

Appendix 16.2 – Verification Graphs and Detailed Methodology

In response to Clarifications and Additional Assessment Information Requests, this technical note intends to provide clarity on the model verification process and satisfy Clarification (2), presented below.

(2)	<p>Air Quality Assessment – Operational</p> <p>The number of monitoring locations used to calculate the verification factors appears to be low compared to the number of monitoring locations available in the modelled domain. A more detailed explanation with regards to the scoping methodology used to remove the monitoring locations would be beneficial to understand how the verification factors have been decided. Without this information, it is not possible to determine the effect at receptors.</p>
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As detailed in the Environmental Statement (ES) Chapter, the emissions from operational and existing traffic have undergone a detailed adjustment and verification process which followed the methodology set out in Defra’s local air quality management technical guidance (LAQM TG(16)).

Modelled results have been verified against known monitored values in close proximity of the site. Verification is an iterative process that follows the following key steps:

1. identify all roadside monitoring sites within a relevant proximity to road links within the modelled domain;
2. appraise monitoring sites using Google Earth and ensure the location and height given in the Annual Air Quality Status Reports are as accurate as possible;
3. remove sites that are not suitable for model verification (i.e. located in close proximity to a bus stop, inappropriate diffusion tube siting, poor data capture, etc.);
4. compare modelled and monitored NO_x concentrations, identify areas and sites where the differences are similar to identify verification zones;
5. calculate adjustment factors for each of the identified zones and ensure difference between modelled and monitored NO₂ concentrations are within 25%;

As stated in the Clarification request, there is a large number of possible verification sites within the modelled domain. The full modelled domain, and all nearby monitoring, is presented in Figure 1.

TG16 is prescriptive in the verification process, and the type of sites that should be used for verification purposes. The following advice is set out in the document, regarding site choice and monitoring data that should be used;

- “7.520- Kerbside sites are generally not recommended for the adjustment of road traffic modelling results as the inclusion of these sites may lead to an over-adjustment of modelling at roadside sites.*
- 7.524- Consideration of roadside and background sites during model verification, local authorities should also consider separating different types of locations when comparing modelling and monitoring*
- 7.526- The use of one continuous monitor alone to derive the adjustment factor for a model is not recommended as the monitoring site.”*

General good practice rules, informed by professional judgment and experience, that have also been considered include;

- Sites should be within 20m of the modelled road network;
- Emphasis on verification sites on road links where operational impact is predicted;
- All major roads, junctions and sources within 50m of a monitoring sites should be included in the model and where this is not possible, the site should not be used for model verification;

Figure 2 shows all monitoring sites within 20m of the modelled road network.

Figure 3 is a marked-up map which provides commentary and high-level justification for ruling out monitoring sites for use as verification site. As well as the reasons presented in the Figure 3, the micro-siting of each tube was reviewed to ensure accuracy against of annual status report and appropriateness for use in the verification. Examples of micro-siting issues for otherwise appropriate sites, and explanation is presented in Figures 5-7.

Following the ruling out of sites not appropriate for verification use, there are 11 sites remaining. The sites have been split zonally based on road type and geographical location. As outlined in (Table 16.14 and Figure 4) the remaining sites perform well and within acceptable percentages of error, the RMSE shows good agreement between monitored and adjusted modelled road NO_x. Figures 8 - 10 are graphs showing the correlation between monitored and modelled road NO_x before and after adjustment.

Table 1: Adjusted modelled results NO_x

Monitoring Site ID	Adjustment Factor	Background (µg/m ³)		Adjusted Modelled Road NO _x (µg/m ³)	Monitored Road NO _x (µg/m ³)	% Difference after Adjustment	Monitored road NO _x concentration – Adjusted NO _x concentration (µg/m ³)	RMSE for each zone
		NO _x	NO ₂					
Bean Interchange	A; 3.4934	38.3	25.6	48.9	50.6	-3.3	1.7	0.8
DA39	A; 3.4934	42.4	27.7	28.3	25.8	9.6	-2.5	
DA49	A; 3.4934	31.4	21.5	31.9	31.2	2.3	-0.7	
DA38	A; 3.4934	29.5	20.3	30.2	30.6	-1.3	0.4	
NAS2	B; 3.5384	36.4	24.3	54.4	59.2	-8.0	4.8	2.5
HL	B; 3.5384	33.8	22.6	27.8	22.3	24.6	-5.5	
ER	B; 3.5384	34.4	23.2	59.6	57.9	2.8	-1.6	
WC	C; 4.8588	33.3	22.3	32.8	39.12	-16.1	6.3	2.5
PBP	C; 4.8588	33.3	22.3	23.3	21.56	8.2	-1.8	
LRSS	C; 4.8588	37.2	24.2	37.3	31.04	20.2	-6.3	
LRG	C; 4.8588	39.9	25.4	18.3	22.05	-17.1	3.8	

The use of 11 verification sites is acceptable for a model of this size and the approach to verify the model zonally minimises the error associated with using one adjustment factor across such a large modelled domain. Ultimately, the verification process must combine all Technical Guidance available with professional judgement to ensure robustness of the model. It is of Buro Happold's opinion that the verification and adjustment methodology went into considerable detail and, as a result of this, shows good agreement with

monitored concentrations, meets all statistical error tests, and most importantly meets the requirements of the LAQM technical guidance.

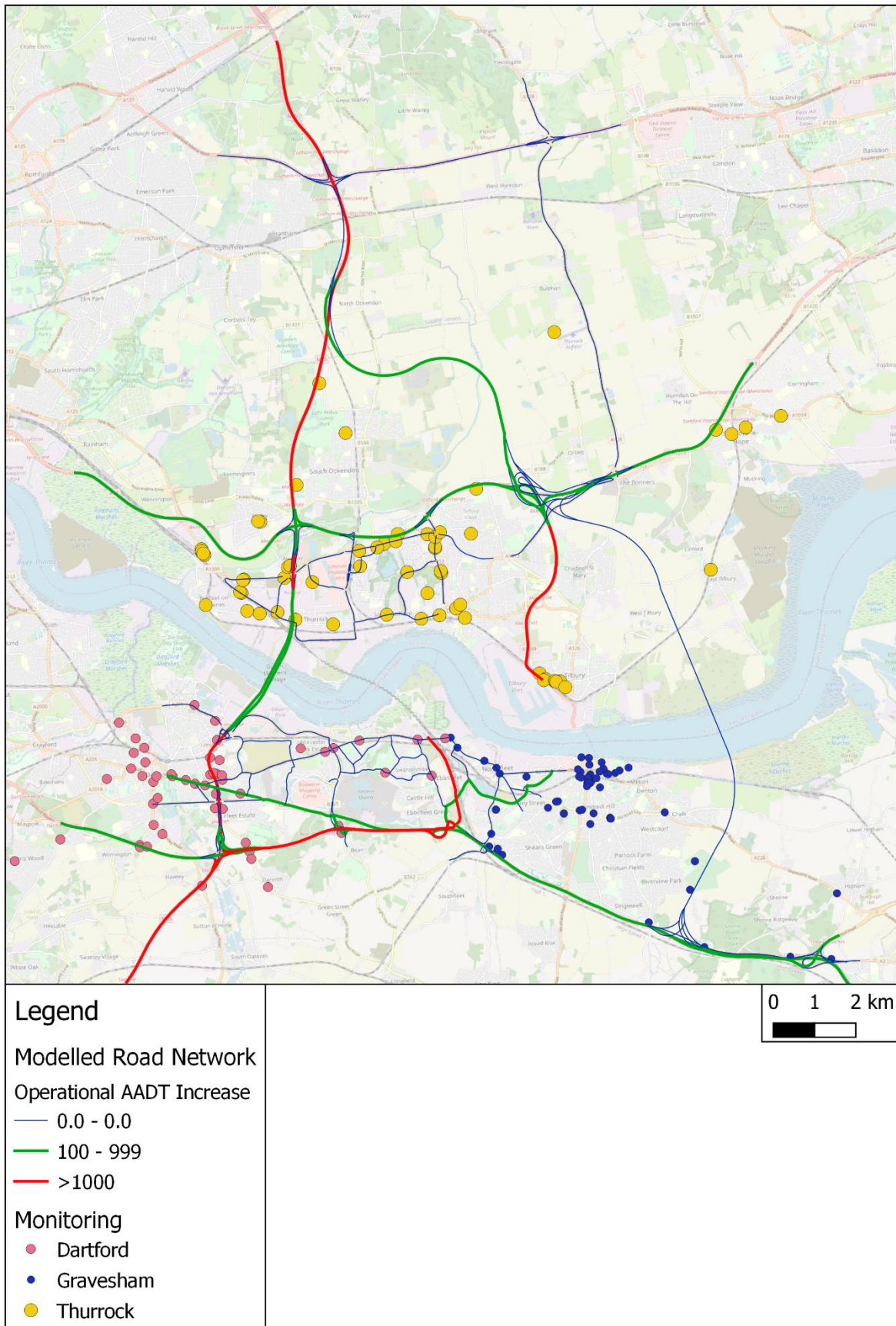


Figure 1- All Monitoring Sites within Modelled Domain

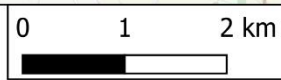
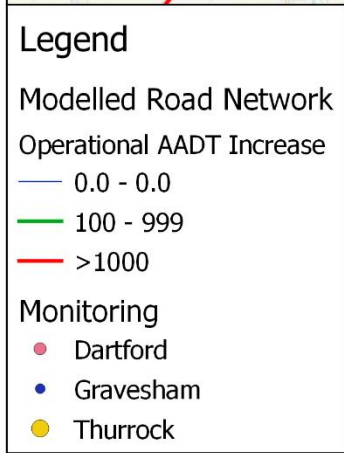
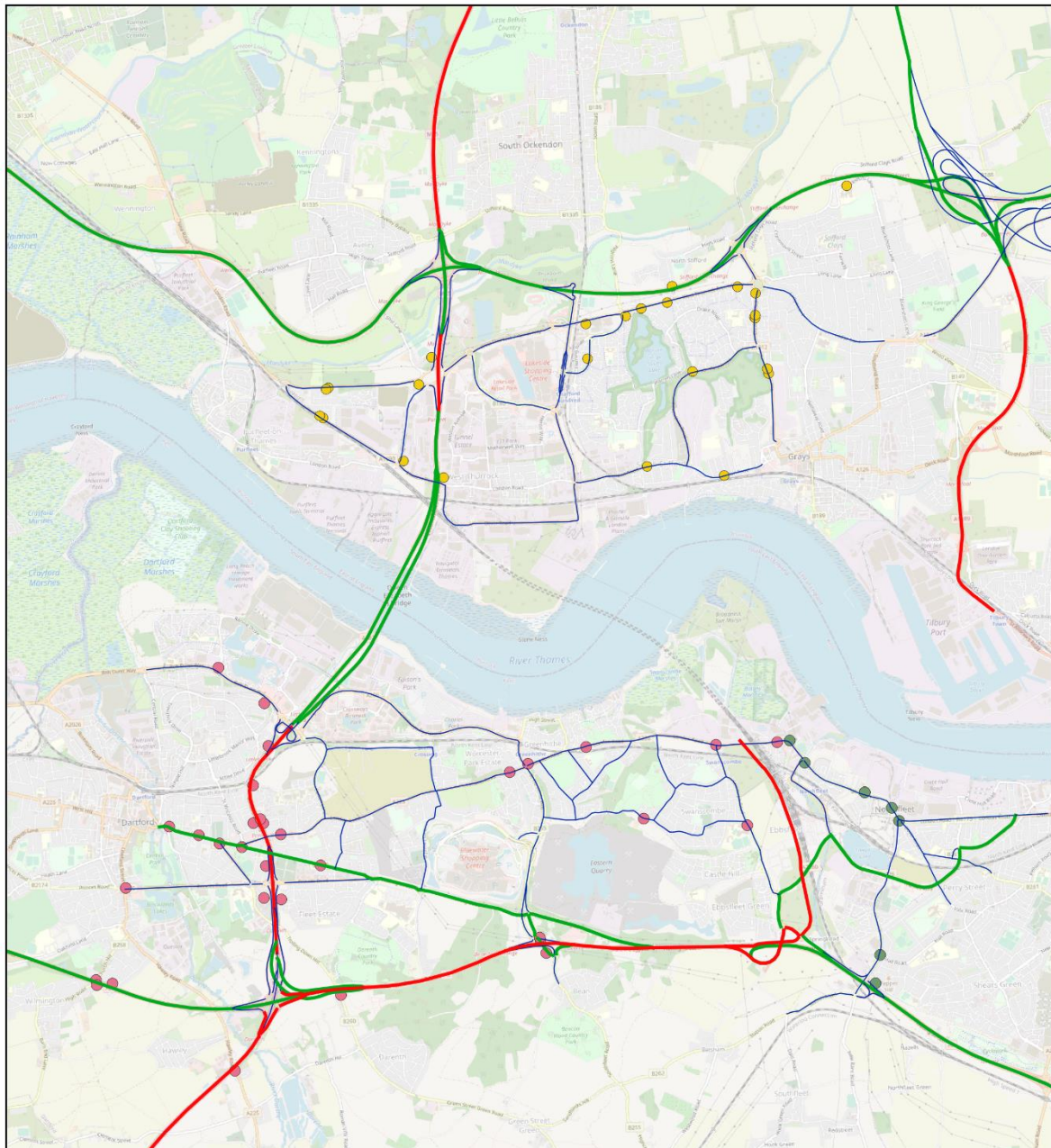
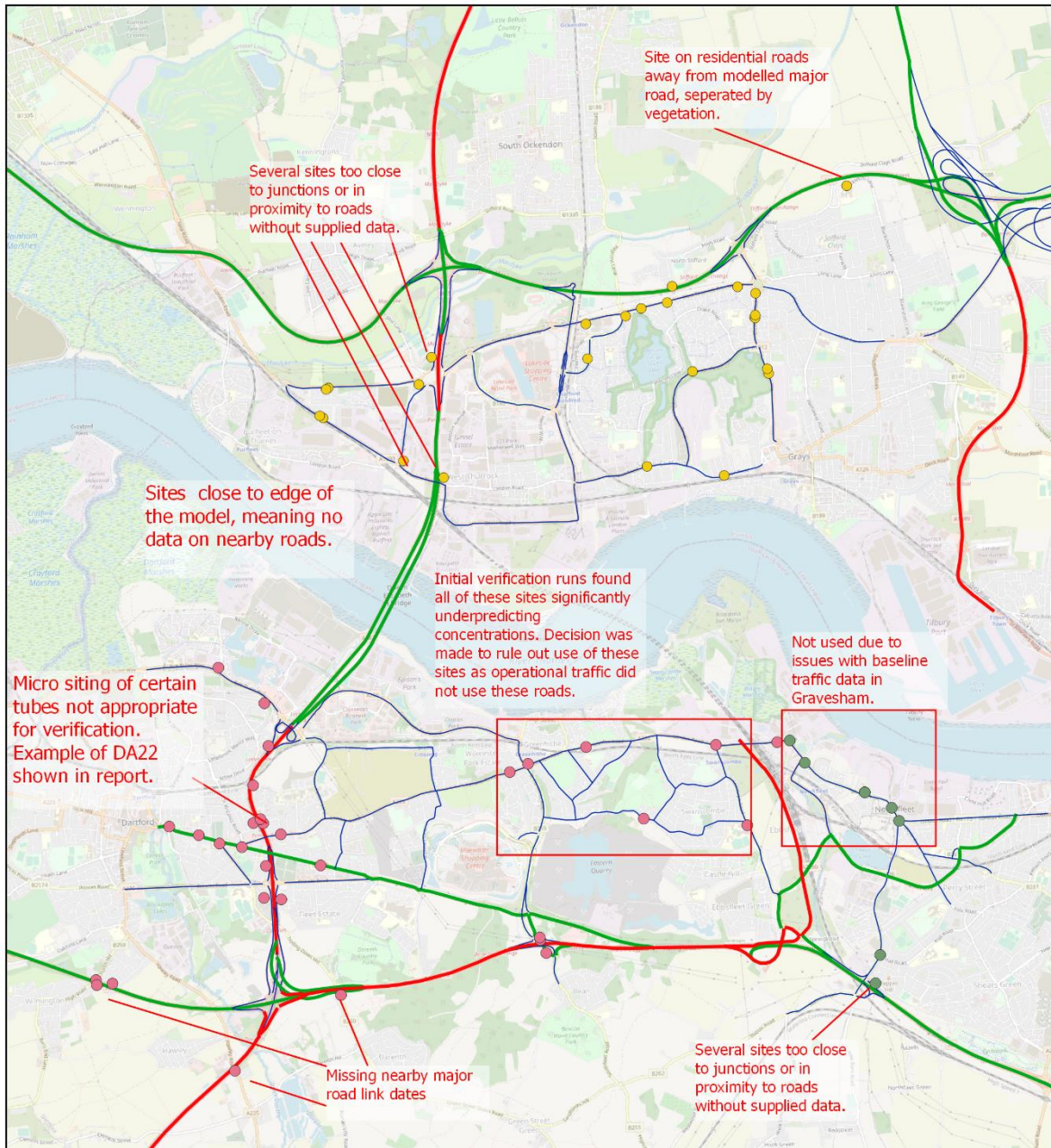


Figure 2- All Monitoring Sites within 10m of modelled road network



Legend

- Order Limits
- Modelled Road Network
- Operational AADT Increase
 - 0 -100
 - 100 - 999
 - >1000
- Monitoring
 - Dartford
 - Gravesham
 - Thurrock

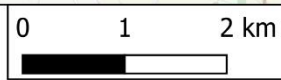


Figure 3- Marked up map

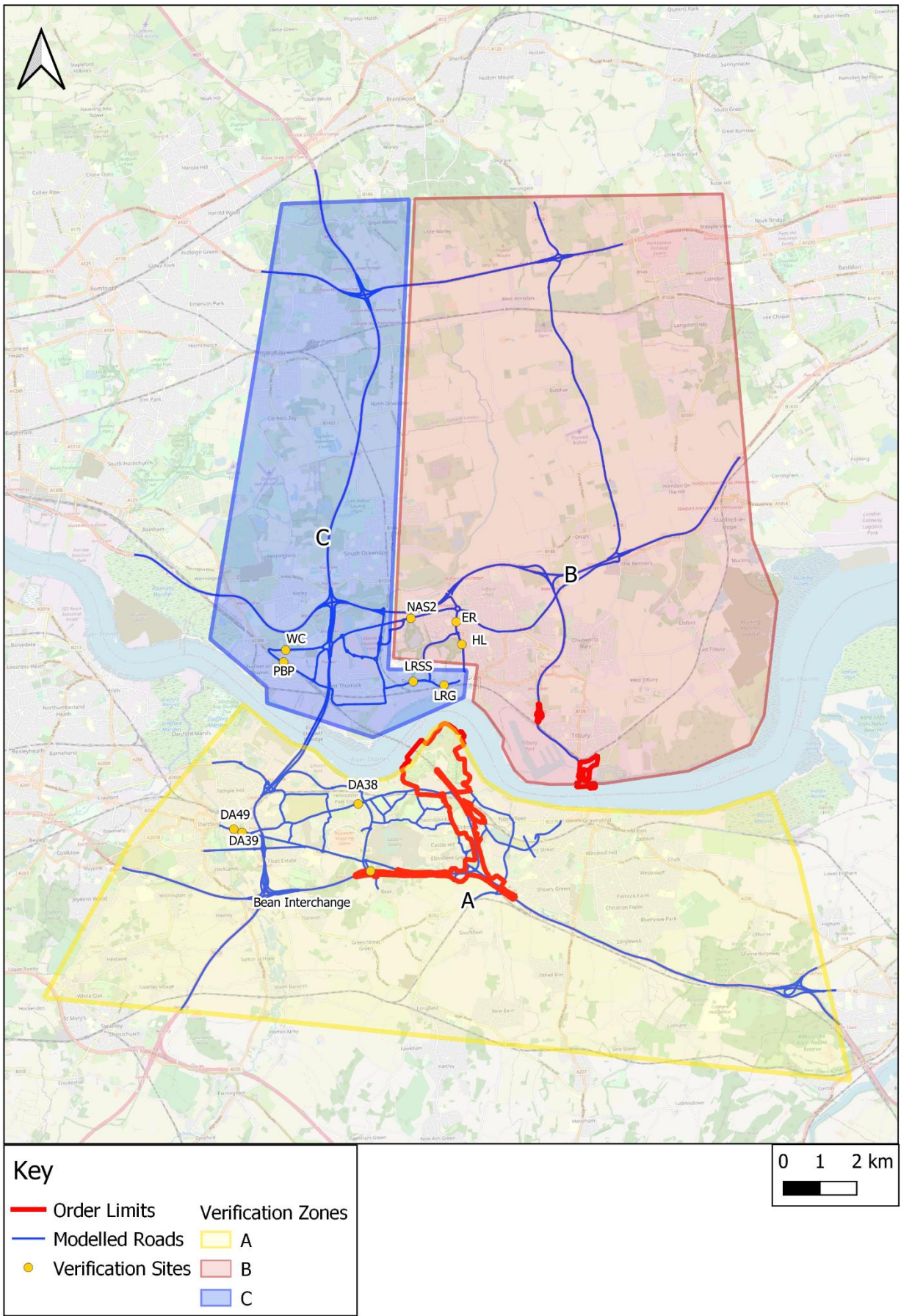


Figure 4- Verification Sites



Site located on 3-way junction with considerable queuing.

Figure 5- Micro Siting Issues DA92



Site located on adjacent residential road that is not within the modelled domain.

Figure 6- Micro Siting Issues DA22



Site located in close proximity to station taxi rank and HGV parking bay serving nearby industrial areas.

Figure 7- Micro Siting Issues TILC

Figure 8- Modelled and monitored road NO_x and Adjusted modelled road NO_x for verification zone A

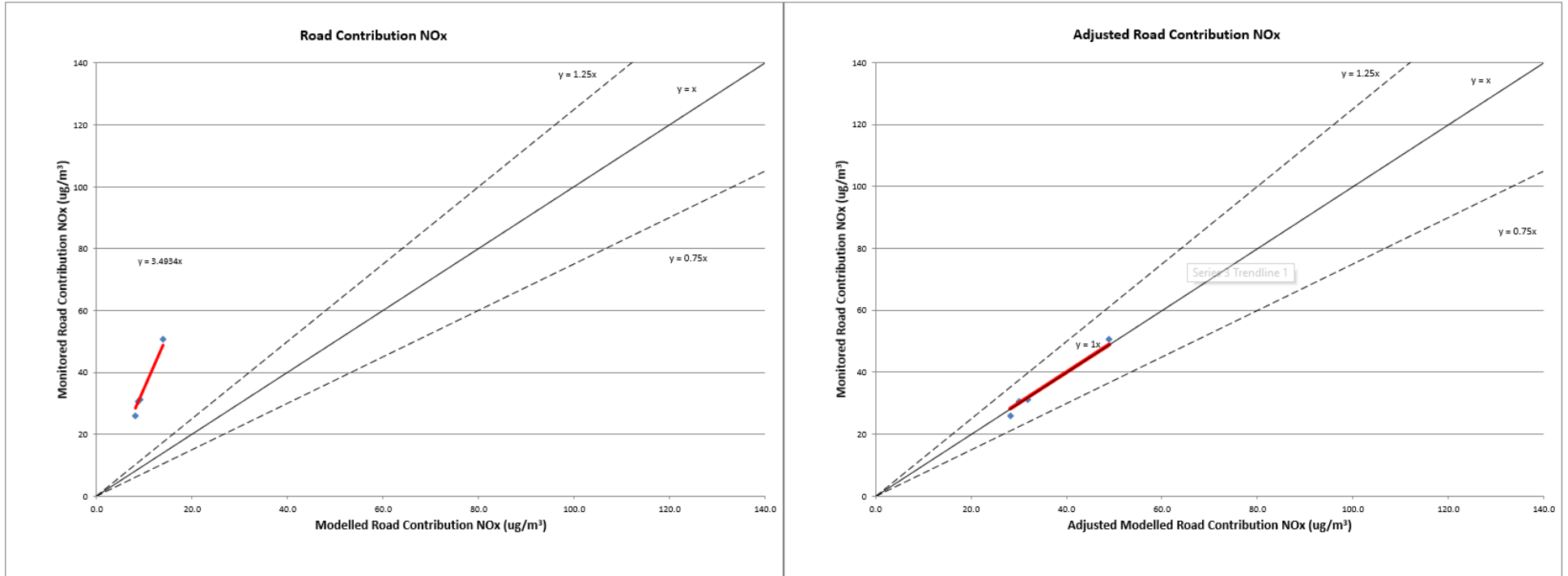


Figure 9- Modelled and monitored road NO_x and Adjusted modelled road NO_x for verification zone B

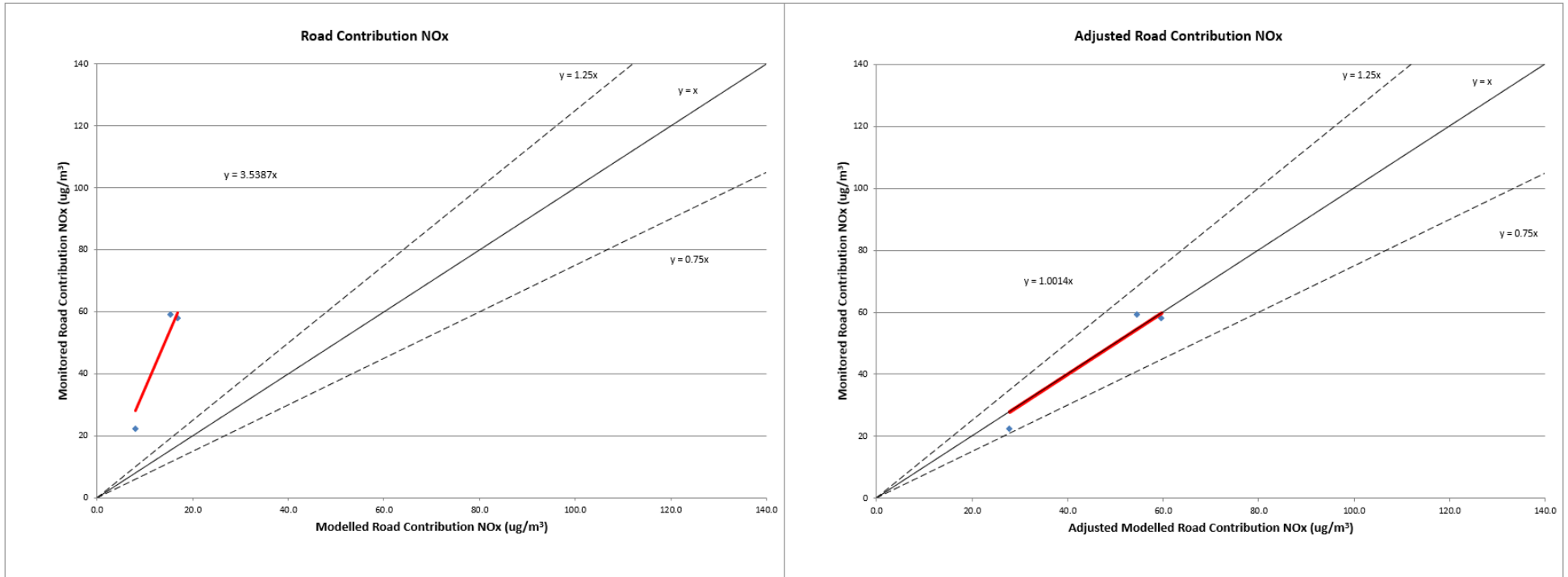


Figure 10- - Modelled and monitored road NO_x and Adjusted modelled road NO_x for verification zone C

