliance with the annual mean NO_2 EU Limit Value.

As the Proposed Scheme is modelled to result in a large reduction in annual mean NO_2 concentrations at a single receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact. Whilst a medium increase is modelled to occur at less than 10 receptors where the AQO is exceeded, these changes can be considered not significant, particularly as annual mean NO_2 concentrations are thought likely to be overestimated at these receptors. Therefore, the overall impact of the Proposed Scheme on local air quality is considered to be a significant beneficial impact.

5. References

Defra (2018). Local Air Quality Management. Technical Guidance LAQM.TG(16). April 2018.

Highways Agency (2007). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality, HA207/07. Highways Agency, Scottish Executive, The National Assembly for Wales and The Department of Regional Development Northern Ireland.

Highways England (2019). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 LA 105 Air Quality. Highways England, Transport Scotland, Welsh Government and The Department for Infrastructure.

Appendix A. Modelled Human Health Receptor Results

Total NO_2, PM_{10} and $PM_{2.5}$ annual mean concentrations predicted at all human health receptors for the Design Year (2040) Do-Minimum and Do-Something (Central 1) scenarios are presented in Table A.1.

Table A.1: Modelled Annual Mean NO_2, PM_{10} and $PM_{2.5}$ concentrations (µg/m^3) at Human Health Receptors in Design Year 2040 Do-Minimum (DM) and Do-Something ((DS) Central 1) Scenarios.

Receptor ID	Location (X,Y)	Modelled Annual Mean Concentrations (µg/m^3)								
		NO_2			PM_{10}			$PM_{2.5}$		
		DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R1	348620, 453688	15.8	16.5	0.6	11.0	11.2	0.2	7.2	7.3	0.1
R2	348894, 454083	17.7	17.3	-0.3	12.6	12.5	-0.1	8.0	8.0	0.0
R3	349239, 454718	10.7	10.1	-0.6	10.0	9.9	-0.1	6.6	6.5	-0.1
R4	348320, 454825	22.4	17.3	-5.1	13.8	12.7	-1.1	8.7	8.1	-0.6
R5	348301, 454967	26.3	19.6	-6.8	14.5	13.1	-1.4	9.1	8.3	-0.8
R6	347403, 455022	7.6	8.0	0.4	10.1	10.2	0.1	6.7	6.8	0.1
R7	348366, 455312	37.5	24.1	-13.5	15.9	14.4	-1.5	10.2	9.3	-0.9
R8	348359, 455360	40.0	28.8	-11.1	16.0	14.8	-1.2	10.3	9.6	-0.7
R9	348370, 455368	**44.5**	34.7	-9.8	16.6	15.6	-1.0	10.6	10.0	-0.6
R10	348262, 455414	15.6	14.7	-0.9	13.4	13.4	0.0	8.7	8.7	0.0
R11	349240, 456087	11.0	11.1	0.1	9.9	9.9	0.0	6.5	6.6	0.1
R12	350573, 456419	7.3	6.9	-0.4	9.4	9.3	-0.1	6.3	6.3	0.0
R13	348117, 456492	11.6	24.9	13.3	12.2	14.2	2.0	7.7	9.0	1.3
R14	348126, 456566	12.5	16.3	3.8	12.3	12.9	0.6	7.8	8.1	0.3
R15	348558, 456681	9.9	12.4	2.5	12.5	13.1	0.6	7.9	8.2	0.3
R16	346175, 457061	5.9	6.0	0.0	9.3	9.3	0.0	6.2	6.2	0.0
R17	348037, 457481	12.6	14.5	1.8	12.6	13.0	0.4	7.9	8.1	0.2
R18	349607, 458222	9.8	10.2	0.4	9.9	10.0	0.1	6.5	6.5	0.0
R19	348009, 458651	13.7	14.4	0.7	12.8	12.9	0.1	8.0	8.0	0.0
R20	348974, 458987	20.2	21.2	1.0	13.1	13.3	0.2	8.2	8.4	0.2
R21	347140, 459012	19.2	15.8	-3.4	13.4	12.6	-0.8	8.6	8.1	-0.5
R22	348837, 459241	21.6	22.5	0.9	14.9	15.1	0.2	9.3	9.4	0.1
R23	347479, 459482	13.4	11.9	-1.4	11.4	11.0	-0.4	7.3	7.1	-0.2
R24	349292, 460229	39.6	**41.7**	2.1	15.5	15.7	0.2	9.9	10.0	0.1
R25	349604, 464219	**41.1**	**43.1**	2.0	15.5	15.5	0.0	9.8	9.8	0.0
R26	349014, 452450	20.1	19.1	-1.0	13.0	12.9	-0.1	8.2	8.2	0.0
R27	349053, 452521	10.1	9.1	-1.1	11.4	11.2	-0.2	7.3	7.2	-0.1
R28	348939, 452626	14.2	14.7	0.5	10.9	11.0	0.1	7.2	7.3	0.1
R29	349089, 452632	8.8	8.0	-0.8	11.2	11.0	-0.2	7.2	7.1	-0.1
R30	348939, 452676	16.7	17.5	0.8	11.4	11.5	0.1	7.5	7.6	0.1
R31	349234, 452909	10.2	8.7	-1.5	11.4	11.1	-0.3	7.3	7.1	-0.2
R32	348772, 453023	14.2	14.7	0.5	10.8	10.9	0.1	7.1	7.1	0.0

Receptor ID	Location (X,Y)	Modelled Annual Mean Concentrations (µg/m³)								
		NO_2			PM_{10}			$PM_{2.5}$		
		DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R33	349075, 453161	8.1	7.9	-0.2	12.4	12.4	0.0	7.8	7.8	0.0
R34	349426, 453239	18.3	17.9	-0.4	13.5	13.4	-0.1	8.5	8.5	0.0
R35	348986, 453291	8.2	8.1	-0.1	9.7	9.7	0.0	6.5	6.4	-0.1
R36	348696, 453319	10.6	10.9	0.3	10.1	10.2	0.1	6.7	6.7	0.0
R37	349507, 453328	32.0	31.7	-0.3	15.2	15.1	-0.1	9.5	9.5	0.0
R38	349948, 453866	8.3	7.7	-0.6	12.5	12.3	-0.2	7.9	7.8	-0.1
R39	348835, 454141	16.2	14.9	-1.4	12.5	12.2	-0.3	8.0	7.8	-0.2
R40	349152, 454184	13.4	12.9	-0.5	10.3	10.3	0.0	6.8	6.7	-0.1
R41	348124, 454574	8.1	8.0	-0.1	11.5	11.4	-0.1	7.3	7.3	0.0
R42	349275, 454639	10.4	9.9	-0.5	10.0	9.9	-0.1	6.6	6.5	-0.1
R43	348345, 454726	14.7	12.7	-2.0	12.5	12.0	-0.5	7.9	7.7	-0.2
R44	350066, 454733	8.8	7.8	-1.0	9.9	9.7	-0.2	6.3	6.2	-0.1
R45	349212, 454808	12.0	10.6	-1.4	10.3	10.0	-0.3	6.7	6.6	-0.1
R46	349119, 454902	11.6	11.2	-0.4	10.1	10.1	0.0	6.7	6.6	-0.1
R47	348990, 455023	16.1	15.3	-0.8	13.5	13.3	-0.2	8.7	8.7	0.0
R48	348309, 455050	27.6	18.9	-8.8	15.2	13.9	-1.3	9.7	9.0	-0.7
R49	349784, 455186	8.1	8.0	0.0	10.0	10.0	0.0	6.8	6.8	0.0
R50	348760, 455196	15.5	15.3	-0.1	13.3	13.4	0.1	8.7	8.7	0.0
R51	348673, 455232	13.2	12.2	-1.0	13.1	13.0	-0.1	8.6	8.5	-0.1
R52	349582, 455234	8.5	8.4	0.0	10.1	10.1	0.0	6.8	6.8	0.0
R53	348350, 455242	35.5	22.3	-13.1	15.8	14.3	-1.5	10.2	9.2	-1.0
R54	348615, 455262	13.0	12.3	-0.7	13.1	13.0	-0.1	8.5	8.5	0.0
R55	348342, 455262	33.7	21.6	-12.1	15.6	14.2	-1.4	10.0	9.2	-0.8
R56	348433, 455314	16.3	13.9	-2.3	13.4	13.1	-0.3	8.7	8.5	-0.2
R57	349576, 455329	8.5	8.5	0.0	10.1	10.1	0.0	6.8	6.8	0.0
R58	348438, 455331	14.4	12.8	-1.7	13.2	13.0	-0.2	8.6	8.5	-0.1
R59	348417, 455340	16.5	14.2	-2.3	13.4	13.1	-0.3	8.7	8.5	-0.2
R60	348379, 455350	29.3	21.9	-7.4	14.7	14.0	-0.7	9.5	9.0	-0.5
R61	348344, 455373	26.4	22.7	-3.7	14.5	14.1	-0.4	9.4	9.1	-0.3
R62	348355, 455378	36.9	31.3	-5.6	15.7	15.1	-0.6	10.1	9.8	-0.3
R63	348379, 455413	32.1	26.7	-5.5	15.2	14.6	-0.6	9.8	9.4	-0.4
R64	348275, 455431	16.8	15.7	-1.1	13.6	13.5	-0.1	8.8	8.8	0.0
R65	348388, 455495	27.7	23.4	-4.4	14.8	14.3	-0.5	9.6	9.3	-0.3
R66	348368, 455542	21.5	18.6	-2.9	14.1	13.7	-0.4	9.1	8.9	-0.2
R67	348161, 455591	13.7	13.4	-0.3	13.3	13.3	0.0	8.6	8.6	0.0
R68	348383, 455600	24.7	21.7	-3.0	14.5	14.2	-0.3	9.4	9.1	-0.3
R69	348363, 455605	21.9	19.6	-2.3	14.2	13.9	-0.3	9.2	9.0	-0.2
R70	348379, 455624	22.2	21.4	-0.7	14.5	14.3	-0.2	9.3	9.2	-0.1

Receptor ID	Location (X,Y)	Modelled Annual Mean Concentrations (µg/m³)								
		NO_2			PM_{10}			$PM_{2.5}$		
		DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R71	348419, 455660	13.6	13.4	-0.2	13.2	13.2	0.0	8.6	8.6	0.0
R72	348489, 455724	12.7	12.7	0.0	13.1	13.1	0.0	8.5	8.5	0.0
R73	348310, 455799	16.7	16.7	-0.1	13.8	13.7	-0.1	8.9	8.9	0.0
R74	348645, 455937	13.1	13.0	-0.1	13.2	13.2	0.0	8.6	8.6	0.0
R75	348608, 456033	13.9	12.7	-1.3	12.5	12.3	-0.2	7.9	7.8	-0.1
R76	349948, 456048	8.5	8.0	-0.5	9.6	9.5	-0.1	6.4	6.3	-0.1
R77	348596, 456056	11.4	11.0	-0.4	12.2	12.1	-0.1	7.7	7.7	0.0
R78	348203, 456320	13.0	13.8	0.8	12.5	12.6	0.1	7.9	7.9	0.0
R79	349382, 456356	9.9	10.4	0.5	9.8	9.9	0.1	6.5	6.5	0.0
R80	349616, 456555	8.9	9.4	0.5	9.6	9.7	0.1	6.4	6.4	0.0
R81	348624, 456570	12.2	14.3	2.1	12.3	12.7	0.4	7.8	8.0	0.2
R82	348322, 456587	8.4	11.2	2.8	12.1	12.7	0.6	7.7	8.0	0.3
R83	349047, 456625	16.8	17.1	0.3	10.5	10.6	0.1	6.9	7.0	0.1
R84	349115, 456714	13.3	13.8	0.5	10.1	10.2	0.1	6.7	6.7	0.0
R85	346263, 456828	8.7	8.6	-0.1	10.2	10.2	0.0	6.7	6.7	0.0
R86	351055, 456943	6.4	6.1	-0.2	8.6	8.6	0.0	5.8	5.7	-0.1
R87	348539, 457002	8.9	10.6	1.8	11.7	12.1	0.4	7.4	7.6	0.2
R88	347870, 457103	8.5	10.3	1.8	10.6	10.9	0.3	6.9	7.1	0.2
R89	348809, 457194	11.7	12.4	0.6	12.3	12.5	0.2	7.7	7.8	0.1
R90	347481, 457270	7.9	7.8	-0.1	10.5	10.5	0.0	6.9	6.9	0.0
R91	349207, 457331	13.4	15.6	2.2	9.9	10.3	0.4	6.5	6.7	0.2
R92	347238, 457375	9.3	7.8	-1.4	10.9	10.5	-0.4	7.1	6.9	-0.2
R93	347838, 457425	14.8	10.4	-4.4	11.7	10.9	-0.8	7.6	7.1	-0.5
R94	347719, 457718	22.0	9.0	-13.1	13.1	10.6	-2.5	8.4	7.0	-1.4
R95	346745, 457725	9.4	8.3	-1.2	10.0	9.7	-0.3	6.6	6.5	-0.1
R96	347779, 457729	19.5	10.3	-9.2	12.5	10.9	-1.6	8.1	7.1	-1.0
R97	347799, 457760	14.5	9.7	-4.8	11.5	10.7	-0.8	7.5	7.0	-0.5
R98	349409, 457810	11.1	11.9	0.8	9.6	9.8	0.2	6.3	6.4	0.1
R99	347540, 457863	10.4	7.8	-2.6	10.9	10.5	-0.4	7.1	6.8	-0.3
R100	347308, 458512	7.3	7.3	0.0	9.8	9.9	0.1	6.5	6.5	0.0
R101	347173, 458989	8.8	8.1	-0.6	10.4	10.3	-0.1	6.8	6.7	-0.1
R102	348012, 459013	14.8	16.0	1.2	14.5	14.9	0.4	8.9	9.1	0.2
R103	348940, 459093	14.2	14.7	0.5	12.8	12.9	0.1	8.0	8.1	0.1
R104	348019, 459175	24.5	25.8	1.4	14.5	14.9	0.4	8.9	9.1	0.2
R105	347764, 459194	8.7	8.8	0.1	10.3	10.3	0.0	6.7	6.7	0.0
R106	348680, 459273	17.1	17.1	-0.1	13.0	12.9	-0.1	8.1	8.1	0.0
R107	347994, 459310	24.0	25.2	1.3	13.1	13.5	0.4	8.3	8.5	0.2
R108	347989, 459396	26.6	27.0	0.5	13.1	13.2	0.1	8.3	8.4	0.1

Receptor ID	Location (X,Y)	Modelled Annual Mean Concentrations (µg/m³)								
		NO_2			PM_{10}			$PM_{2.5}$		
		DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R109	347459, 459479	10.5	9.5	-1.0	11.2	10.9	-0.3	7.3	7.1	-0.2
R110	348003, 459515	20.0	21.0	0.9	13.6	13.9	0.3	8.4	8.6	0.2
R111	348034, 459521	23.4	24.7	1.3	14.2	14.6	0.4	8.7	8.9	0.2
R112	348066, 459560	17.9	18.0	0.2	13.3	13.4	0.1	8.3	8.3	0.0
R113	348027, 459602	17.3	18.2	0.9	13.3	13.5	0.2	8.2	8.4	0.2
R114	348079, 459614	13.8	13.7	-0.2	13.8	13.7	-0.1	8.5	8.5	0.0
R115	348057, 459614	15.9	17.1	1.2	14.7	15.2	0.5	9.0	9.3	0.3
R116	347415, 459621	20.4	17.0	-3.4	13.0	12.2	-0.8	8.2	7.8	-0.4
R117	347441, 459727	18.1	15.3	-2.8	12.6	12.0	-0.6	8.0	7.7	-0.3
R118	348873, 459771	16.4	16.4	0.1	12.8	12.8	0.0	8.0	8.0	0.0
R119	348083, 459846	21.0	23.0	1.9	14.2	14.7	0.5	8.7	9.0	0.3
R120	348054, 459897	17.2	18.5	1.3	13.3	13.7	0.4	8.3	8.4	0.1
R121	348577, 460101	18.0	17.9	-0.1	13.7	13.7	0.0	9.1	9.1	0.0
R122	348537, 460113	17.0	16.5	-0.4	13.5	13.4	-0.1	9.0	8.9	-0.1
R123	348590, 460128	17.6	17.7	0.1	13.6	13.6	0.0	9.0	9.0	0.0
R124	348520, 460158	19.5	19.3	-0.2	14.2	14.1	-0.1	9.3	9.3	0.0
R125	347989, 460402	20.5	22.3	1.8	12.8	13.2	0.4	8.2	8.4	0.2
R126	348430, 460402	21.0	20.6	-0.4	14.3	14.2	-0.1	9.4	9.3	-0.1
R127	348381, 460460	20.3	20.2	-0.1	14.1	14.1	0.0	9.3	9.3	0.0
R128	348402, 460480	21.8	21.7	-0.2	14.4	14.3	-0.1	9.4	9.4	0.0
R129	347622, 460497	18.8	16.5	-2.3	13.4	12.6	-0.8	8.5	8.1	-0.4
R130	347998, 460534	16.2	17.3	1.1	12.0	12.3	0.3	7.7	7.9	0.2
R131	348381, 460537	20.7	21.1	0.4	14.1	14.3	0.2	9.3	9.4	0.1
R132	349424, 460624	18.0	18.4	0.5	12.9	12.9	0.0	8.2	8.3	0.1
R133	347685, 460673	16.1	14.5	-1.6	12.6	12.1	-0.5	8.1	7.8	-0.3
R134	347736, 460739	18.2	16.2	-2.0	13.2	12.5	-0.7	8.4	8.0	-0.4
R135	348289, 460792	20.3	20.7	0.4	14.2	14.3	0.1	9.3	9.4	0.1
R136	347972, 460797	21.0	22.8	1.8	13.1	13.5	0.4	8.3	8.6	0.3
R137	347950, 460819	19.6	21.0	1.4	12.7	13.1	0.4	8.1	8.3	0.2
R138	349211, 460847	11.5	11.6	0.1	12.3	12.3	0.0	7.9	7.9	0.0
R139	347878, 460889	22.6	21.9	-0.7	13.6	13.3	-0.3	8.6	8.5	-0.1
R140	347910, 460893	20.9	20.7	-0.2	12.8	12.7	-0.1	8.2	8.1	-0.1
R141	347948, 460894	30.3	31.1	0.8	13.8	14.0	0.2	8.7	8.9	0.2
R142	347904, 460952	30.7	30.8	0.1	14.3	14.3	0.0	9.0	9.0	0.0
R143	347985, 460972	30.8	31.5	0.7	14.0	14.0	0.0	8.9	8.9	0.0
R144	347917, 460997	32.7	32.7	0.0	14.9	14.9	0.0	9.3	9.3	0.0
R145	347940, 461015	28.7	28.6	0.0	14.9	14.9	0.0	9.4	9.4	0.0
R146	350384, 461092	11.0	10.7	-0.3	10.3	10.3	0.0	6.8	6.7	-0.1

Receptor ID	Location (X,Y)	Modelled Annual Mean Concentrations (µg/m³)								
		NO_2			PM_{10}			$PM_{2.5}$		
		DM 2040	DS 2040	Change	DM 2040	DS 2040	Change	DM 2040	DS 2040	Change
R147	347828, 461173	31.5	31.4	-0.1	16.0	16.0	0.0	10.0	10.0	0.0
R148	350285, 461346	12.0	12.1	0.1	10.4	10.4	0.0	6.8	6.9	0.1
R149	349760, 461406	16.3	16.7	0.4	13.5	13.5	0.0	8.5	8.5	0.0
R150	349883, 461786	15.3	15.8	0.4	13.2	13.3	0.1	8.3	8.4	0.1
R151	351428, 462127	16.9	14.0	-2.9	10.7	10.1	-0.6	7.0	6.7	-0.3
R152	348184, 462238	34.9	33.3	-1.7	16.5	16.2	-0.3	10.6	10.4	-0.2
R153	348192, 462284	29.5	27.8	-1.8	15.6	15.3	-0.3	10.0	9.9	-0.1
R154	348207, 462363	35.3	33.7	-1.6	16.6	16.4	-0.2	10.6	10.5	-0.1
R155	348242, 462567	21.9	20.8	-1.1	14.3	14.1	-0.2	9.3	9.2	-0.1
R156	348321, 462667	23.5	21.4	-2.1	14.5	14.2	-0.3	9.4	9.2	-0.2
R157	352478, 462793	15.8	12.8	-3.0	10.5	9.9	-0.6	6.8	6.5	-0.3
R158	348520, 463252	25.6	24.6	-0.9	14.5	14.3	-0.2	9.4	9.3	-0.1
R159	348988, 463864	20.9	20.3	-0.6	12.8	12.6	-0.2	8.5	8.5	0.0
R160	349889, 464264	14.9	15.0	0.1	12.8	12.8	0.0	8.1	8.1	0.0
R161	349694, 464299	27.6	28.6	1.0	14.0	14.1	0.1	8.9	8.9	0.0
R162	352812, 464638	12.7	10.7	-2.0	10.3	9.9	-0.4	6.7	6.5	-0.2
R163	352755, 464667	14.2	12.2	-2.0	10.5	10.2	-0.3	6.8	6.6	-0.2
R164	354403, 467651	4.7	4.7	0.0	8.5	8.5	0.0	5.6	5.6	0.0

Note: Exceedances of annual mean NO_2 AQO (40 µg/m³) shown in **bold** type.

Values presented above rounded to 1 d.p.

Appendix B. Figures

Figure 1: Modelled Human Health Receptors (North)

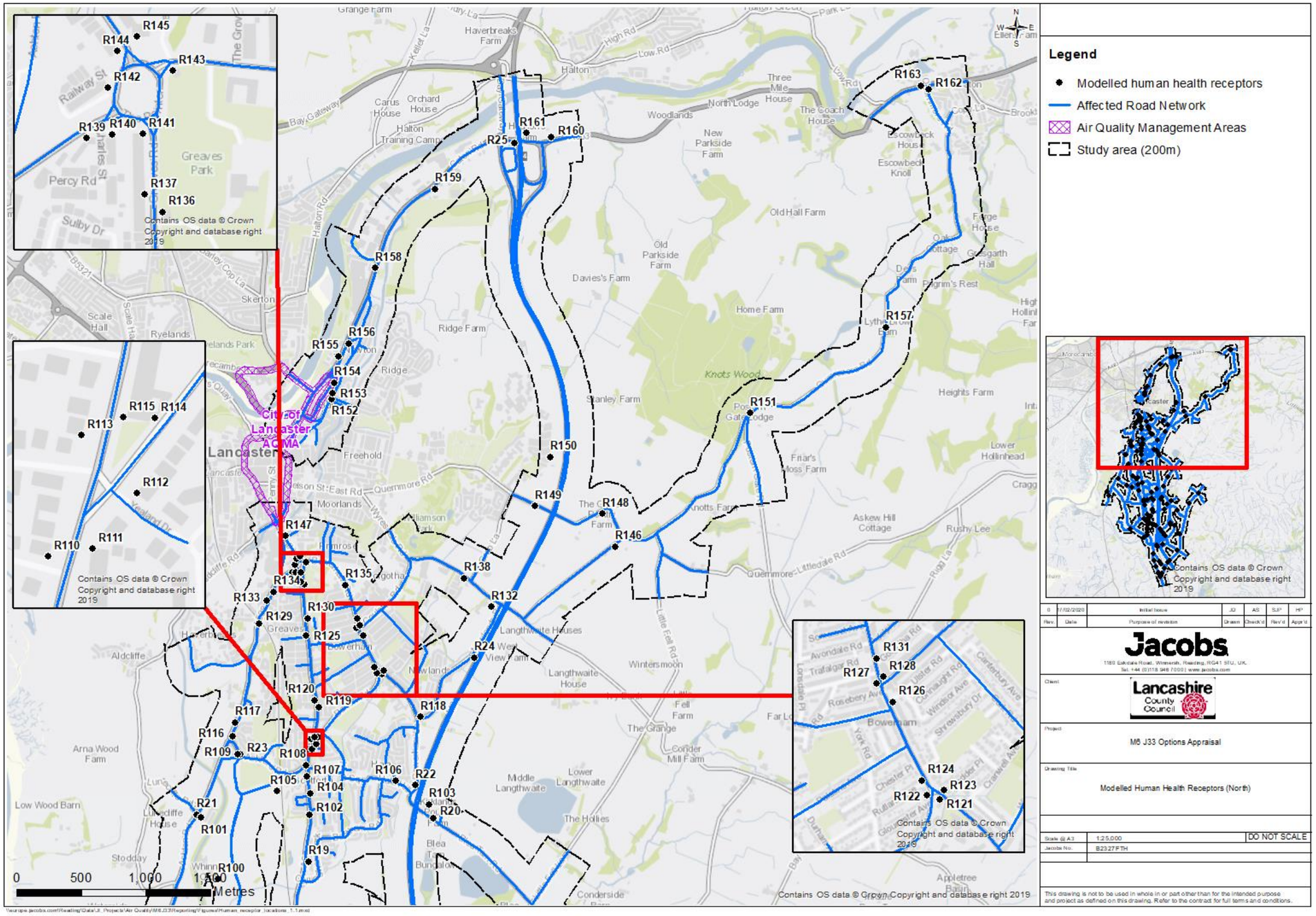

Figure 2: Modelled Human Health Receptors (South)

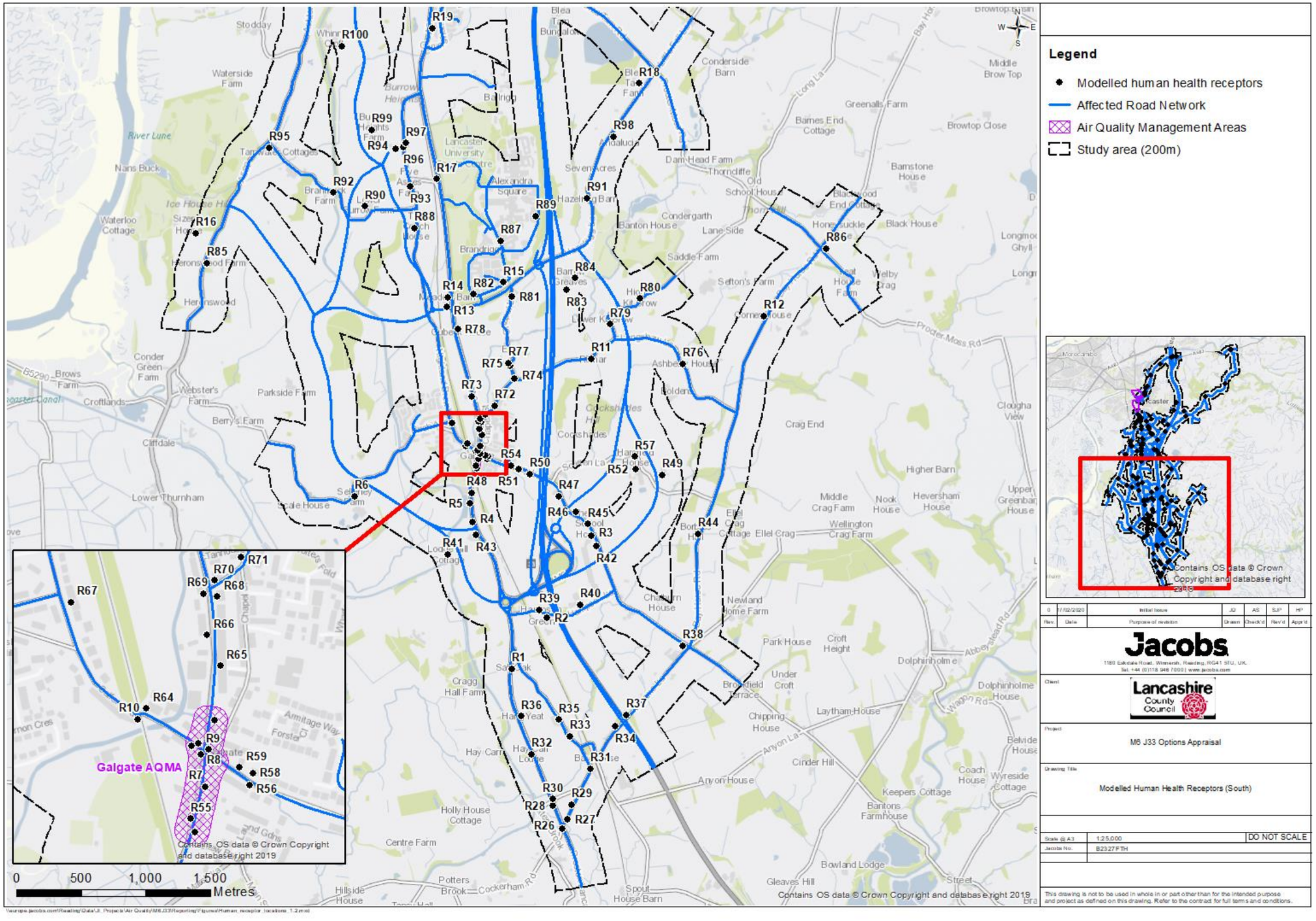

Figure 3: Selected human Health Receptor Results – Central 1

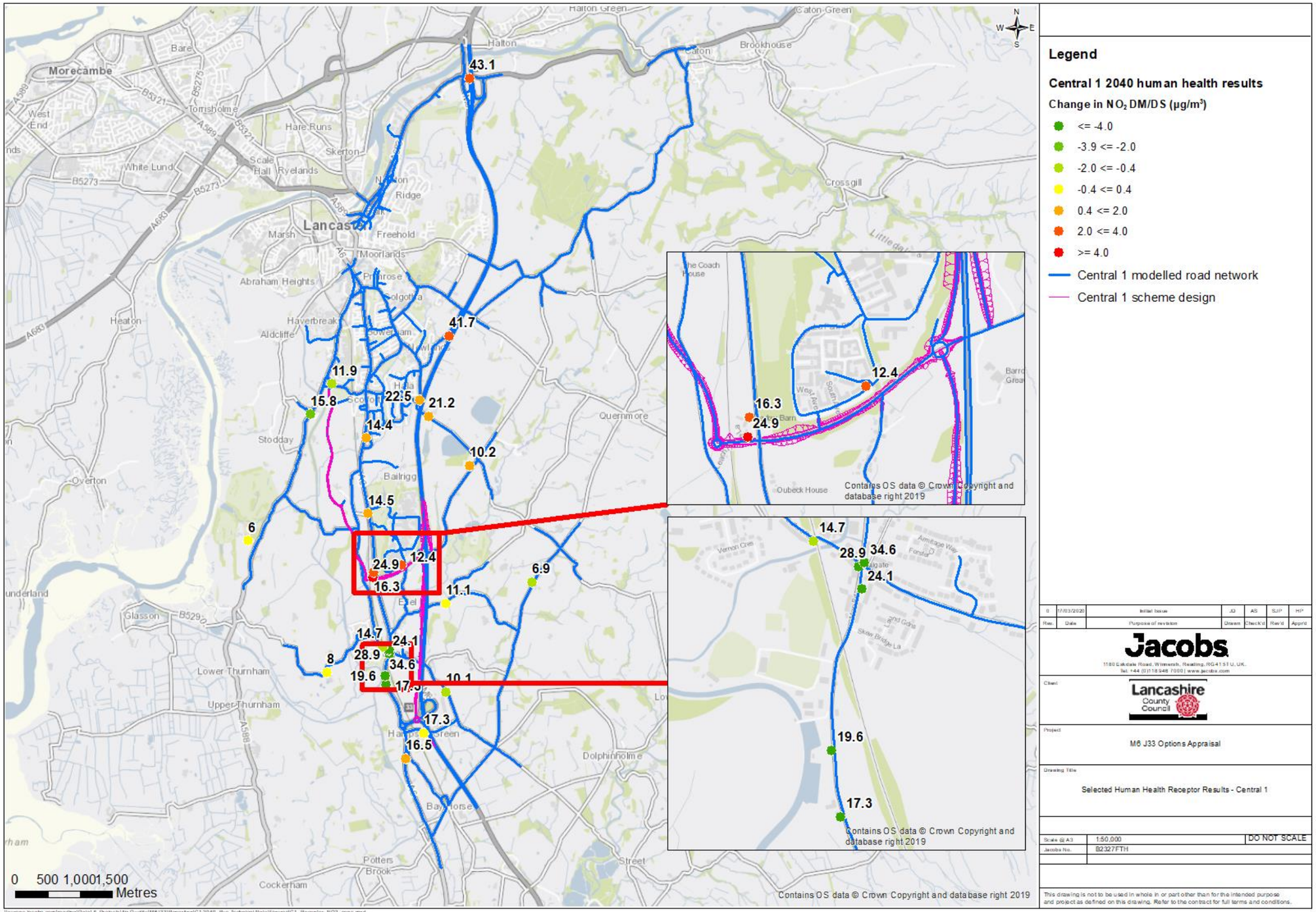

Figure 4: Change in 2040 AADT flow from the Do-Minimum (DM) to the Do-Something (DS) Central 1