AURN SITE METADATA ASSESSMENT 2022

Report for the Environment Agency

Ref. EA Contract 25952 Lot 2

Ricardo ref. ED12695115 Issue: 1 15/09/2022

Ricardo Energy & Environment, Gemini Building, Fermi Avenue, Harwell, Oxfordshire, OX11 0QR, UK | +44(0)1235 75 3000 | ee.ricardo.com
Registered company no. 08229264 | VAT no. GB 212 8365 24

Customer: The Environment Agency

Customer reference: Contract 25952 Lot 2

Contact:
Paul Willis, Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK

T: +44 (0) 1235 753 639
E: paul.willis@ricardo.com

Author: Tim Bevington

Approved by: Alison Loader

Signed

Alison Loader

Ricardo reference:
ED12695115

Date:
15/09/2022

EXECUTIVE SUMMARY

The Automatic Urban and Rural Network (AURN) is the UK's largest automatic air quality monitoring network. It provides a major part of the dataset used by Defra to assess and report compliance with the air quality limit and target values of the Air Quality Standards Regulations. Monitoring sites used for this purpose must meet a range of siting criteria, which are derived from the European Union Quality Directive (2008/50/EC) (European Parliament and Council of the European Union, 2008).

This report describes a study carried out by Ricardo, to assess the AURN monitoring sites' metadata (that is, information about the site and its location), to determine whether:

1. The metadata collected when the site was first set up, or was last reviewed, are still accurate.
2. The site classification (such as 'urban traffic', 'urban background', 'industrial background', 'rural background' etc.) still correctly reflects the site's location and surroundings.
3. The site still fully meets the siting criteria of the Air Quality Directive (and therefore those of the Air Quality Standards Regulations).

The basis of this desk-based study was the use of Google Earth™ to view the AURN site locations online and assess them for compliance with the Air Quality Standards Regulations' siting criteria (as set out in Annex III of the Air Quality Directive). Ricardo also used site photographs routinely taken at previous QAQC audit visits.

The desk-based assessments were carried out shortly before the winter 2022 round of QAQC site audits (in January and February 2022), to be carried out by Ricardo in their role as AURN quality assurance and quality control (QAQC) contractor. Where the desk-based assessment had identified an issue that needed checking at the site (for example, height of the sampling inlet, concerns about encroaching vegetation or a potential nearby emission source), this was noted for checking at the forthcoming scheduled audit visit. The findings of these additional on-site checks were incorporated into the assessment.

The study carried out by Ricardo covered the 155 sites in the 'main' AURN only. The 16 sites of the Automatic London Network (ALN) were assessed separately by NPL, the QAQC contractor for the ALN. Data provided by NPL for the ALN sites has been included in this report where indicated.

This investigation found that five AURN and ALN sites appear to no longer meet the siting criteria and it is recommended consideration be given to re-locating them. At a follow-up a meeting with the Environment Agency, the Central Management and Control Unit (CMCU) and NPL, the following conclusions, and required actions, were agreed.

1. **Aberdeen Union Street Roadside**: *less than 25 m from a major junction.* The CMCU will discuss with the local authority the possibility of moving the site further from junction. Otherwise, Ricardo will explore alternative options in the Scottish Network (North East Scotland zone) which could be affiliated in its place.
2. **Billingham**: *no longer representative of public exposure.* It was agreed that there was no public access (it is in a council bin lorry depot), and that this location was unrepresentative of public exposure in the surrounding area. The inlet height of 6 m is above the specified range of 1.5 – 4 m. It is therefore recommended the site be relocated. The CMCU will investigate alternative locations within the Teesside zone (avoiding Stockton-on-Tees and Middlesbrough, both of which already have AURN sites).
3. **Nottingham Centre**: *no longer representative of public exposure*. It is affected by burger vans within metres, and has a large overhanging tree. Due to re-development of the area, which will increase the number of street food vendors, the local authority has also (and independently of this assessment) requested that the site is relocated. CMCU will liaise with the local authority to identify a new location. Some locations in nearby parks are being considered.
4. **York Fishergate**: *questionable whether it is representative of public exposure.* This urban traffic site is next to a primary school, but is on a reservation between two lanes of a city road, at the point of a pedestrian crossing. It is therefore debatable whether site is representative of public exposure. Also, it is a difficult site operationally due to access and parking difficulty. A bingo hall next to the site is now being demolished, to be replaced with student flats. It is an affiliate site, and its location next to the

school means that any question of moving it could be politically sensitive for the local authority. It is also being used for a co-location study of air quality sensors. One option would be to de-affiliate it from the AURN, and replace with another affiliate site elsewhere in the Yorkshire and Humberside zone. York City Council has several other roadside monitoring sites, some of which could be suitable alternatives. Replacement with another existing York site is the recommended option. If this is not possible, Ricardo will seek alternative affiliate candidates elsewhere in the zone: if none are found, they will approach the local authority to discuss the options.

5. **Tower Hamlets Roadside (ALN)**: *no longer representative of 100m road length.* The inlet is beside a pedestrian crossing with traffic lights, on an otherwise uninterrupted stretch of road. It is recommended the site should be relocated. The CMCU and NPL will explore options to relocate the site.

Issues have also been highlighted with the following sites. Ricardo has brought these to the attention of the Environment Agency and CMCU for discussion. Following a meeting with the Environment Agency, CMCU, NPL the following conclusions, and required actions, were agreed.

- **Chesterfield Roadside**: site is in close to a pedestrian crossing on an otherwise generally clear road. However, it was agreed that there are other street features that potentially interrupt free traffic flow, therefore it was not a clear-cut case. Ricardo agreed to monitor the data for any effects, but no immediate action is required.
- **Christchurch Barrack Road**: site is close to a bus stop: while bus frequency has greatly increased since the site was set up in 2017, Ricardo's review of the nitric oxide dataset from the site has found no evidence of the buses (such as spikes in concentration). Ricardo will keep a 'watching brief' on the site, but no immediate action is required.
- **Rochester Stoke**: rural, but within 5 km of Thamesport and two power stations. The site classification has been fully re-assessed using Ricardo's 2013 source apportionment-based method (Vincent & Stedman, 2013): this concluded that no change is needed to the current classification of rural background.
- **Sunderland Wessington Way**: Shrubs planted in recent years now forming a barrier between the road and the site. Following discussion, the CMCU agreed to explore the relocation of the site with the local authority.
- **Warrington**: the enclosure is surrounded by tall mature trees. CMCU are to investigate relocation within the school premises. Also, the site classification has been fully re-assessed using the source apportionment method: this concluded that the site classification should be changed from urban industrial to urban background.
- **Middlesbrough**: Full reassessment of the site classification using the 2013 source apportionment method above concluded that the site classification should now be changed from urban industrial to urban background.
- **Haringey Roadside (ALN)**: a metal structure has been constructed around a tree near the site (possibly as a support for the tree). Following discussion, it was agreed that air flow to the inlet was not impeded. No action needed.
- **London Eltham (ALN)**: there is an air conditioning unit outlet close to the sampling inlet. Following discussion it was agreed that the inlet is too close to the air conditioning unit, which vents into an enclosed corner. Ricardo will review the data for any evidence of the effect of the air conditioning cycling. NPL will investigate whether it is possible to relocate the inlet.

For three sites, specific actions were identified in order for the site to remain compliant with the siting criteria:

- **Bournemouth** – overhanging vegetation needed to be cut back.
- **Sunderland Silksworth** – surrounding vegetation needed to be cut back.
- **Wirral Tranmere** – overhanging tree should be pruned (though it is not suggested that the tree be removed).

These issues were referred to CMCU via the usual route.

The remaining 142 AURN sites and 13 ALN sites were found to fully meet the siting criteria and no action was required apart from in some cases minor updates to site coordinates or inlet heights.

GLOSSARY

Air Quality Directive. The European Union's Directive 2008/50/EC of 21st May 2008, on Ambient Air Quality and Cleaner Air for Europe, which is often referred to as 'the Air Quality Directive'.

Air Quality Standards Regulations. Prior to 31st January 2020, the UK was a Member State of the European Union. As such, the UK was required to incorporate - or 'transpose' - the provisions of EU Directives into their own national law by a specified date. The Air Quality Standards Regulations are the legislation by which the UK fulfilled this requirement.

ALN. Automatic London Network

Ambient Air. Outdoor air.

AURN. Automatic Urban and Rural Network

CMCU. Central Management and Co-Ordination Unit

EA. Environment Agency

LA. Local Authority

Limit value. The ***Air Quality Standards Regulations*** set 'limit values' for ambient concentrations of pollutants. Limit values are legally binding and must not be exceeded.

NPL. National Physical Laboratory

CONTENTS

Appendices

1. INTRODUCTION

1.1 BACKGROUND

The Automatic Urban and Rural Network (AURN) is the UK's largest automatic air quality monitoring network. It comprises 171 (as of 16th June 2022) automatic air quality monitoring stations in total, located in urban and rural areas throughout the UK. Data provided by the AURN form a major part of the dataset used by the Department for Environment, Food and Rural Affairs (Defra) for monitoring and reporting compliance with the Air Quality Standards Regulations.

The Air Quality Standards Regulations have their origins in the EU Air Quality Directive (AQD) 2008/50/EC (European Parliament and Council of the European Union, 2008), and set the same limit values and target values for air pollutants as those in the Directive. The Air Quality Standards Regulations also specifically require monitoring stations used for compliance monitoring purposes to meet the siting criteria set out in the Air Quality Directive (Annex VIII for ozone, Annex III for other pollutants). Therefore, these siting criteria still apply although the UK is no longer part of the European Union.

Ricardo Energy & Environment (Ricardo) is contracted to provide Quality Assurance and Quality Control (QAQC) services for 155 of the AURN monitoring stations (mostly outside of Greater London), under Lot 2 of Environment Agency contract 25952. A subset of 16 AURN sites (mostly within Greater London) are designated as the Automatic London Network and have QAQC services provided by a different contractor.

The Environment Agency (EA) has asked Ricardo Energy & Environment (Ricardo) to carry out a desk-based review of all the automatic monitoring stations (referred to here as 'sites') in the main AURN, excluding the Automatic London Network (ALN), for compliance with the siting criteria of the Air Quality Directive. The ALN sites have been assessed separately by the relevant contractor (NPL) and the metadata provided by the EA for inclusion.

1.2 AIMS AND OBJECTIVES

The aim of this study was to undertake a full assessment of each site's 'metadata' – that is, information about the site and its location – to determine whether:

1. The metadata recorded when the site was first set up, or last reviewed, are still accurate.
2. The site classification (urban, suburban or rural plus traffic-related, industrial or background – e.g. 'urban traffic') still correctly reflects the site's location and surroundings.
3. The site still fully meets the siting criteria of the Air Quality Directive (and therefore those of the Air Quality Standards Regulations).

2. METHODOLOGY

The starting point for this desk-based study was the existing AURN site metadata, which are available online, on the UK-AIR website at https://uk-air.defra.gov.uk/. As explained above, the scope of this study included all monitoring sites within the AURN, excluding the Automatic London Network (ALN). The ALN sites were assessed separately by NPL: this section describes the methodology used for the main AURN. A similar approach was taken by NPL for the ALN sites.

The work was carried out by members of Ricardo's air quality monitoring team: each team member was allocated a number of sites to review. A spreadsheet checklist template was prepared at the outset, for reference when assessing the sites and to record the results. Separate copies of the spreadsheet checklist were prepared for different site classifications - urban traffic, urban/suburban background, urban/suburban industrial and rural background. Each team member saved a copy of the relevant checklist for the sites they were asked to review.

Google Earth™ was used to look at the AURN sites online and assess them for compliance with the Air Quality Standards Regulations siting criteria (as set out in Annex III of the Air Quality Directive). Ricardo also used site photographs routinely taken at previous QAQC audit visits.

The procedure for the desk-based part of the study was as follows:

1. The AURN site was located in Google Earth™ and marked with a 'pin' place marker. The latitude and longitude were either confirmed as correct, or, if incorrect, the correct coordinates noted for update.
2. Most sites were visible in the Google Earth™ aerial views. However, some sites were not visible in Google Earth™ street view. This was usually because the site was in a location inaccessible to the Google Earth™ camera vans – for example, remote rural sites, or urban background sites in pedestrianised areas or large parks. In these cases, it was often possible to complete the assessment of parameters such as inlet height using existing photographs of the site.
3. The site's compliance with the Directive criteria were then assessed and recorded in the appropriate cells of the spreadsheet checklist. Distances from the kerb, or from the nearest major junction, were measured using measurement tool.
4. Sites were classified overall as 'Fully meets all siting criteria', 'Further checks needed' or 'No', in terms of whether they met the Directive siting criteria. The reviewer added any comments necessary, to explain their conclusion about the site, or to highlight what further checks might be needed at the forthcoming site audit visit. For example, changes to road layout that could affect the site's compliance with the siting criteria.
5. Ricardo took a relatively prescriptive approach: if it was questionable whether a site met any of the siting criteria, it was highlighted for further checks.
6. Also recorded at this stage were any updates needed – for example if the coordinates or other parameter needed correction – and any aspects that might need checking and confirmation at the next site audit, such as inlet height, free air flow around the inlet, minimum distance of 50 cm from a wall behind the inlet, or overhanging trees. *(Note: the Directive does not specifically prohibit tree branches above inlets: however, it is not good practice for the inlets to be under the drip-line of tree branches).*

Each team member's assessments were checked by another team member. Particular attention was paid to sites flagged as needing further checks, or possibly not meeting the siting criteria.

One point particularly noted was the Directive's Annex IIIA, item (a). This is the requirement for the site to be in a location which has public access, and/or fixed habitation. In relation to this:

- We took the view that sites on the premises of schools, colleges and universities *did* count as having public access, since the students are members of the public.
- We took the view that sites in public areas such as parks *did* still count as having public access even if fenced off from the park itself (e.g., surrounded by a security fence), since they are representative of the surroundings.
- Some rural sites are within farm fields, which may not have public access. These were reviewed on a case-by-case basis but in general we took the view that if the site was representative of the surrounding wider area which did have public access (e.g., nearby houses or villages), the rural site met the criteria.

Also noted was the fact that the Directive contains two siting criteria that appear contradictory - Annex IIIB, (a) and (b):

- There must be monitoring "*in the area within the zone or agglomeration where the highest concentrations occur to which the population is likely to be directly or indirectly exposed for a period which is significant in relation to the averaging period of the limit value(s)*"
- But also "*in an area within the zone or agglomeration which is representative of the exposure of the general population*".

Our interpretation is that these requirements relate to the network as a whole, rather than any one individual site having to meet both of these criteria. However, each site should meet at least one, and the network as a whole should be comprised of sites which fulfil these requirements.

The siting criteria for all pollutants other than ozone are set out in Annex III of the Air Quality Directive. However, for ozone there is a separate set of site classifications, with additional ozone-specific siting criteria, set out in Annex VIII of the Directive. For operational purposes (to avoid the potential confusion of having two classifications and because few sites measure ozone only), AURN sites are classified according to the Annex III siting criteria. In this study, the sites have therefore been assessed only against the Annex III criteria.

It should be noted however that for ozone, there are two distinct rural classifications: 'rural', and the more remote 'rural background'. The latter has more stringent requirements regarding factors such as distance from urban areas, than the Annex III 'rural background' classification. In much of the UK, particularly in the south, there are few areas that meet these criteria, in particular the requirement to be "*at least 20 km from urban and industrial areas…*". Most AURN sites classified 'rural background' according to Annex III would only meet the less stringent 'rural' classification requirements of Annex VIII.

The desk-based assessments were carried out shortly before the winter 2022 round of QAQC site audits (in January and February 2022). Before each week's audits, the site auditors were provided with a list of any questions arising from the desk-based assessments, things to check during their visit to the site (such as inlet height or distance from kerb), and requests for updated photos to be taken where necessary. (All site visits were routine scheduled site audits which form part of the AURN's QAQC: no additional visits were carried out solely for the purpose of this study).

Following the site visits, the team met in an online 'Quality Circle'-type meeting to agree a consensus for the sites which had required further checks.

Having delivered the draft report and conclusions, a follow-up meeting with the EA, Bureau Veritas (the Central Management and Control Unit - CMCU) and NPL, to discuss and agree the actions needed.

3. RESULTS AND DISCUSSION

In the desk-based study, 52 of the AURN sites reviewed in this study were judged to fully meet the siting criteria of the Air Quality Directive (and therefore the Air Quality Standards Regulations), without any further checks. Also, all site metadata parameters were correct and up to date, and no change was needed to the site classification. For these sites, which are listed in Appendix 1, no further checks were required, and no follow-up action is needed.

This section presents the findings for the sites which did require further checks, at site audit or otherwise.

The issues identified in this study tended to be grouped into several main topics:

1. Site coordinates or other parameters needing update.
2. Whether the site classification was still valid.
3. Distance from the nearest major junction (which must be a minimum of 25 m.)
4. Impacts of localised sources, which could call into question whether the site is representative of the relevant area: a road length of at least 100 m for a traffic site, an area of 250 m x 250 m for an industrial site and an area of several km^2 for a background site.
5. Inlet issues. For example, inlets that might be less than the minimum 1.50 m from the ground, less than 50 cm from any wall behind, or affected by air conditioning units on top of the roof.
6. Overhanging trees or overgrowing vegetation around the inlet.
7. Whether the site met the requirement for having public access.
8. Other issues.

The following 51 sites required updates to latitude and longitude, inlet height or other parameters. Updates to coordinates were usually minor – a few metres or tens of metres – and arose not because the site had moved, but because it is now possible to pinpoint the location more accurately than when the site was first set up.

- Birkenhead Borough Road: location updated to 53.388624, -3.024942, inlet height updated to 1.75 m
- Birmingham A4540 Roadside: inlet height updated to 3m, location updated to 52.476145, -1.874978
- Birmingham Ladywood: inlet height updated to 3 m
- Blackburn Accrington Road: location updated to 53.747763, -2.452680, inlet height updated to 2.71 m
- Blackpool Marton: inlet height updated to 2.9 m
- Bradford Mayo Avenue: inlet height updated to 2 m

- Burton-on-Trent Horninglow: inlet height updated to 1.85 m
- Cannock A5190 Roadside: inlet height updated to 2 m
- Cardiff Centre: inlet height updated to 3.1 m
- Carlisle Morton A595: updated inlet heights to 2.4 m for NOx and 2.7 m for PM.
- Chesterfield Loundsley Green: inlet height updated to 2.7 m
- Chesterfield Roadside: location updated to 53.231751, -1.456928
- Coventry Allesley: location updated to 52.411628, -1.560189
- Cwmbran Crownbridge: updated inlet height to 3.6 m
- Dewsbury Ashworth Grove: inlet height updated to 1.5 m
- Doncaster A630 Cleveland Street: inlet height updated to 1.7 m, location updated to 53.518383, -1.13806
- Dumbarton Roadside: updated distance to kerb to 4.6 m
- Eastbourne: inlet height updated to 3.5 m
- Glasgow Kerbside: location updated to 55.858940, -4.259122
- High Muffles: location updated to 54.334497, -0.808820, inlet height updated to 2.9 m
- Hull Freetown: inlet height updated to 3.05 m
- Hull Holderness Road: location updated to 53.759013, -0.305678
- Immingham Woodlands Avenue: inlet height updated to 2.8 m
- Leeds Centre: inlet height updated to 3.2 m
- Leeds Headingley Kerbside: inlet height updated to 2.56 m
- Leicester A594 Roadside: location updated to 52.638742 -1.124267
- Leicester University: location updated to 52.619904, -1.127182
- Leominster: location updated to 52.221593, -2.736840
- Lincoln Canwick Road: location updated to 53.221432, -0.534204
- Manchester Piccadilly: inlet height updated to 3.7 m
- Manchester Sharston: inlet height updated to 2.75 m
- Narbeth: location updated to 51.782616, -4.692370, outdated site observations on UK-AIR updated.
- Newport: inlet height updated to 3 m
- Norwich Lakenfields: location updated to 52.614823, 1.302686
- Oldbury Birmingham Road: inlet height updated to 2.8 m
- Portsmouth Anglesea Road: location updated to 1.5 m, distance to kerb updated to 2 m
- Scunthorpe Town: location updated to 53.586340, -0.636811
- Shaw Crompton Way: location updated to 53.579227, -2.093844
- Sheffield Devonshire Green: inlet height updated to 2.7 m, location updated to 53.378622, -1.478096
- Southampton Centre: location updated to 50.908173, -1.395757, inlet height updated to 3 m
- Southend-on-Sea: location updated to 51.544166, 0.678331
- St Helens Linkway: inlet height updated to 2.5 m
- St Osyth: location updated to 51.777874, 1.04901
- Telford Hollinswood: inlet height updated to 1.85 m
- Walsall Woodlands: location updated to 52.605641, -2.030371
- Warrington: location updated to 53.389225, -2.615593
- West Bromwich Kenrick Park: location updated to 52.508342, -1.98607, inlet height to 1.75 m
- Widnes Milton Road: Site description updated to remove reference to ‘mobile unit’ as this has now been replaced with a permanent enclosure
- Wigan Centre: inlet height updated to 2.85 m

- Wirral Tranmere: inlet height updated to 2.5 m
- Wrexham: location updated to 53.042282, -3.002829

These changes were made both in Ricardo's data handling system and in the UK-AIR database.

The following sites required update of site classification, because the nature of the area surrounding the site had changed since the site was set up or last reviewed:

- Grangemouth Moray: classification in Ricardo data handling system updated from Urban Background to Urban Industrial to agree with UK-AIR.
- Peebles: Classification in Ricardo data handling system updated from Suburban Background to Urban Background to agree with UK-AIR.

Results from the 70 monitoring sites requiring further investigation are shown in the following tables. The sites discussed at the quality circle are grouped by similar potential issues in Table 3-1 to Table 3-5. (Please note that some of these sites also appear in the list above because they also needed metadata updates.)

Following this process, it was concluded that a further 57 sites were fully compliant with the siting criteria, and no action was needed – apart from metadata updates where necessary, and cutting back of vegetation in three cases. These are also shown in Appendix 1 but listed separately.

Sites considered potentially non-compliant with the siting criteria are shown in **bold font**. These were discussed with the Environment Agency and with the Central Management and Control Unit for the AURN (Bureau Veritas), to agree a consensus and potentially make plans to re-locate the site somewhere suitable.

Sites for which concerns remained, and further discussion was required, or actions needed, are shown in *italics*.

In three such cases, Middlesbrough, Rochester Stoke and Warrington, this metadata assessment raised the question of whether the site's classification needed updating, due to an increase or decrease in industrial activity in the surrounding area. These three specific cases were addressed by applying a source apportionm*ent-based method originally used in 2013 by Ricardo's Pollution Climate and Mapping team (Vincent & Stedman, 2013).*

Table 3-1 shows cases where the main concern was whether the site was at least 25 m from a major junction, within 10 m of the kerb of a major road (for an urban traffic site) or at least 10 m from the kerb (for a background site). Some had other issues too, such as overhanging trees, or proximity to a bus stop.

Table 3-1 Distance from Major Road Junctions, Kerb or Other Road Features

Site Name	*Site Type*	*Lat °*	*Lon °*	*Pollutants Measured*	*Further Checks Carried Out*	*Assessment Conclusion*
Aberdeen Union Street Roadside	**Urban Traffic**	**57.144555**	**-2.106472**	***NO_x***	**Site confirmed to be within 25 m of a major junction. (It is 17m from a box junction with traffic lights, considered likely to interrupt traffic flow). Site was affiliated to the AURN in 2008, before the EU's 2014 clarification of what constituted a 'major' junction.**	**Non-Compliant**
Armagh Roadside	Urban Traffic	54.353728	-6.654558	*NO_x*	Close to petrol station – not an issue. Within 25 m of a junction but this is not considered a major junction. Tree overhanging the site that will require trimming.	Fully Meets Siting Criteria
Chepstow A48	Urban Traffic	51.638094	-2.678731	*NO_x*, *$PM_{2.5}$*	Close to the junction with Bulwark Road: junction confirmed as minor and will not affect traffic flow.	Fully Meets Siting Criteria
Chesterfield Roadside	*Urban Traffic*	*53.231751*	*-1.456928*	*NO_x*, *PM_{10}*, *$PM_{2.5}$*	*Highlighted for discussion as close to a pedestrian crossing. Otherwise, a good site, and representative of road and of public exposure. Further discussion concluded there were other features on the road which could affect traffic flow. No action needed.*	*Fully Meets Siting Criteria*
Glasgow High Street	Urban Traffic	55.860936	-4.238214	*NO_x*, *$PM_{2.5}$*	Close to bus stop but considered to be minor and a sufficient distance from the site.	Fully Meets Siting Criteria
Southampton Centre	Urban Background	50.90814	-1.395778	*NO_x*, *SO_2*, *PM_{10}*, *$PM_{2.5}$*	Close to major junction but greater that 25 m. Site more than 10 m from kerbside.	Fully Meets Siting Criteria
Stoke-on-Trent Centre	Urban Background	53.02821	-2.175133	*NO_x*, *O_3*, *PM_{10}*, *$PM_{2.5}$*	<10 m from kerb of road, but road considered minor. Large tree within 5 m of the site but not impacting dispersion or overhanging. Meets criteria but potential for more representative urban background sites within Stoke.	Fully Meets Siting Criteria
Wrexham	Urban Traffic	53.04222	-3.002778	*NO_x*, *PM_{10}*, *$PM_{2.5}$*	Close to traffic lights preceding major junction but distance greater than 25 m.	Fully Meets Siting Criteria

Site Name	*Site Type*	*Lat °*	*Lon °*	*Pollutants Measured*	*Further Checks Carried Out*	*Assessment Conclusion*
York Fishergate	**Urban Traffic**	**53.951889**	**-1.075861**	**NO_x, PM_{10}, $PM_{2.5}$**	**Site on reservation between two lanes of a road, at the point of a crossing. Also, within 30 m of a major junction. Parking an issue for site visitors. Probably intended to be representative of exposure in the nearby school, but questionable whether this is the case. Potentially requires relocation.**	**Compliance questionable.**

Table 3-2 shows cases where there were concerns whether the site was representative of the relevant road length, or area. For traffic sites, this is a road length of at least 100 m. There might be concerns if the site was next to e.g., a bus stop or pedestrian crossing, if this was likely to interrupt traffic flow on an otherwise clear section of road. An industrial site should be representative of an area at least 250 m x 250 m, and a background site should be representative of several km^2.

Table 3-2 Impact of Local Sources

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Christchurch Barrack Road	*Urban Traffic*	*50.735454*	*-1.780888*	*NO_x, $PM_{2.5}$*	*Close to a busy bus stop (typically 11 buses per hour during 09:00 – 17:00.) Original site set-up notes say the bus stop was only used on market days, so bus traffic has clearly increased substantially. However, no evidence of effects of buses is seen in NO 15-minute dataset. No action needed.*	*No action needed.*
Glasgow Kerbside	Urban Traffic	55.85917	-4.258889	NO_x, PM_{10}, $PM_{2.5}$	Site on Hope St next to Glasgow Central station, with lots of taxis idling. Considered to be representative of the street section.	Fully Meets Siting Criteria
Grangemouth	Urban Industrial	56.010319	-3.704399	NO_x, SO_2, PM_{10}, $PM_{2.5}$	Following discussion agreed that the site is representative of air quality for at least 250 m × 250 m at industrial site.	Fully Meets Siting Criteria
Grangemouth Moray	Urban Industrial	56.013142	-3.710833	NO_x	Following discussion agreed that the site is representative of air quality for at least 250 m × 250 m at industrial site.	Fully Meets Siting Criteria

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Immingham Woodlands Avenue	Urban Background	53.619241	-0.213324	NO_x	Industrial area within 1 km to the north-east of the site. Site considered to be representative of the area and Urban Background.	Fully Meets Siting Criteria
Leicester University	Urban Background	52.619823	-1.127311	NO_x, O_3, PM_{10}, $PM_{2.5}$	Concern raised about the proximity to swimming pool vents. Further investigation concluded that any emissions of chlorine from the pool were not considered likely to impact on any pollution measurements.	Fully Meets Siting Criteria
Lough Navar	Rural Background	54.43951	-7.900328	03, PM_{10}, $PM_{2.5}$	Close to road but road considered minor so not impacting classification. Overhanging vegetation requires cutting back.	Fully Meets Siting Criteria
Manchester Piccadilly	Urban Background	53.48152	-2.237881	NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Increased number of street food stalls close to the site, from 20 m. No evidence of the impact of the food stalls found in the data. Considered to be representative.	Fully Meets Siting Criteria
Manchester Sharston	Suburban Background	53.371722	-2.238917	NO_x, O_3	Airport 1.5 km south-west of site. Following discussion Suburban Background was agreed to be the correct site type.	Fully Meets Siting Criteria
Middlesbrough	*Urban Industrial*	*54.569297*	*-1.220874*	*NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$*	*Industrial site 500 m to the North. Following discussion agreed that the site is representative of air quality for at least 250 m × 250 m. Site classification re-assessed due to reduction in industrial activity in the area; contribution from industrial sources has decreased and requires changing to urban background.*	*Fully Meets Siting Criteria. Update site classification.*
Nottingham Centre	**Urban Back-ground**	**52.95473**	**-1.146447**	**NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$**	**Recommended to be moved as not representative of public exposure. Tall buildings on either side form a canyon, there are nearby burger vans, an overhanging tree and questionable whether it is representative of public exposure. Council also wishes to move it, as part of the redevelopment of the area. Relocation process started.**	**Non-Compliant**
Oldbury Birmingham Road	Urban Traffic	52.502436	-2.003497	NO_x	Question over classification, due to industrial area close to the site. Site concluded to be representative of the area and Urban Traffic classification.	Fully Meets Siting Criteria
Plymouth Centre	Urban Background	50.37167	-4.142361	NO_x, O_3, PM_{10}, $PM_{2.5}$	Concern about street food stalls. Site visit confirmed food stalls just sold ice cream, therefore not of concern.	Fully Meets Siting Criteria

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Rochester Stoke	*Rural Background*	*51.45617*	*0.634889*	*NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$*	*Site within 5 km of Thamesport and two power stations. Site classification fully re-assessed using source apportionment method, which confirmed it still meets the siting criteria for a rural background site.*	*Fully meets siting criteria. No change to site classification.*
Saltash Callington Road	Urban Traffic	50.411463	-4.227678	PM_{10}, $PM_{2.5}$	Close to bus stop and mini roundabout. Bus stop considered to have a minor impact - on the other side of the road and in a bay.	Fully Meets Siting Criteria
Shaw Crompton Way	Urban Traffic	53.579218	-2.093846	NO_x	Site visit found no obvious sources for 'midnight' spikes observed in the NOx data for many years.	Fully Meets Siting Criteria
Sheffield Tinsley	Urban Background	53.41058	-1.396139	NO_x	Motorway 100 m from the site and industrial area within 1 km. Site considered to be representative of the area and Urban Background. Air conditioning unit on roof of the site but not impacting flow of air to the inlet.	Fully Meets Siting Criteria
Telford Hollinswood	Urban Background	52.673471	-2.436692	NO_x	Large industrial area 500 m to the north-east of the site but does not appear to include major point sources. Representative.	Fully Meets Siting Criteria
West Bromwich Kenrick Park	Urban Background	52.508337	-1.986008	NO_x	Large industrial area 130 m to the south. Site considered to be representative of the area and Urban Background classification.	Fully Meets Siting Criteria
Wicken Fen	Rural Background	52.2985	0.290917	NO_x, SO_2, O_3	Previous concerns about potential local SO_2 source resulting in data spikes. No nearby sources identified during site visit.	Fully Meets Siting Criteria

Table 3-3 below shows cases where there were issues concerning the inlet. These included concerns about air conditioning units on the roof potentially affecting the inlet, and issues of inlet height.

Table 3-3 Inlet Issues

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Ballymena Antrim Road	Urban Traffic	54.851491	-6.274961	NO_x	Inlet height was confirmed to be greater than 1.5 m at site visit.	Fully Meets Siting Criteria
Ballymena Ballykeel	Urban Background	54.861595	-6.250873	NO_x, SO_2	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Barnsley Gawber	Urban Background	53.56292	-1.510436	NO_x, O_3, SO_2	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Belfast Stockman's Lane	Urban Traffic	54.572586	-5.974944	NO_x, PM_{10}	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Cambridge Roadside	Urban Traffic	52.20237	0.124456	NO_x	Inlet height 4.2 m, so slightly above maximum, but this is still allowed by criteria. 60 cm from façade.	Fully Meets Siting Criteria
Chesterfield Loundsley Green	Urban Background	53.244131	-1.454946	NO_x, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Dumfries	Urban Traffic	55.070033	-3.614233	NO_x	Inlet location was confirmed to be hidden in light pillar beside building entrance. It was confirmed that the open structure of the pillar allowed free flow of air to the inlet, and that the inlet was over 1.5 m above ground.	Fully Meets Siting Criteria
Exeter Roadside	Urban Traffic	50.725083	-3.532465	NO_x, O_3	Inlet in metal post near building entrance. Confirmed at audit that the inlet is greater than 50 cm from wall.	Fully Meets Siting Criteria
Fort William	Suburban Background	56.82266	-5.101102	NO_x, O_3	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Glasgow Townhead	Urban Background	55.865782	-4.243631	NO_x, O_3, PM_{10}, $PM_{2.5}$	Aircon unit on roof: confirmed that this is > 50 cm from the inlet and positioned so as not to blow air from the enclosure towards the inlets. No action required.	Fully Meets Siting Criteria
Inverness	Urban Traffic	57.481308	-4.241451	NO_x, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Lincoln Canwick Road	Urban Traffic	53.221373	-0.534189	NO_x	Confirmed at audit that the inlet is greater than 50 cm from wall.	Fully Meets Siting Criteria

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Newcastle Cradlewell Roadside	Urban Traffic	54.986405	-1.595362	NO_x, PM_{10}	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Oxford Centre Roadside	Urban Traffic	51.751745	-1.257463	NO_x	Confirmed at audit that the inlet is greater than 50 cm from wall.	Fully Meets Siting Criteria
Peebles	Urban Background	55.657472	-3.196527	NO_x, O_3	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Sheffield Devonshire Green	Urban Background	53.378622	-1.478096	NO_x, O_3, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet. Within small car park, but this is not considered a dominant source.	Fully Meets Siting Criteria
Southend-on-Sea	Urban Background	51.544206	0.678408	NO_x, O_3, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Stockton-on-Tees Eaglescliffe	Urban Traffic	54.516667	-1.358547	NO_x, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet. Road opposite the site not considered to be a major junction.	Fully Meets Siting Criteria
Walsall Woodland	Urban Background	52.605621	-2.030523	NO_x, O_3	Inlet height was confirmed to be greater than 1.5 m at site visit.	Fully Meets Siting Criteria
York Bootham	Urban Background	53.967513	-1.086514	NO_x, PM_{10}, $PM_{2.5}$	Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet. Site also within a car park, considered to be minor due to size and configuration.	Fully Meets Siting Criteria

Table 3-4 shows cases where vegetation was a concern: either large trees overhanging the inlet, or surrounding bushes, shrubs or hedges growing around the enclosure and potentially affecting free flow of air.

Table 3-4 Encroaching or Overhanging Vegetation

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Blackpool Marton	Urban Background	53.80489	-3.007175	NO_x, O_3, PM_{10}, $PM_{2.5}$	Site visit confirmed inlet clear of vegetation, and no overhanging trees.	Fully Meets Siting Criteria
Bournemouth	*Urban Background*	*50.73957*	*-1.826744*	*NO_x, O_3, $PM_{2.5}$*	*Site visit confirmed that inlet is clear of vegetation. There is an overhanging tree: this has recently been cut back but inlet may still be under drip line of a branch. Aircon unit is on roof, but is more than 50 cm from the inlet and positioned so flow of air does not impact inlet.*	*Tree Pruning Required.*
Canterbury	Urban Background	51.27399	1.098061	NO_x, O_3	Confirmed at audit that vegetation was no longer covering the site.	Fully Meets Siting Criteria
Hull Freetown	Urban Background	53.74878	-0.341222	NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Site visit confirmed inlet clear of vegetation, and no overhanging trees.	Fully Meets Siting Criteria
Leamington Spa Rugby Road	Urban Traffic	52.294884	-1.542911	NO_x, $PM_{2.5}$	Site visit confirmed inlet clear of vegetation, and no overhanging trees.	Fully Meets Siting Criteria
Leominster	Suburban Background	52.22174	-2.736665	NO_x, O_3	Site visit confirmed inlet clear of vegetation, and no overhanging trees, although trimming of trees required soon.	Fully Meets Siting Criteria
London Bloomsbury	Urban Background	51.52229	-0.125889	NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Confirmed at audit that there is no issue with vegetation covering inlet.	Fully Meets Siting Criteria
London Westminster	Urban Background	51.49467	-0.131931	NO_x, O_3, $PM_{2.5}$	Confirmed at audit that there is no issue with vegetation covering inlet. Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet.	Fully Meets Siting Criteria
Lullington Heath	Rural Background	50.79370	0.181250	NO_x, O_3, SO_2,	Site surrounded by bushes. Following site visit inlets judged to be clear for free-flowing air.	Fully Meets Siting Criteria
Newcastle Centre	Urban Background	54.97825	-1.610528	NO_x, O_3, PM_{10}, $PM_{2.5}$	Trees planted in 2006 as saplings have grown and matured, and now form a barrier between the site and the road. There are also bushes surrounding the site on two sides, though these are kept cut back. The site itself is not overhung by	Fully Meets Siting Criteria

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
					trees, and they do not appear to affect free flow of air to the site. The site is urban background rather than urban traffic, therefore the trees between the site and the road is not considered a major issue. No clear evidence in the dataset that the trees have impacted concentrations over the years.	
Oxford St Ebbes	Urban Background	51.744806	-1.260278	NO_x, PM_{10}, $PM_{2.5}$	Confirmed at audit that surrounding trees have been trimmed.	Fully Meets Siting Criteria
Portsmouth	Urban Background	50.82881	-1.068583	NO_x, O_3, PM_{10}, $PM_{2.5}$	Site surrounded by vegetation. Following site visit inlets judged to be clear for free-flowing air.	Fully Meets Siting Criteria
Sunderland Silksworth	*Urban Background*	*54.88361*	*-1.406878*	*NO_x, O_3, PM_{10}, $PM_{2.5}$*	*Location meets criteria, surrounding vegetation requires cutting back.*	*Vegetation Pruning Required.*
Sunderland Wessington Way	*Urban Traffic*	*54.91839*	*-1.408391*	*NO_x*	*Bushes have been planted between monitoring site and the road since site installation. These potentially affect monitoring of pollutant concentrations from traffic sources. Assess potential for removing vegetation or relocation of site.*	*Approach LA regarding relocation of site.*
Warrington	*Urban Industrial*	*53.38928*	*-2.615358*	*NO_x, PM_{10}, $PM_{2.5}$*	*Trees are clear of inlets and not overhanging, but site is very enclosed by trees. Aircon unit on roof. More than 50 cm from the inlet and positioned so flow of air does not impact inlet. Industrial area 600 m to the south-east. Site classification re-assessed due to decrease in local industrial activity and should now be changed to urban background.*	*Approach LA regarding relocating elsewhere on school site, away from trees. Update site classification to urban background.*
Wirral Tranmere	*Urban Background*	*53.37287*	*-3.022722*	*NO_x, O_3, PM_{10}, $PM_{2.5}$*	*Inlet within the dripline of a large overhanging tree, ~5 m above the inlet. Cut back required, if possible.*	*Tree Pruning Required*

Table 3-5 shows sites with concerns about public access, and other miscellaneous issues.

Table 3-5 Public Access and Other Issues

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Carried Out	Assessment Conclusion
Auchencorth Moss	Rural Background	55.79216	-3.2429	O_3, PM_{10}, $PM_{2.5}$	Farm and house 350 m to the north-east of the site. Issues with farm emissions considered to be rare. Site is representative of the surrounding area.	Fully Meets Siting Criteria
Billingham	**Urban Industrial**	**54.60537**	**-1.275039**	**NO_x**	**Site pre-dates Directive requirements. Previous industrial sources are no longer present. Currently located in a council bin lorry depot, therefore not representative of surroundings. No public access to the location. Inlet height is 6 m, well above the maximum of 4 m. Long history of data from the site (since 1987), but it no longer appears to meet siting criteria.**	**Non-Compliant**
London Teddington Bushy Park	Urban Background	51.425286	-0.345606	PM_{10}, $PM_{2.5}$	No public access directly to the site, however it is considered to be representative of the surrounding area including neighbouring park.	Fully Meets Siting Criteria
Narbeth	Rural Background	51.781784	-4.691462	NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$	Information on UK-AIR mentioned an issue with surrounding farm buildings. However, this was out of date, as site has since been relocated a small distance. UK-AIR has been updated.	Fully Meets Siting Criteria
Widnes Milton Road	Urban Traffic	53.365391	-2.73168	NO_x	Site not located on an A-road but still considered to meet siting criteria. Inlet confirmed to be greater than 50 cm from the wall.	Fully Meets Siting Criteria

Data for sites in the ALN were provided by NPL (the QAQC contractor for the ALN sites.) Sites with no issues or actions needed are listed in Appendix 1 as a separate list. Table 3-6 shows the findings for ALN sites with questions or concerns identified, which have been raised with NPL for their action.

Table 3-6 ALN Sites Assessed by NPL with Further Checks Required

Site Name	Site Type	Lat °	Lon °	Pollutants Measured	Further Checks Required	Assessment Conclusion
Borehamwood Meadow Park	Urban Background	51.661229	-0.270550	NO_x, PM_{10}, $PM_{2.5}$	Check inlet height: listed as 2.6 m but looks lower? (Still within acceptable range though).	Fully Meets Siting Criteria
Camden Kerbside	Urban Traffic	51.544233	-0.175227	NO_x, PM_{10}, $PM_{2.5}$	Enclosure recently replaced: lat/lon and inlet height (currently recorded as 3 m) may need updating?	Fully Meets Siting Criteria
Haringey Roadside	*Urban Traffic*	*51.599300*	*-0.068218*	*NO_x*	*Quite enclosed: there is now a metal structure (support for tree?) beside it. Could this affect free flow of air? Trees nearby do not appear to overhang. Also, it is 7.7m from edge of lane – therefore meets criteria – but this is a bus lane. It is borderline 10m from edge of main carriageway. Further discussion concluded the structure is unlikely to affect air flow to site.*	*Fully Meets Siting Criteria*
London Eltham	*Suburban Background*	*51.452580*	*0.070766*	*NO_x, O_3, PM_{10}, $PM_{2.5}$*	*Update ALN inlet height (~ 2.5 m). Could aircon affect inlets? Aircon unit (on wall of main building) appears only around 1 m from the inlet (although not pointing directly at it)and vents into quite an enclosed corner. Explore options for inlet relocation.*	*Move inlet if possible.*
Southwark A2 Old Kent Road	Urban Traffic	51.480499	-0.059550	NO_x, PM_{10}	Check coordinates: appear slightly out. Should be 51.480485° -0.059413°. Inlet height stated as 3 m but appears lower (may need updating as a result of cabinet being replaced). Appears at least 1.5 m.	Fully Meets Siting Criteria
Tower Hamlets Roadside	***Urban Traffic***	***51.522530***	***-0.042155***	***NO_x***	***Located beside a pedestrian crossing on an otherwise uninterrupted stretch of road. Review whether site is representative of 100 m street length.***	***Non-compliant.***

4. CONCLUSIONS AND RECOMMENDATIONS

This investigation found that four AURN sites appear to no longer meet the siting criteria and it is recommended they be reviewed, with consideration being given to re-locating them. These have been discussed with the EA, CMCU and NPL at a follow-up meeting and actions agreed.

1. Aberdeen Union Street Roadside. This urban traffic site is 17 m from a box junction on a crossroads with traffic lights. Such a junction would be expected to interrupt traffic flow, thereby qualifying it as a 'major' junction. The site therefore clearly does not meet the requirement to be at least 25 m from any major junction. The site was affiliated into the AURN in 2008, before EU Commission Directive 2015/1480 of 2015, which defined a 'major junction' as one which "*interrupts the traffic flow and causes different emissions (stop & go) from the rest of the road*". It was agreed that CMCU would approach the local authority to ask whether they would be amenable to moving it a few metres further away – avoiding the nearby pub entrance, where people stand and smoke, and water from hanging baskets may drip on it. Ricardo will investigate whether any Scottish Network sites in the North East Scotland zone could be affiliated in its place.
2. Billingham. This is an urban industrial site which has been in operation a very long time (since 1987). However, the major industrial sources in the area have now gone. The site is in a council bin lorry depot, therefore there is no public access, and arguably the emissions from the bin lorries make the site unrepresentative of the surrounding area. The inlet height of 6 m is also well above the specified range of 1.5 – 4 m (although higher siting is permitted if the monitoring station is representative of a large area). The site therefore does not meet several of the siting criteria. CMCU also reported complaints from other building occupants of noise from the monitoring site. It was therefore agreed that the site should be relocated elsewhere in the Teesside zone. CMCU will seek alternative locations, avoiding Stockton-on-Tees and Middlesbrough, which both already have AURN sites.
3. Nottingham Centre. This urban background site is arguably no longer representative of public exposure. It is situated in a city centre pedestrianised street, which is not in itself an issue, but there are tall buildings on either side forming a canyon, creating a stagnant air space. Burger vans operate within metres, and there is a large overhanging tree. However, this too is a long-running site, having been in operation since 1996. Since this study was carried out, the Council has said they wish to relocate the site anyway, as part of a redevelopment of the area which will involve increasing the number of street food vendors. It was agreed that the site should be relocated, and CMCU are investigating potential new locations in Nottingham's city parks.
4. York Fishergate. This urban traffic site is on a reservation between two lanes of a city road, at the point of a pedestrian crossing near a primary school. Annex III part 2(c) of the Directive states that compliance with the limit values aimed at protection of human health shall ***not*** be measured "*on the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access to the central reservation*." This site is on the central reservation, but the pedestrian crossing means that there is pedestrian access. Arguably therefore, this criterion is met. However, it is questionable whether site is representative of public exposure. From the practical point of view, access and parking are also difficult. Therefore, it is recommended that relocation or replacement is considered. Any request to move the site is likely to be politically sensitive, because of its location by the primary school. Also, there is an ongoing research study involving co-locating air quality sensors at the site, likely to continue for some time. Therefore, in the first instance Ricardo will look for alternative affiliation candidates in the Yorkshire and Humberside zone. York City Council has several other roadside monitoring sites, and an initial investigation suggests that one or more of these may well be a suitable alternative. If not, the LA can be approached for suggestions: they are proactive on air quality and have many diffusion tube sites, so should be able to advise on suitable locations.

Issues have also been highlighted with the following sites. These were brought to the attention of the Environment Agency and CMCU for discussion at the follow-up meeting, to agree a consensus on whether the issues are of concern and warrant further action.

- Chesterfield Roadside – proximity to a pedestrian crossing on an otherwise generally clear road. The site was reviewed at the follow-up meeting to confirm whether it is representative of 100 m of street.

Since there are other street features which also potentially interrupt traffic flow, the site was deemed representative of 100 m and no action is needed.

- Christchurch Barrack Road: site is close to a bus stop. Site set-up records from 2017 say the bus stop was only used on weekly market days at that time, and the local authority said there were no plans to increase this. Current online timetables indicate buses are now much more frequent, as many as 10-12 per hour at busy times. However, Ricardo has reviewed the measurement data from the site and can find no evidence of the buses in the NO dataset. Ricardo agreed to keep a 'watching brief' on this site and its data, but no immediate action is required.
- Rochester Stoke – rural, but within 5 km of Thamesport and two power stations. This raised the question of whether it still meets the siting criteria for a rural background site. In 2013, the site was confirmed as rural background in a report by Ricardo's Pollution Climate and Mapping team (Vincent & Stedman, 2013), using a source apportionment-based method to assess site compliance with macroscale criteria. Applying the same methodology confirmed that Rochester Stoke still meets the criteria of the Annex III rural background classification.
- Sunderland Wessington Way – since site was established, shrubs have been planted between the site and the road, forming a barrier. This requires investigation and the site may need to be relocated or plants replaced with smaller ones. It was agreed that CMCU will approach the LA to discuss the possibility of moving the site, either to a gap in the bushes by a nearby street sign, or further away if necessary.
- Warrington – although the inlet is clear of vegetation, the enclosure is surrounded by tall mature trees. Consideration should be given to moving the site needs elsewhere within the school premises. The site classification was historically urban background but changed to urban industrial in the light of a 2013 macroscale siting study based on source apportionment (Vincent & Stedman, 2013). Applying the same methodology confirmed that the industrial contribution to NO_X, PM_{10} and $PM_{2.5}$ has decreased to the extent that the site classification should revert to urban background.
- Middlesbrough: re-running the 2013 source apportionment methodology (as for Rochester Stoke and Warrington above) concluded that, due to a reduction in industrial sources in the area, the site classification should now be updated from urban industrial to urban background.

For three sites, specific actions were identified for the site to remain compliant with the siting criteria:

- Bournemouth – there is a tree branch overhanging the inlet which needs to be cut back. This had been done at the most recent visit.
- Sunderland Silksworth – surrounding vegetation needs to be cut back.
- Wirral Tranmere – under the drip line of a large tree. Tree should be pruned back if possible (though it is not suggested that the mature tree be removed).

These were communicated to CMCU for action via the normal route.

There are also three sites where encroaching vegetation is not currently a problem, but there are bushes or trees nearby which need to be kept under control in the future, as part of ongoing site maintenance. These are Bradford Mayo Avenue, Lullington Heath and Portsmouth.

Sites in the Automatic London Network subset were assessed separately by NPL (the ALN QAQC contractor), and NPL provided the metadata for inclusion in this report. Four ALN sites appeared to need updates to coordinates or inlet heights (in most cases as a result of recent enclosure replacements) but otherwise fully met the siting criteria. Three ALN sites were highlighted for further investigation:

- Haringey Roadside: a metal structure has been constructed around a tree next to the site, possibly to support or protect the tree. The structure appears to be quite open and well away from the inlets, but we advised checking to confirm this does not affect free flow of air. It was agreed the structure was not likely to affect air flow around the site, and no action is needed.
- London Eltham: this assessment highlighted that the air conditioning unit outlet is close to the gases sampling inlet (although not pointing directly at it). Further discussion concluded that it would be better for the gaseous analysers' inlet to be moved further away. NPL will investigate the feasibility of this.
- Tower Hamlets Roadside: the inlet is beside a pedestrian crossing with traffic lights, on an otherwise uninterrupted stretch of road. This raised the question of whether the site is representative of 100m road length. Further discussion agreed that it was not representative, and NPL will investigate relocating the site.

5. REFERENCES

European Parliament and Council of the European Union, 2008. *Council Directive on ambient air quality and cleaner air for Europe (2008/50/EC).* [Online]
Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0050:EN:NOT
[Accessed 20 July 2022].

Vincent, K. & Stedman, J., 2013. *A review of air quality station type classifications for UK compliance monitoring.* [Online]
Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat13/1309250915_130923_Review_of_air_quality_monitoring_station_classifications.pdf
[Accessed 08 August 2022].

APPENDICES

APPENDIX 1 - SITES REQUIRING NO FURTHER ACTION

The list below shows the 52 AURN monitoring sites that were identified as fully meeting the siting criteria of the Air Quality Directive following the desk-based assessment and required no further action, further investigation or metadata updates.

- Aberdeen Erroll Park
- Aston Hill
- Barnstaple A39
- Bath A4 Roadside
- Belfast Centre
- Birmingham Acocks Green (site currently being relocated)
- Bradford Mayo Avenue (but note the need for ongoing maintenance of hedge behind site)
- Bristol Temple Way
- Bury Whitefield Roadside
- Bush Estate
- Cardiff Centre
- Cardiff Newport Road
- Charlton Mackrell
- Chilbolton Observatory
- Coventry Binley Road
- Crewe Coppenhall
- Derby St Alkmund's Way
- Derry Rosemount
- Dumbarton Roadside
- Dundee Mains Loan
- Edinburgh Nicholson Street
- Eskdalemuir
- Glasgow Great Western Road
- Glazebury
- Greenock A8 Roadside
- Hafod-yr-Ynys Roadside
- Honiton
- Ladybower
- Lerwick
- Liverpool Speke
- London Harlington
- London Hillingdon
- Luton A505 Roadside
- Northampton Spring Park
- Nottingham Western Boulevard
- Plymouth Tavistock Road
- Port Talbot Margam
- Preston
- Reading London Road
- Salford Eccles
- Sheffield Barnsley Road

- Sibton
- Southampton A33
- Stockton-on-Tees A1305 Roadside
- Stoke-on-Trent A50 Roadside
- Storrington Roadside
- Strathvaich
- Swansea Roadside
- Swindon Walcot
- Weybourne
- Worthing A27 Roadside
- Yarner Wood

The list below shows all monitoring sites in the ALN subset of the AURN that were identified as fully meeting the siting criteria of the Air Quality Directive, based on the information provided by NPL, the QAQC contractor for these sites. These also required no further action.

- Ealing Horn Lane
- Horley
- London Bexley
- London Haringey Priory Park South
- London Honor Oak South
- London North Kensington
- London Marylebone Road
- Sandy Roadside
- Stanford-le-Hope Roadside
- Thurrock

The following list shows the AURN and ALN sites which **did** require further investigation, as detailed in the tables in Section 3. However, in the light of the further investigations carried out, they were found to be fully compliant with the siting criteria and required no further action apart from metadata updates in some cases:

- Armagh Roadside
- Ballymena Antrim Road
- Ballymena Ballykeel
- Barnsley Gawber
- Belfast Stockman's Lane
- Blackpool Marton (also required inlet height update)
- Borehamwood Meadow Park (ALN)
- Bournemouth (but noted need for surrounding vegetation to be cut back)
- Cambridge Roadside
- Camden Kerbside (ALN)
- Canterbury
- Chepstow A48
- Chesterfield Loundsley Green (also required inlet height update)
- Dumfries (after confirming location of inlet and that it had free flow of air).
- Exeter Roadside
- Fort William

- Glasgow High Street
- Glasgow Kerbside (also required coordinates update)
- Glasgow Townhead
- Grangemouth
- Grangemouth Moray
- Hull Freetown (also required inlet height update)
- Immingham Woodlands Avenue (also required inlet height update)
- Inverness
- Leamington Spa Rugby Road
- Leicester University (after investigation of whether nearby swimming pool was likely to be a problem: also required coordinates update)
- Leominster
- Lincoln Canwick Road (also required coordinates update)
- London Bloomsbury
- London Westminster
- Lough Navar
- Lullington Heath (but note the need to keep surrounding bushes under control)
- Manchester Piccadilly (also required inlet height update)
- Manchester Sharston (also required inlet height update)
- Newcastle Centre (but noted the presence of trees planted around 2006 that now form a barrier between the site and the road: also new small trees planted in the area around 2018).
- Newcastle Cradlewell Roadside
- Oldbury Birmingham Road (also required inlet height update)
- Oxford Centre Roadside
- Oxford St Ebbes
- Peebles
- Plymouth Centre
- Portsmouth (but note the need to keep surrounding bushes under control)
- Saltash Callington Road
- Shaw Crompton Way (also required coordinates update)
- Sheffield Devonshire Green (also required inlet height update)
- Sheffield Tinsley
- Southampton Centre
- Southend-on-Sea (also required coordinates update)
- Southwark A2 Old Kent Road (ALN)
- Stockton-on-Tees Eaglescliffe
- Stoke-on-Trent Centre
- Sunderland Silksworth (but noted need for surrounding vegetation to be cut back)
- Telford Hollinswood (also required inlet height update)
- Walsall Woodlands (also required coordinates update)
- West Bromwich Kenrick Park (also required coordinates and inlet height update)
- Wicken Fen
- Wirral Tranmere ((but noted need for overhanging tree to be cut back)
- Wrexham (also required coordinates update)
- York Bootham

The final list below shows the 51 sites which needed minor updates to metadata, e.g. inlet height or coordinates (also listed in Section 3 of the main report).

- Birkenhead Borough Road
- Birmingham A4540 Roadside
- Birmingham Ladywood
- Blackburn Accrington Road
- Blackpool Marton (also required further investigation)
- Bradford Mayo Avenue
- Burton-on-Trent Horninglow
- Cannock A5190 Roadside
- Cardiff Centre
- Carlisle Morton A595
- Chesterfield Loundsley Green
- Chesterfield Roadside (also required further investigation)
- Coventry Allesley
- Cwmbran Crownbridge
- Dewsbury Ashworth Grove
- Doncaster A630 Cleveland Street
- Dumbarton Roadside
- Eastbourne
- Glasgow Kerbside (also required further investigation)
- High Muffles
- Hull Freetown (also required further investigation)
- Hull Holderness Road
- Immingham Woodlands Avenue (also required further investigation)
- Leeds Centre
- Leeds Headingley Kerbside
- Leicester A594 Roadside
- Leicester University (also required further investigation)
- Leominster
- Lincoln Canwick Road (also required further investigation)
- Manchester Piccadilly (also required further investigation)
- Manchester Sharston (also required further investigation)
- Narbeth
- Newport
- Norwich Lakenfields
- Oldbury Birmingham Road (also required further investigation)
- Portsmouth Anglesea Road
- Scunthorpe Town
- Shaw Crompton Way (also required further investigation)
- Sheffield Devonshire Green (also required further investigation)
- Southampton Centre
- Southend-on-Sea (also required further investigation)
- St Helens Linkway
- St Osyth

- Telford Hollinswood (also required further investigation)
- Walsall Woodlands (also required further investigation)
- Warrington (also required further investigation and change of classification)
- West Bromwich Kenrick Park (also required further investigation)
- Widnes Milton Road
- Wigan Centre
- Wirral Tranmere
- Wrexham

T: +44 (0) 1235 75 3000

E: enquiry@ricardo.com

W: ee.ricardo.com