Annual Progress Report (APR)

North Ayrshire Council
Comhairle Siorrachd Àir a Tuath

2019 Air Quality Annual Progress Report (APR) for
North Ayrshire Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

June 2019

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Executive Summary: Air Quality in Our Area

Air Quality in North Ayrshire Council

This report was prepared in accordance with the Local Air Quality Management (LAQM) Technical Guidance 2016 (TG16) and sets out the air quality monitoring carried out in North Ayrshire, with results and conclusions of data collected for 2018. Monitoring is carried out in North Ayrshire for Nitrogen Dioxide (NO_2) and Particulate Matter (PM), particles of soot (carbon), metals or inorganic salts of sizes less than or equal to 10micrometers, PM_{10}; and less than or equal to 2.5micrometers, $PM_{2.5}$.

Monitoring in previous years identified that the main air quality issue in North Ayrshire was related to a) traffic congestion caused by a small section of High Street, Irvine being used as a bus terminus and b) queuing traffic in New Street, Dalry as a result of traffic lights on the main A737 passing through the town. The main pollutant of concern was NO_2 for both locations. The history of these two areas have been discussed in in previous reports which can be found here https://www.north-ayrshire.gov.uk/pests-pollution-and-food-_hygiene/pollution/air-quality-management.aspx

In 2018 a significant decrease of NO_2 has been seen in High Street, Irvine at the three diffusion tube monitors of previous years' concern adjacent to the bus stops. They decreased from 27,41, 32ug/m^3 in 2017 to 18, 23, 22ug/m^3 in 2018 respectively. This reduction, over the 2018 calendar year, coincides with the introduction of 27 new Euro VI engine buses on bus Route 11 on Saturday 5th January 2018 (Photo 1 below) and this would appear to be the reason for the reduced levels. An immediate change in concentrations on this date was also recorded by a nearby AQ Mesh indicative active air monitor (Appendix D, Figure 18). The nearby automatic monitor station also showed a decrease in NO_2 from 21μg/m^3 in 2017 to 18μg/m^3 in 2018.

In New Street, Dalry NO_2 is noted to be marginally down from 38μg/m^3 in 2017 to 34μg/m^3 in 2018 for the same corresponding diffusion tube of concern. However, the new Dalry Bypass opened on Thursday 30th May, 2019, seven months ahead of schedule and traffic congestion through the town has been reduced significantly. It is anticipated that future monitoring of this area will show a corresponding decrease of NO_2 levels. This will be observed and detailed in future reports.

PM_{10} was recorded at 14μg/m^3 for 2018 for High Street, Irvine, marginally up from 13μg/m^3 for 2017. The Scottish annual mean air quality objective for PM_{10} is 18μg/m^3. In 2018 $PM_{2.5}$ monitoring in High Street, Irvine recorded a result of 8μg/m^3, again showing a marginal increase from 7μg/m^3 in 2017. The Scottish annual mean air quality objective for $PM_{2.5}$ is 10μg/m^3.

Overall, the automatic monitoring results for 2018 have shown that levels of NO_2 have decreased in High Street whilst PM_{10} and $PM_{2.5}$ levels have shown a marginal increase. NO_2 levels in New Street, Dalry have also shown a decrease. Generally, NO_2 has shown a downward trend across North Ayrshire since 2014 whilst on average PM levels have shown a slight increase.

North Ayrshire Council has one officer located within Environmental Health who implements the LAQM requirements: ensuring monitoring equipment is maintained correctly; dealing with any enquiries, planning permissions and complaints; report writing and liaising with relevant colleagues in other departments, and close consultation with our partners as required e.g. SEPA and Transport Scotland.

Actions to Improve Air Quality

Public Realm works (streetscape improvements) commenced on Monday 4th June 2017, and are still ongoing at the time of writing. Once completed this will also help to improve air quality within the Irvine High Street area by widen the pavement on the side where the elevated levels were being recorded and relocating one of the bus stops further along the High Street and one to nearby Bank Street. A programme of works and time scales are included in Appendix C, Figure 13. As part of the High Street works the automatic monitoring station cabinet will be replaced with a new one and it was removed from service on Saturday 20th April 2019. All monitoring equipment will reinstalled at the same location within a new enclosure following the works to ensure a consistent comparison before and after the works.

Photo 1: Launch of new Stagecoach Route 11 Euro VI buses (January 2019).

(Irvine Times, January 2019).

The new Dalry Bypass opened on Thursday 30th May, 2019, seven months ahead of schedule and traffic congestion through the town has been reduced significantly. It is anticipated that future monitoring of this area will show a corresponding decrease of NO_2 levels. This will be observed and detailed in future reports. All the details pertaining to the project can be found here https://www.transport.gov.scot/projects/a737-dalry-bypass/

In addition to LAQM North Ayrshire Council has Energy and Sustainability Officers, an Access Officer, a School Travel Plan Co-ordinator, Traffic and Transportation Managers, a Business Change Project Manager, Workplaces Engagement Officers and supporting teams.

North Ayrshire Council implemented a Sustainable Business Travel Plan Car Pool Scheme alongside Enterprise CarClub. Across January – December 2018, this car-share scheme had between 21 and 25 vehicles, with 190,422 miles being travelled on these. Around 11% of this total mileage was carried out on 100% electric vehicles. There are now 925 members who have access to 27 vehicles (5 all-electric and 9 hybrid vehicles) across 10 council office locations. During 2019, the number of vehicles will increase again up to a contracted 33 cars, and we continue to scope out new locations for these. The next stage is to continue improving on charge-infrastructure so that we may further increase our use of electric vehicles.

North Ayrshire Council participated in National Clean Air Day on Thursday 20th June 2019 and encouraged staff to actively travel to work. Staff Pledged to do various activities throughout Clean Air Day, these ranged from Cycling To Work, participating in our Daily Step Count Challenge and Leaving The Car At Home. 37 Council employees pledged to walk to work/achieve up to 20,000

steps/Register for Enterprise Car Club Electric Vehicle/Trial our new e-bikes; 10 Council employees pledged to Complete the Clean Air Day Quiz; 15 Council Employees pledged to ditch the car and Walk/Cycle/Go Electric to get to work. 3 employees from Ayrshire Central Hospital Pledged to Cycle To Work and received an Active Travel Breakfast. Those who used an alternative mode of transport to the car also had the option to enter the Clean Air Day Quiz competition with a chance to win 1 weeks paid for Public Transport, a Sports Voucher and a Clean Air Day Water Bottle. A photo of the staff with their pledges is shown below.

Photo 2: Staff with their pledges.

(North Ayrshire Council)

The event was promoted to staff and schools via internal News Letters, Facebook and Twitter. For information on how to become involved in air quality events around the UK and free promotional material please visit https://www.cleanairday.org.uk/

A new Environmental Sustainability & Climate Change Strategy has been developed for 2018-20, and contains an ambition to achieve a 40% reduction in carbon emissions North Ayrshire wide by 2030, based on a 2005 baseline year.

This would equate to a reduction of 581,000 tonnes CO2 across North Ayrshire in total since 2005, and 27,088 tonnes within the Council estate.

The Council's Travel Smart behaviour change project continues to promote modal shift to active and sustainable travel. It has been recognised locally and nationally as good practice. This is funded by the Smarter Choices Smarter Places programme and delivered a wide range of activities including: bike maintenance training; a Workplace Engagement Officer to promote active and sustainable travel to/from work; and a Schools and Workplaces Active Travel Programme.

This project worked with a number of local employers including NHS Ayrshire and Arran, KA Leisure, EDF Energy, J and D Pierce, GSK and Booth Welsh. It has:

- Supported 8 local businesses to become Cycle Friendly Employers
- One local business, Booth Welsh, has been awarded the Cycle Friendly Employer Plus Award. They are only the second workplace throughout Scotland to have received this award
- Delivered 14 bike maintenance sessions
- Organised 3 walking challenges

The Irvine Active Travel Hub and Closed Loop Facility was officially opened on Tuesday 25th 2019 by Lee Craigie, the Active Nation Commissioner. This is funded through the European Regional Development Fund (ERDF) Low Carbon Travel and Transport Challenge Fund. This project has established a bike library and support cycle parking; public cycle pumps; public cycle tools and an e- bike charging station. Furthermore, funding from both Sustrans and the Energy Saving Trust has allowed us to purchase nine e-bikes and one tandem.

A pool bike scheme has also been developed to encourage staff to cycle to meetings instead of taking the car. The bikes also include the e-bikes. Bikes are also available at evenings and weekends to encourage cycling and build confidence.

During 2018 our Workplace Engagement Officers organised 77 events and visited 6 work places, engaging with 764 staff to help facilitate and encourage alternative active travel in the work place.

Funding has been secured in principle to install an Urban Traffic Control (UTC) system a tool for managing and controlling traffic signals in urban areas that responds to fluctuations in traffic flow through the use of detectors, for High Street, Irvine however, the viability of this project is still being evaluated.

Local Priorities and Challenges

The priorities for North Ayrshire Council in addressing air quality for the coming year are a) to continue with monitoring and characterising air quality within its area, particularly in High Street, Irvine and New Street, Dalry, b) to complete the proposed public realm works in High Street, Irvine, c) to extend the sustainable staff pool car scheme, d) continue to promote, support and help facilitate Active Travel and e) to implement the Actions in the Council's Environmental Sustainability & Climate Change Strategy 2018-20.

The challenges will be to ensure that a) any LAQM monitoring equipment malfunction is rectified timeously and the data capture rate is maintained at a high level, b) any Public Realm design works are concluded on schedule and c) any targets with regard to improving air quality, directly or indirectly within North Ayrshire are achieved.

How to Get Involved

If you would like to become involved and participate in helping improving air quality in the area, details of alternative modes of travel, route options and projects can be found at https://www.north-ayrshire.gov.uk/leisure-parks-and-events/leisure-parks-and-events.aspx

North Ayrshire Council participated in the National Clean Air Day on Thursday 20th June 2019 and encouraged staff to actively travel to work. The event was promoted to staff and schools via internal News Letters, Facebook and Twitter. North Ayrshire Council will continue to support and promote this event. For information on how to become involved in air quality events around the UK and free promotional material please visit https://www.cleanairday.org.uk/

Further information on our local air quality can also be found here http://www.scottishairquality.co.uk/latest/site-info?site_id=IRV on the National website where information is updated every hour. A free service to subscribers in Scotland (that may be of benefit to people whose breathing gets worse when air pollution increases) is Know & Respond – Scotland. The service sends an alert message to registered members if air pollution in their area is forecast to be moderate, high or very high and this may be of benefit to pollution sensitive individuals who want to take steps to minimise the effects of any pollution incidents. To register for Know & Respond – Scotland please visit: http://www.scottishairquality.co.uk/know-and-respond/.

Know and Respond can also be accessed via an iPhone and Android app which is free to download at:

http://www.scottishairquality.co.uk/stay-informed/apps.

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1. Local Air Quality Management

This report provides an overview of air quality in North Ayrshire Council during 2018. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) is summarises the work being undertaken by North Ayrshire Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Lead	0.25 µg/m^3	Annual Mean	31.12.2008

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives. North Ayrshire Council currently does not have any AQMAs.

With regard to elevated levels of NO_2 in High Street, Irvine, public realm works (streetscape improvements) that commenced on 4th June 2018 are still ongoing. The programme of works and time scales are included in Appendix C, Figure 13 and an 18 month construction period is anticipated. The pavement is being widened on the side where the elevated levels are being recorded and two of the bus stops have been relocated. One further along the High Street and one to nearby Bank Street. This will ensure that the existing frequency of service and convenient access to public transport will be maintained. These changes will not only move the source of pollution away from the receptor (residential flats above the shops) but will also allow better dilution and dispersion of pollutants. In January of this year (2019) the bus operator, Stagecoach replaced their fleet of 27 buses on Route 11 with new Euro VI standard engine buses. Route 11 is the main service through High Street, Irvine with one bus approximately every 7-8 minutes.

Monitoring to date is encouraging and it would appear that NO_2 concentrations are reducing significantly in the High Street area. This is borne out by both the diffusion tube and automatic monitoring station results. Monitoring will continue in the area and will be reported accordingly in future reports to ensure these changes are constant.

The new Dalry Bypass opened on Thursday 30th May, 2019, seven months ahead of schedule and traffic congestion through the town has been reduced significantly. It is anticipated that continued monitoring of this area will show a corresponding decrease of NO_2 levels. All the details pertaining to the project can be found here https://www.transport.gov.scot/projects/a737-dalry-bypass/

All relevant locations in Dalry will continue to be monitored until there is confidence that the levels of pollutants will remain below the objective limits.

2.2 Cleaner Air for Scotland

Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities as soon as possible. A series of actions across a range of policy areas are outlined, a summary of which is available at http://www.gov.scot/Publications/2015/11/5671/17. Progress by North Ayrshire Council against relevant actions within this strategy is demonstrated below.

2.2.1 Transport – Avoiding travel –T1

North Ayrshire Council has a Travel Plan which can be accessed here https://www.north-ayrshire.gov.uk/council/strategies-plans-and-policies/transport-strategy.aspx

2.2.2 Climate Change – Effective co-ordination of climate change and air quality policies to deliver co-benefits – CC2

OK A new Environmental Sustainability & Climate Change Strategy has been developed for 2018-20 and contains an ambition to achieve a 40% reduction in carbon emissions North Ayrshire wide by 2030, based on a 2005 baseline year. This would equate to a reduction of 581,000 tonnes CO2 across North Ayrshire in total since 2005, and 27,088 tonnes within the Council estate.

Key actions completed, in progress or planned and outcomes in terms of benefits for air quality can be found in Appendix 1 of the Strategy's Action Plan here:

https://www.north-ayrshire.gov.uk/Documents/CorporateServices/Finance/environmental-sustainability-climate-change-strategy.pdf

2.2.3 Further Actions

North Ayrshire Council implemented a Sustainable Business Travel Plan Car Pool Scheme alongside Enterprise CarClub. Across January – December 2018, this car-share scheme had between 21 and 25 vehicles, with 190,422 miles being travelled on these. Around 11% of this total mileage was carried out on 100% electric vehicles. There are now 925 members who have access to 27 vehicles (5 all-electric and 9 hybrid vehicles) across 10 council office locations. During 2019, the number of vehicles will increase again up to a contracted 33 cars, and we continue to scope out new locations for these. The next stage is to continue improving on charge-infrastructure so that we may further increase our use of electric vehicles.

3. Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

A fixed automatic monitoring station is located in High Street, Irvine. It has contained a chemiluminescent NO_x analyser monitor since its installation in 2009 and a Fidas 200 fine dust and monitoring immission measurement system for the continuous and simultaneous measurement of PM_1, $PM_{2.5}$ as per EN 14907 and PM_{10} as per EN12341 since 14th April 2015. This monitoring station is also the site being used for the triplicate co-location of NO_2 diffusion tubes.

The data capture rate in 2018 for NOx was 90% and 86% for PMs and ensure we have a good data set to analyse.

Calibration checks are conducted every 2 weeks on site by Local Authority Officers and collected data is forwarded to Ricardo - EE who validate and ratify the data. The unit is calibrated by Ricardo - EE every 6 months. Ricardo - EE reports are included in Appendix C, Figures 1 & 2.

Twenty two diffusion tubes also monitor NO_2 at various locations in towns throughout North Ayrshire and data capture rate was 96.6%. 2018 results show that the localised area of approximately 10 meters diameter on the High Street, Irvine which was the subject of an elevated level exceeding the NO_2 air quality annual mean objective of 40$\mu g/m^3$ in previous years has significantly reduced. Based on diffusion tube monitoring the level has reduced from 41$\mu g/m^3$ in 2017 to 23$\mu g/m^3$ in 2018 at the same tube of concern. No monitoring results for 2018 within North Ayrshire has exceeded any relevant EU Limit Value.

None of these changes have led to the declaration of an AQMA, decision to amend or revoke an AQMA, or appropriate local strategy.

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

North Ayrshire Council undertook automatic (continuous) monitoring at one site during 2018. Table A.1 in Appendix A shows the details of the sites. National automatic monitoring sites and results are available at:
http://www.scottishairquality.scot/

Maps showing the location of the monitoring site is provided in Appendix D: Figure 14. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

In addition three AQ Mesh mobile air monitoring pods to measure NO_2 and PM_{10}, which can provide real time data over an online connection, were deployed in the High Street to monitor ambient air quality and are collocated with diffusion tubes (Appendix C: Figure 16). AQ Mesh pods are indicative instruments which allow daily trends to be characterised which in turns leads to an understanding of the area and a can assist informed decisions to be made.

3.1.2 Non-Automatic Monitoring Sites

North Ayrshire Council undertook non-automatic (passive) monitoring of NO_2 at twenty two sites during 2018. Table A.2 in Appendix A shows the details of the sites. National non-automatic monitoring sites and results are available at: http://www.scottishairquality.scot/latest/diffusion-sites

Maps showing the location of the monitoring sites within North Ayrshire are provided in Appendix D: Figures 15. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C.

Annual Mean NO_2 Concentrations measured at the Automatic monitoring site in High Street, Irvine and Diffusion Tube monitoring sites located throughout North Ayrshire have shown a general downward trend since 2014. It is unclear if this is due to favourable climatic conditions as the trend appears to be widespread across local areas with different geographical locations or vehicle fleets have less emissions. PM_{10} and $PM_{2.5}$ levels have shown a slight increase in the High Street, Irvine for 2018.

NO_2 levels in New Street, Dalry have also shown a decrease. Graphs of the trends are included in Appendix C: Figures 8 – 11.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in Appendix B.

As stated above, based on diffusion tube monitoring there has been a significant decrease in High Street, Irvine at the area of exceedance in previous years and it would appear that is due to the fleet of new Euro VI engine buses on Route 11. It is expected that concentrations may reduce further once the public realm works are completed the pavement at this location will be wider and bus stops are being relocated. Appendix C: Figure 12 for reference.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 Hourly Mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. There has been no exceedance of over 18 times per year for the 2014 to 2018 reporting period.

In Dalry there was an area of concern due to congestion at traffic lights. A very slow decline has been noted here over the past 5 years and again there has been a slightly reduction from 38µg/m^3 in 2017 to 37µg/m^3 in 2018. It is anticipated that there will be a significant reduction in NO^2 levels following the opening of the new Dalry bypass.

None of these changes have led to the declaration of an AQMA.

3.2.2 Particulate Matter (PM_{10})

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 18µg/m^3. Results show there has been no exceedances of the objective limit in the last 5 years.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 7 times per year.

There have been no exceedances of over 7 times per year for the 2014 to 2018 reporting period.

None of these changes have led to the declaration of an AQMA.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years with the air quality objective of 10µg/m^3.

The information presented in Table A.7 in Appendix A for 2015 is for illustrative purposes only as monitoring of $PM_{2.5}$ commenced in April of that year for the first time in North Ayrshire. An Annual Mean value of 10µg/m^3 has now been set for $PM_{2.5}$ for local authorities to achieve by the year 2020 but $PM_{2.5}$ has not been monitored for long enough in North Ayrshire to establish any trends. However, considering the previous years' PM_{10} trends and the known PM_{10} to $PM_{2.5}$ ratio it is not anticipated that any $PM_{2.5}$ exceedance will be breached within North Ayrshire. $PM_{2.5}$ recorded a reading of 8µg/m^3 for 2018. This was a slight increase from 7µg/m^3 in 2017.

None of these changes have led to the declaration of an AQMA.

3.2.4 Sulphur Dioxide (SO_2)

Monitoring for sulphur dioxide and smoke has been discontinued in North Ayrshire since 2004. Historical monitoring data is available for nearly every town in the area and there is no indication from these results that the air quality standard is likely to be breached even around local industrial sources.

Further details of historic SO_2 monitoring can be found in North Ayrshire Council's previous Air Quality Reports which are available online at:

https://www.north-ayrshire.gov.uk/pests-pollution-and-food-hygiene/pollution/air-quality-management.aspx

There has been no evidence of any change to sulphur dioxide production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in sulphur dioxide levels at locations where there could be relevant public exposure.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

No recent monitoring of Carbon Monoxide, Lead and 1,3-Butadiene has been undertaken.

Further details of historic Carbon Monoxide, Lead and 1,3-Butadiene monitoring can be found in North Ayrshire Council's previous Air Quality Reports which are available online at:

https://www.north-ayrshire.gov.uk/pests-pollution-and-food-hygiene/pollution/air-quality-management.aspx

There has been no evidence of any change to Carbon Monoxide, Lead and 1,3-Butadiene production or release in North Ayrshire. Similarly, there has been no development likely to result in any increase in Carbon Monoxide, Lead and 1,3-Butadiene levels at locations where there could be relevant public exposure.

4. New Local Developments

There were one significant housing development proposed during 2018 that was considered to have the potential to increase traffic numbers and flows in and around the relevant area. An Air Quality Assessment Screening Report was submitted with the application which showed that the development did not meet the full reporting criteria and there would be no detrimental effect on local air quality. This development was refused permission for other reasons. The application details are retained by the Planning Authority and can be found here:

18/00340/PPPM
https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=P7BKWXLEIV900

In 2017 it was recommended, that an air quality assessment was undertaken for Planning Application 17/00584/PPM however it would appear that this was not attached as a Condition in the permission granted. Details of the application can be found here:

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=documents&keyVal=OQUXKPLEFIS00

Previous Planning App 16/00581/PPPM was for Planning Permission in Principle and as such will require as full application to be submitted in the future. Permission may or may not be applied for therefore a watching brief will be kept at this time for any future permission being sought for this development.

4.1 Road Traffic Sources

North Ayrshire Council confirms that there are no new/newly identified: narrow congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb; busy streets where people may spend 1 hour or more close to traffic; roads with high flows of buses/heavy delivery vehicles; busy junctions/busy roads; junctions; roads with significantly changed traffic flows and no relevant bus stations in the Local Authority area. The A737 Dalry Bypass is now open but there is still some peripheral construction works in the area to complete road junctions.

All the details pertaining to the project can be found here:

https://www.transport.gov.scot/projects/a737-dalry-bypass/

Another, smaller section of major road works, the A737 Den Realignment, has now commenced and completion is expected to December 2019. All the details pertaining to the project can be found here:

https://www.transport.gov.scot/projects/a737-the-den-realignment/

4.2 Other Transport Sources

North Ayrshire Council confirms that there are no: airports in the Local Authority area; locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m; locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m; or ports or shipping that meet the specified criteria within the Local Authority area.

4.3 Industrial Sources

North Ayrshire Council confirms that there are no new or proposed industrial installations: for which an air quality assessment has been carried out; existing installations where emissions have increased substantially or new relevant exposure has been introduced; significantly changed installations with no previous air quality assessment; major fuel storage depots storing petrol; petrol stations or poultry farms.

4.4 Commercial and Domestic Sources

North Ayrshire Council is aware of two applications: Clyde Coast and Garnock Valley Crematorium, Dalry, KA24 5LF. This is regulated by SEPA under Licence Number PPC/B/1166212 and a Short Term Operation Reserve (STOR) application 18/00406/PP which was withdrawn:

https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=P83A5HLEJ3C00

North Ayrshire Council confirms that there is no areas of significant domestic fuel use or Combined Heat and Power CHP) plant in the Local Authority area that we are aware of at this time.

4.5 New Developments with Fugitive or Uncontrolled Sources

North Ayrshire Council is not aware of any new developments with fugitive or uncontrolled sources within the Local Authority area in 2018. The potential fugitive source identified in 2017 from open yardage at a woodchip facility has been resolved following discussion with the operator. Potential fugitive sources were identified and processes were relocated within the yard together with the attachment of water spray bars on specific operating equipment.

5. Planning Applications

Relevant new local developments are also discussed at Section 4 of this report. In 2018 one application was submitted for a proposed significant housing development. The screening report submitted was satisfactory however, the application was refused for other reasons. Details of the applications are retained by the Planning Authority online at:

18/00340/PPPM
https://www.eplanning.north-ayrshire.gov.uk/OnlinePlanning/applicationDetails.do?activeTab=summary&keyVal=P7BKWXLEIV900

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

All NO_2, PM10 and PM2.5 monitoring data within North Ayrshire Council for 2018 complied with the 40μg/m^3, 18μg/m^3 and 10μg/m^3 respective Air Quality Objectives as set out in the Directive.

Monitoring will continue at all the existing sites for 2019.

6.2 Conclusions relating to New Local Developments

Planning applications for one significant housing development was received in 2018. Considered was given to the application as it had the potential to increase traffic numbers and flows in and around the local area the location. The applicants were requested to undertake Air Quality Assessments and submit a report to demonstrate whether their proposed development would have any detrimental effect on local air quality via the Planning process. The resultant screening report provided was satisfactory.

6.3 Proposed Actions

The new monitoring data has not identified any new exceedences of the objectives for any pollutant or any need for additional monitoring or changes to the existing monitoring programme within North Ayrshire.

Irvine

As outlined earlier in this report, following the introduction of 27 Euro VI buses on Route 11 in January 2018 by the bus operator, Stagecoach, a significant reduction in NO2 has been recorded in High Street, Irvine. Calculations using the Drop-off with Distance calculator in previous years' reports have shown that levels should reduce further following pavement widening on the completion of public realm works. The programme and time scale for this project is shown in Appendix C: Figure 12. It is proposed that NO_2 sampling continues in this area with close supervision of future developments.

Dalry

Following the opening of the new Dalry Bypass on 30th May 2019, traffic congestion has reduced significantly through the town. At the time of writing, the relevant diffusion tubes in New Street have been not been collected for their monthly

analysis but it is anticipated that there will be a corresponding decrease in NO2 levels coinciding with this change.

It is proposed that monitoring is continued in this area and, in addition to the existing NO_2 diffusion tubes.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
ROM	ROMON	Roadside	232188	638861	NO_2; PM_{10}; $PM_{2.5}$	N	Chemiluminescent; Optical Light Scatter	20	2.5	2.0

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
DT1	**35 East Road, Irvine**	Roadside	**232323**	**638892**	**NO_2**	**N**	1	2.5	N
DT2	**18 Bank St, Irvine**	Roadside	**232202**	**638952**	**NO_2**	**N**	2.5	1.6	N
DT3	**147 High Street, Irvine**	Roadside	**232077**	**638990**	**NO_2**	**N**	0	4	N
DT4	**85 High St, Irvine**	Roadside	**232158**	**638882**	**NO_2**	**N**	0	3.7	N
DT5	**79 High St, Irvine**	Roadside	**232169**	**638878**	**NO_2**	**N**	3.5	1.5	N
DT6	**75 High St, Irvine HIGH**	Roadside	**232170**	**638871**	**NO_2**	**N**	0	5	N
DT7	**65a High Street, Irvine, (ROMON)**	Roadside	**232188**	**638861**	**NO_2**	**N**	4.7	1.7	Y
DT8	**65 High Street, Irvine, (ROMON)**	Roadside	**232188**	**638861**	**NO_2**	**N**	4.7	1.7	Y
DT9	**63 High Street, Irvine, (ROMON)**	Roadside	**232188**	**638861**	**NO_2**	**N**	4.7	1.7	Y
DT10	**34 Kirkgate Irvine**	Urban Background	**232085**	**638774**	**NO_2**	**N**	10	0.5	N
DT11	**25 Main Rd, Springside**	Kerbside	**236813**	**638659**	**NO_2**	**N**	5	1	N
DT12	**Auchengate (Bridge)**	Urban Background	**233332**	**635558**	**NO_2**	**N**	N/A	32	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
DT13	**Dalry Rd, Kilwinning**	Kerbside	**229928**	**643400**	**NO_2**	**N**	2	1	N
DT14	**Vernon St, Saltcoats**	Kerbside	**224697**	**641366**	**NO_2**	**N**	0	1	N
DT15	**12 Garnock St, Dalry**	Urban Background	**229326**	**649250**	**NO_2**	**N**	10	0.5	N
DT16	**67 New St, Dalry**	Kerbside	**229338**	**649337**	**NO_2**	**N**	0	0.5	N
DT17	**45 New St, Dalry**	Kerbside	**229286**	**649365**	**NO_2**	**N**	0	0.5	N
DT18	**2 Townhead St, Dalry**	Roadside	**229230**	**649338**	**NO_2**	**N**	0	3	N
DT19	**Highfield Hamlet, Dalry**	Urban Background	**230943**	**650280**	**NO_2**	**N**	10	1	N
DT20	**85 Main Street, Largs**	Kerbside	**220333**	**659322**	**NO_2**	**N**	1.5	0	N
DT21	**Hunterston Road**	Rural	**219582**	**650020**	**NO_2**	**N**	N/A	N/A	N
DT22	**Princess St/Glasgow St, Ardrossan**	Kerbside	**219582**	**650020**	**NO_2**	**N**	0	0.5	N

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2014	2015	2016	2017	2018
ROMON	Roadside	Automatic	-	90	29	28	25	21	18
DT1	Roadside	Diffusion Tube	-	83	23	22	22	22	21
DT2	Roadside	Diffusion Tube	-	100	25	22	23	22	25
DT3	Roadside	Diffusion Tube	-	75	34	24	25	21	23
DT4	Roadside	Diffusion Tube	-	100	32	31	29	27	18
DT5	Kerbside	Diffusion Tube	-	100	**53**	**51**	**43**	**41**	23
DT6	Roadside	Diffusion Tube	-	92	**45**	**37**	30	32	22
DT7	Roadside	Diffusion Tube	-	100	29	28	25	25	20
DT8	Roadside	Diffusion Tube	-	100	28	29	25	24	21
DT9	Roadside	Diffusion Tube	-	100	27	27	25	23	19
DT10	Urban Background	Diffusion Tube	-	100	11	8	9	8	11
DT11	Kerbside	Diffusion Tube	-	92	15	15	14	14	13

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2014	2015	2016	2017	2018
DT12	Urban Background	Diffusion Tube	-	100	11	10	12	12	12
DT13	Kerbside	Diffusion Tube	-	100	22	19	18	19	21
DT14	Kerbside	Diffusion Tube	-	92	11	9	11	9	10
DT15	Urban Background	Diffusion Tube	-	100	30	30	31	29	25
DT16	Kerbside	Diffusion Tube	-	100	**42**	36	39	38	34
DT17	Kerbside	Diffusion Tube	-	100	32	28	24	27	26
DT18	Roadside	Diffusion Tube	-	92	23	18	20	19	17
DT19	Urban Background	Diffusion Tube	-	100	19	18	19	17	18
DT20	Kerbside	Diffusion Tube	-	100	7	5	5	5	5
DT21	Rural	Diffusion Tube	-	100	18	18	17	15	16
DT22	Kerbside	Diffusion Tube	-	100	21	21	18	19	17

Notes: Exceedences of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedence of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2014	2015	2016	2017	2018
ROMON	Roadside	Automatic	-	90	0	**1**	0	0	0

Notes: Exceedences of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} Annual Mean Concentration (µg/m^3) (3)				
				2014	2015	2016	2017	2018
ROMON	Roadside	-	86	16	14	15	13	14

Notes: Exceedences of the PM_{10} annual mean objective of 18µg/m^3 are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2014	2015	2016	2017	2018
CM1	Roadside	-	86	0	0	0	0	0

Notes: Exceedences of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 7 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 98.1st percentile of 24-hour means is provided in brackets.

Table A.7 – Annual Mean $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m³) (3)				
				2014	2015	2016	2017	2018
CM1	Roadside	-	86	-	6	7	7	8

Notes: Exceedences of the $PM_{2.5}$ annual mean objective of 10µg/m³ are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results for 2018

Site ID	NO_2 Mean Concentrations (µg/m^3)												Annual Mean	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (1)
DT1	24.0	27.7	23.8	23.9			18.7	19.0	15.7	22.6	29.5	31.1	23.6	21
DT2	48.9	31.0	33.5	31.9	24.9	16.7	18.9	15.9	16.1	22.3	32.8	33.6	27.2	25
DT3	33.1	24.7		21.8	15.5		16.0	15.4		31.1	25.6	42.6	25.1	23
DT4	27.4	22.9	21.7	19.7	18.3	10.5	19.7	18.8	17.8	15.3	23.8	26.9	20.2	18
DT5	30.4	32.4	24.6	29.6	21.4	12.5	25.9	23.1	23.3	20.0	29.3	32.3	25.4	23
DT6	33.2	28.8	23.6	19.5		20.8	20.8	19.8	18.0	21.5	24.5	29.5	23.6	22
DT7	23.9	26.7	21.3	23.8	22.3	21.1	21.7	17.5	16.5	18.7	23.2	25.2	21.8	20
DT8	27.8	25.0	24.7	23.2	21.4	29.5	21.4	12.4	19.7	17.3	24.0	26.4	22.7	21
DT9	28.3	24.2	21.8	21.3	21.0	17.8	22.2	13.9	12.3	20.2	25.8	24.8	21.1	19
DT10	18.7	11.9	15.9	11.7	7.3	3.1	8.8	3.4	5.6	23.6	17.0	14.9	11.8	11
DT11	20.6	17.0	15.6	11.5	13.1		12.1	9.7	10.9	13.0	19.4	19.1	14.7	13
DT12	20.2	19.6	15.4	13.4	8.8	5.6	11.4	7.8	7.9	11.9	16.7	16.7	13.0	12
DT13	22.6	28.7	24.8	24.0	20.1	14.6	18.8	20.4	13.3	27.5	29.5	29.2	22.8	21
DT14	22.0	15.5	14.9		6.6	4.1	7.2	2.7	3.8	8.0	16.1	17.0	10.7	10
DT15	43.0	40.9	31.1	19.3	21.2	10.4	22.3	13.7	25.0	33.5	29.3	36.5	27.2	25
DT16	50.9	49.5	40.3	36.0	37.5	30.6	31.2	21.2	27.2	33.8	43.9	45.9	37.3	34
DT17	39.8	32.7	28.4	31.2	31.6	14.0	27.3	18.6	21.8	26.3	36.4	39.4	29.0	26
DT18	28.0	24.3	21.0	24.6	15.7		16.1	7.9	8.7	13.7	28.2	20.9	19.0	17
DT19	24.8	25.6	22.2	22.4	20.2	9.5	20.6	17.2	10.6	16.0	23.0	19.8	19.3	18
DT20	10.7	5.1	7.8	6.5	6.6	2.0	5.0	3.3	2.0	4.7	8.7	5.8	5.7	5
DT21	27.8	15.7	23.8	21.7	20.5	15.0	13.6	11.5	9.2	13.9	23.1	19.6	18.0	16
DT22	22.9	21.3	21.0	20.6	16.3	13.1	20.3	18.1	10.0	14.1	19.0	21.3	18.2	17

(1) See Appendix C for details on bias adjustment

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Figure 1: RICARDO-EE Air Pollution Report

Air Pollution Report

Air Quality in Scotland

1st January to 31st December 2018

North Ayrshire Irvine High St (Site ID: IRV)

These data have been fully ratified

Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³	PM_{10} µg/m³	PM_{25} µg/m³
Number Days Low	-	335	-	313	313
Number Days Moderate	-	0	-	0	0
Number Days High	-	0	-	0	0
Number Days Very High	-	0	-	0	0
Max Daily Mean	59	42	132	39	31
Annual Max	185	99	374	105	65
Annual Mean	17	18	43	14	8
98th Percentile of daily mean	-	-	-	28	-
90th Percentile of daily mean	-	-	-	22	-
99.8th Percentile of hourly mean	-	73	-	-	-
98th Percentile of hourly mean	79	53	163	36	24
95th Percentile of hourly mean	63	44	134	29	18
50th Percentile of hourly mean	9	14	28	13	7
% Annual data capture	**90.54%**	**90.49%**	**90.49%**	**86.47%**	**86.47%**

Instruments: PM_{10}: FIDAS

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

Note: For a strict comparison against the objectives there must be a data capture of 85% or greater throughout the calendar year.

1 / 3

Report produced by Ricardo Energy & Environment

Pollutant	Air Quality Standards (Scotland) Regulations 2010	Exceedances	Days
PM10 particulate matter (Hourly measured)	daily mean > 50 microgrammes per metre cubed	0	0
PM10 particulate matter (Hourly measured)	Annual mean > 18 microgrammes per metre cubed	0	-
PM2.5 particulate matter (Hourly measured)	Annual mean > 12 microgrammes per metre cubed	0	-
Nitrogen dioxide	Hourly Mean > 200 microgrammes per metre cubed	0	0
Nitrogen dioxide	Annual Mean > 40 microgrammes per metre cubed	0	-

Annual Graph

No graph is currently available for this monitoring site

Figure 2: RICARDO-EE Certificates of Calibration.

0401

CERTIFICATE OF CALIBRATION

Ricardo Energy and Environment, Gemini Building, Fermi Avenue Harwell, Didcot, Oxfordshire OX11 0QR. Telephone 01235 753692

RICARDO

Page 1 of 3

Approved Signatories:

- ☐ S. Eaton
- ☐ D Hector
- ☐ N Rand
- ☐ B Davies
- ☐ B Stacey
- ☐ S Stratton
- ☐ S Telfer
- ☑ S Gray

Signed:

Date of issue: 29 Apr 19

Certificate Number: 4481

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for the air monitoring station(s) at North Ayrshire

Ricardo Energy & Environment ID: ED61598/4481

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory

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CERTIFICATE OF CALIBRATION

Date of issue: 29 Apr 19

Certificate Number: 4481

Ricardo Energy & Environment ID: ED61598/4481

North Ayrshire
NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response[1]	Zero uncertainty ppb	Calibration Factor[2]	Factor uncertainty %	Converter eff. (%)[3]
North Ayrshire Irvine High St	11-Dec-18	NOx	2981873	6.0	2.5	1.0204	3.50	98.1
		NO		0.0	2.5	1.0041	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High St	11-Dec-18	6251			4.55	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High St	11-Dec-18	6251				2.2		2.2

0401

CERTIFICATE OF CALIBRATION

Date of iss+A127:I151ue: 29 Apr 19

Certificate Number: 4481

Ricardo Energy & Environment ID: ED61598/4481

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NOx analysers) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and ko(where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1] The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NOx, SO_2, O_3 and ppm for CO. Where 1ppm = 1000ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F(Output - Zero Response)

Where F = Calibration Factor provided on this certificate

Output = Reading on the data logging system of the analyser

Zero Response = Zero Response provided on this certificate

[3] Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$, reported at prevailing ambient conditions unless otherwise specified. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[5] The calculated ko value (specifically for TEOM analysers) is the calculated ko spring constant based on tests undertaken with filters of known weight.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.

0401

CERTIFICATE OF CALIBRATION

Ricardo Energy and Environment, Gemini Building, Fermi Avenue Harwell, Didcot, Oxfordshire OX11 0QR. Telephone 01235 753692

Approved Signatories:

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- ☐ D Hector
- ☐ N Rand
- ☐ B Davies
- ☐ B Stacey
- ☐ S Stratton
- ☐ S Telfer
- ☑ S Gray

Signed:

Date of issue: 09 May 19

Certificate Number: 4509

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for the air monitoring station(s) at North Ayrshire Council

Ricardo Energy & Environment ID: ED61598/4509

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95% The uncertainty evaluation has been carried out in accordance with UKAS requirements.

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CERTIFICATE OF CALIBRATION

0401

Date of issue: 09 May 19

Certificate Number: 4509

Ricardo Energy & Environment ID: ED61598/4509

North Ayrshire Council

NOx analysers

Station	Date of Audit	Species	Analyser Serial no	Zero Response[1]	Zero uncertainty ppb	Calibration Factor[2]	Factor uncertainty %	Converter eff. (%)[3]
North Ayrshire Irvine High St	27-Jun-18	NOx	2981873	7.0	2.7	0.9978	3.50	100.9
		NO		-1.0	2.7	0.9800	3.50	

PM10 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High St	21-Aug-18	6251			4.68	2.2		2.2

PM2.5 analysers

Station	Date of audit	Analyser Serial no	Calculated ko	Uncertainty %	Total flow	Uncertainty %	Main flow	Uncertainty %
North Ayrshire Irvine High St	21-Aug-18	6251			4.68	2.2		2.2

CERTIFICATE OF CALIBRATION

0401

Date of issue: 09 May 19

Certificate Number: 4509

Ricardo Energy & Environment ID: ED61598/4509

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NOx analysers) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and k0(where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1] The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2] The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NOx, SO_2, O_3 and ppm for CO. Where 1ppm = 1000ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F(Output - Zero Response)

Where F = Calibration Factor provided on this certificate

Output = Reading on the data logging system of the analyser

Zero Response = Zero Response provided on this certificate

[3] Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4] The measured main flow rate (where this is applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are $l.min^{-1}$, reported at prevailing ambient conditions unless otherwise specified. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[6] The calculated k0 value (specifically for TEOM analysers) is the calculated k0 spring constant based on tests undertaken with filters of known weight.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.

Figure 3: NOx & PM Fidas Service Report

SERVICE REPORT

AirMonitors.co.uk
Quality - Service - Innovation

Customer :	North Ayrshire	**Job No:**	KD051118_Irv	**Start Date**	05/11/18
				Start Time	09:30
Site Name:	Irvine High Street			**End Date**	05/11/18
				End Time	15:00

Reason for visit: Service

Additional Reason for visit: Please select

Action Taken:

NOx Carried out pre zero and span. Pump vacuum poor at 24". Rebuilt pump; new vaccum 25.75". Serviced instrument, cleaned critical orifices, valves and reaction cell. Replaced 47mm Filter, Small DFU, O rings and Sintered Filters. Replaced scrubber media. Gas analyser sample inlet checked. Leak check passed. Carried out post zero and span. Calibrated instrument.

FIDAS Carried out pre flow and leak checks. Corrected time. Cleaned TSP head. Serviced instrument. Cleaned filter holder and suction filter. Performed sensor calibration. Removed IADS and cleaned optical sensor using compressed dust remover. Performed hardware optical sensor clean. Deleted data. Carried out post flow and leak checks.
Comms tested ok.

Parts Used

Model Used on:	Part No: (Must be completed)	Description:	Qty	Invoice
ML9841B	DIF-BN50	Small DFU	1	
ML9841B	F010004	Sintered Filter	3	
ML9841B	0010012	O Ring	6	
ML9841B	0010010	O Ring	2	
ML9841B		47mm Filter	1	
		Consumables		
ML9841B	SK61722	.22 Stroke Pump Rebuilld Kit	1	
ML9841B	Unknown	Charcoal	1	

Engineer: Kris Dalziel

Visit Type: Routine Service

Complete site inventory

For Office Use Only:

TTS 1.5

VDT A

Air Monitors Ltd - Units 2/3 Miller Court - Severn Drive – Tew kesbury – Glos - GL20 8DN
Tel: 01684 857530 Fax 01684 857538 Email: service@airmonitors.co.uk Web: w w w .airmonitors.co.uk

Figure 4: QA/QC Data

Diffusion Tube Bias Adjustment Factors

National Adjustment Factors
Diffusion tubes (20% TEA/Water) used in the sampling period for 2018 were supplied and analysed by Glasgow Scientific Services (GSS). Diffusion Tube Bias Adjustment Factors for tubes provided by GSS are listed in the National Diffusion Tube Bias Adjustment Factor Spreadsheet in Figure 5 below. The Tube Precision and AIR results for the laboratory are shown in Figure 6 below. The resultant bias for GSS is **0.91** based on 6 studies with 2 of poor precision.

Factor from Local Co-location Studies
The automatic monitoring station (ROMON) has been operational since early 2009 and is the site being used for three co-location tubes. The unit is permanently located here and allows for full "calendar year" data to be collected.
The ROMON has fortnightly checks carried out in accordance with the prescribed methodology as issued by Ricardo - EE. The unit is audited every 6 months by Ricardo - EE and is serviced every 6 months under contract to another company. Corresponding data was entered in the "Checking Precision and Accuracy of Triplicate Tubes" spreadsheet provided by Ricardo - EE Energy & Environment (Figure 7 below). The resulting Bias factor for 2018 data is **0.79** using all 12 periods.

Discussion of Choice of Factor to Use
Although the diffusion tube co-location study for North Ayrshire Council has "Good" precision and corresponding "Good" overall Data Capture from the ROMON it is felt that the local derived bias factor of 0.78 – 0.81 is significantly lower than that of other years. Records show that previously local derived bias factors ranged from 0.91 – 1 between 2009 and 2016 and the National Bias Adjustment Factor from GSS is more in accordance with these values and when applied reflects this more accurately on the true values of air quality when considered over the entire district. Using the national bias factor reflects a more realistic trend for NO_2 pollution levels.

PM Monitoring Adjustment
The automatic monitoring station (ROMON – Fidas 200) is visually checked every 2 weeks during the NOx calibration check. The PM_{10} and $PM_{2.5}$ data collected by the ROMON is processed and ratified by Ricardo - EE. The Air Pollution Report for North Ayrshire, Irvine High Street for 1st January to 31st December 2018 is included above.

QA/QC of automatic monitoring
The automatic monitoring station (ROMON – NOx) has an onsite calibration check conducted every 2 weeks by Local Authority Officers. All checks are carried out in accordance with procedures laid out by Ricardo - EE and calibration check sheets are forwarded to them after each visit. The site is visited by Ricardo - EE engineers every 6 months to carry out calibration tests and the unit is serviced twice yearly. Reports from these visits are included above.

Figure 5: Bias Factor Spreadsheet (Glasgow Scientific)

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/18

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2019

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	**Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.**
If a laboratory is not shown, we have no data for this laboratory	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Glasgow Scientific Services	20% TEA in water	2018	UB	Glasgow City Council	12	34	25	32.9%	G	**0.75**
Glasgow Scientific Services	20% TEA in water	2018	R	Glasgow City Council	12	38	37	2.9%	G	**0.97**
Glasgow Scientific Services	20% TEA in water	2018	R	Glasgow City Council	10	35	34	3.6%	P	**0.97**
Glasgow Scientific Services	20% TEA in water	2018	KS	Glasgow City Council	12	63	59	6.2%	G	**0.94**
Glasgow Scientific Services	20% TEA in water	2018	R	Glasgow City Council	12	45	36	24.5%	P	**0.80**
Glasgow Scientific Services	20% TEA in water	2018	KS	Marylebone Road Intercomparison	12	77	79	-2.2%	G	**1.02**
Glasgow Scientific Services	20% TEA in water	2018		**Overall Factor[3] (6 studies)**				**Use**		**0.91**

Figure 6: Tube Precision & AIR Results

Table 1: Laboratory summary performance for AIR NO_2 PT rounds AR0019, 21, 22, 24, 25, 27, 28 and 30

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

AIR PT Round	AIR PT AR019	AIR PT AR021	AIR PT AR022	AIR PT AR024	AIR PT AR025	AIR PT AR027	AIR PT AR028	AIR PT AR030
Round conducted in the period	April – May 2017	July – August 2017	September – October 2017	January – February 2018	April – May 2018	July – August 2018	September – October 2018	January – February 2019
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
SOCOTEC	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	87.5 % [1]
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	50 %	0 %	100 %	100 %	100 %	50 %	100 %	100 %
Gradko International [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 %	100 %	100 %	75 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Lambeth Scientific Services	NR [2]	NR [2]	100 %	NR [2]	NR [2]	NR [2]	25 %	50 %
Milton Keynes Council	75 %	0 %	75 %	100 %	75 %	100 %	100 %	100 %
Northampton Borough Council	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Somerset Scientific Services	100 %	100 %	75 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	100 %	100 %	50 %	100 %	100 %	100 %	100 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %
West Yorkshire Analytical Services	100 %	100 %	100 %	50 %	75 %	100 %	100 %	100 %

[1] Participant subscribed to two sets of test results (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Northampton Borough Council, Kent Scientific Services, Cardiff Scientific Services, Kirklees MBC and Exova (formerly Clyde Analytical) no longer carry out NO2 diffusion tube monitoring and therefore did not submit results.

Figure 7: Diffusion Tube Accuracy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm $^{-3}$	Tube 2 µgm $^{-3}$	Tube 3 µgm $^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2018	29/01/2018	23.9	27.8	28.3	27	2.4	9	6.0
2	29/01/2018	26/02/2018	26.7	25.0	24.2	25	1.3	5	3.2
3	26/02/2018	26/03/2018	21.3	24.7	21.8	23	1.8	8	4.6
4	26/03/2018	02/05/2018	23.8	23.2	21.3	23	1.3	6	3.2
5	02/05/2018	06/06/2018	22.3	21.4	21.0	22	0.7	3	1.7
6	06/06/2018	04/07/2018	21.1	29.5	17.8	23	6.0	26	15.0
7	04/07/2018	08/08/2018	21.7	21.4	22.2	22	0.4	2	1.0
8	08/08/2018	05/09/2018	17.5	12.4	13.9	15	2.6	18	6.5
9	05/09/2018	04/10/2018	16.5	19.7	12.3	16	3.7	23	9.2
10	04/10/2018	31/10/2018	18.7	17.3	20.2	19	1.5	8	3.6
11	31/10/2018	05/12/2018	23.2	24.0	25.8	24	1.3	5	3.3
12	05/12/2018	07/01/2019	25.2	26.4	24.8	25	0.8	3	2.1
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method	
Period Mean	Data Capture (% DC)
21	87
20	100
18	100
16	99
14	100
18	99
15	61
13	43
14	99
19	100
17	99
21	100
Overall survey -->	

Data Quality Check	
Tubes Precision Check	Automatic Monitor Data
Good	Good
Good	Good
Good	Good
Good	Good
Good	Good
Poor Precision	Good
Good	or Data Capture
Good	or Data Capture
Poor Precision	Good
Good	Good
Good	Good
Good	Good
Good precision	Good Overall DC

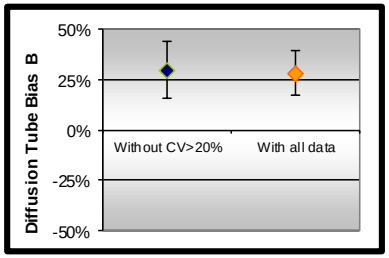
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	High Street, Irvine

Precision: 10 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 8 periods of data	
Bias factor A	0.78 (0.7 - 0.87)
Bias B	28% (14% - 42%)
Diffusion Tubes Mean:	23 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	18 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	18 (16 - 20) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.79 (0.72 - 0.86)
Bias B	27% (16% - 38%)
Diffusion Tubes Mean:	23 µgm^{-3}
Mean CV (Precision):	10
Automatic Mean:	18 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	18 (16 - 19) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Diffusion Tube Accuracy NAC (cont'd)

Adjustment of SINGLE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tube Measurements

Site Name/ID	Periods													Raw Mean	Valid periods	Adjusted measurement (95% confidence interval) with all the data 10 periods used in this calcuations
	1	2	3	4	5	6	7	8	9	10	11	12	13			Bias Factor A 0.79 (0.72 - 0.86) Bias B 27% (16%- 38%) Tube Precision: 10 Automatic DC: 98%
35 East Road Irvine/DT1	24.0	27.7	23.8	23.9			18.7	19.0	15.7	22.6	29.5	31.1		23.6	10	Adjusted with 95% CI 19 (17 - 20)
18 Bank St, Irvine (Pitchers)/DT2	48.9	31.0	33.5	31.9	24.9	16.7	18.9	15.9	16.1	22.3	32.8	33.6		27.2	12	Adjusted with 95% CI 21 (20 - 23)
147 High Street, Irvine (Browings)/DT3	33.1	24.7		21.8	15.5		16.0	15.4		31.1	25.6	42.6		25.1	9	Adjusted with 95% CI 20 (18 - 22)
85 High St, Irvine (Shoe Repair/Indian Palace)/DT4	27.4	22.9	21.7	19.7	18.3	10.5	19.7	18.8	17.8	15.3	23.8	26.9		20.2	12	Adjusted with 95% CI 16 (15 - 17)
79 High St, Irvine (Fishmongers)/DT5	30.4	32.4	24.6	29.6	21.4	12.5	25.9	23.1	23.3	20.0	29.3	32.3		25.4	12	Adjusted with 95% CI 20 (18 - 22)
75 High St, Irvine (Yoohoo/The Meridian Room)/DT6	33.2	28.8	23.6	19.5		20.8	20.8	19.8	18.0	21.5	24.5	29.5		23.6	11	Adjusted with 95% CI 19 (17 - 20)
65a High Street, Irvine, (AUTO MONITOR STATION)/DT7	23.9	26.7	21.3	23.8	22.3	21.1	21.7	17.5	16.5	18.7	23.2	25.2		21.8	12	Adjusted with 95% CI 17 (16 - 19)
65 High Street, Irvine, (AUTO MONITOR STATION)/DT8	27.8	25.0	24.7	23.2	21.4	29.5	21.4	12.4	19.7	17.3	24.0	26.4		22.7	12	Adjusted with 95% CI 18 (16 - 20)
65 High Street, Irvine, (AUTO MONITOR STATION)/DT9	28.3	24.2	21.8	21.3	21.0	17.8	22.2	13.9	12.3	20.2	25.8	24.8		21.1	12	Adjusted with 95% CI 17 (15 - 18)
34 Kirkgate Irvine/DT10	18.7	11.9	15.9	11.7	7.3	3.1	8.8	3.4	5.6	23.6	17.0	14.9		11.8	12	Adjusted with 95% CI 9 (9 - 10)
25 Main Rd, Springside/DT11	20.6	17.0	15.6	11.5	13.1		12.1	9.7	10.9	13.0	19.4	19.1		14.7	11	Adjusted with 95% CI 12 (11 - 13)
Auchengate (Bridge)/DT12	20.2	19.6	15.4	13.4	8.8	5.6	11.4	7.8	7.9	11.9	16.7	16.7		13.0	12	Adjusted with 95% CI 10 (9 - 11)
Dalry Rd , Kilwinning/DT13	22.6	28.7	24.8	24.0	20.1	14.6	18.8	20.4	13.3	27.5	29.5	29.2		22.8	12	Adjusted with 95% CI 18 (16 - 20)
12 Garnock St, Dalry/Dt14	22.0	15.5	14.9		6.6	4.1	7.2	2.7	3.8	8.0	16.1	17.0		10.7	11	Adjusted with 95% CI 8 (8 - 9)
67 New St, Dalry (Royal Hotel)/DT15	43.0	40.9	31.1	19.3	21.2	10.4	22.3	13.7	25.0	33.5	29.3	36.5		27.2	12	Adjusted with 95% CI 21 (20 - 23)
45 New St Dalry (Zain's Curry House)/DT16	50.9	49.5	40.3	36.0	37.5	30.6	31.2	21.2	27.2	33.8	43.9	45.9		37.3	12	Adjusted with 95% CI 29 (27 - 32)
2 Townhead, St, Dalry (Housing Office)/DT17	39.8	32.7	28.4	31.2	31.6	14.0	27.3	18.6	21.8	26.3	36.4	39.4		29.0	12	Adjusted with 95% CI 23 (21 - 25)
Highfield Hamlet , Dalry/DT18	28.0	24.3	21.0	24.6	15.7		16.1	7.9	8.7	13.7	28.2	20.9		19.0	11	Adjusted with 95% CI 15 (14 - 16)
85 Main Street , Largs (Key Centre)/DT19	24.8	25.6	22.2	22.4	20.2	9.5	20.6	17.2	10.6	16.0	23.0	19.8		19.3	12	Adjusted with 95% CI 15 (14 - 17)
Hunterston Road/Cycle Track/DT20	10.7	5.1	7.8	6.5	6.6	2.0	5.0	3.3	2.0	4.7	8.7	5.8		5.7	12	Adjusted with 95% CI 4 (4 - 5)
41-43 Princes St, Ardrossan/DT21	27.8	15.7	23.8	21.7	20.5	15.0	13.6	11.5	9.2	13.9	23.1	19.6		18.0	12	Adjusted with 95% CI 14 (13 - 15)
21 Vernon St, Saltcoats/DT22	22.9	21.3	21.0	20.6	16.3	13.1	20.3	18.1	10.0	14.1	19.0	21.3		18.2	12	Adjusted with 95% CI 14 (13 - 16)

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Diffusion Tube Accuracy NAC (cont'd)

Adjustment of DUPLICATE or TRIPLICATE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Average	Standard Deviation	CV	95% CI mean
1	03/01/2018	29/01/2018	23.9	27.8	28.3	26.7	2.41	9.03	5.98
2	29/01/2018	26/02/2018	26.7	25.0	24.2	25.3	1.28	5.05	3.17
3	26/02/2018	26/03/2018	21.3	24.7	21.8	22.6	1.84	8.12	4.56
4	26/03/2018	02/05/2018	23.8	23.2	21.3	22.8	1.31	5.73	3.24
5	02/05/2018	06/06/2018	22.3	21.4	21.0	21.6	0.67	3.09	1.65
6	06/06/2018	05/09/2018	21.1	29.5	17.8	22.8	6.03	26.46	14.99
7	04/07/2018	08/08/2018	21.7	21.4	22.2	21.8	0.40	1.86	1.00
8	08/08/2018	05/09/2018	17.5	12.4	13.9	14.6	2.62	17.95	6.51
9	05/09/2018	04/10/2018	16.5	19.7	12.3	16.2	3.71	22.96	9.22
10	04/10/2018	31/10/2018	18.7	17.3	20.2	18.7	1.45	7.74	3.60
11	31/10/2018	05/12/2018	23.2	24.0	25.8	24.3	1.33	5.47	3.31
12	05/12/2018	07/01/2019	25.2	26.4	24.8	25.5	0.83	3.27	2.07
13									

Data Quality Check
Diffusion Tubes Precision Check
Good
Good
Good
Good
Good
Poor Precision
Good
Good
Poor Precision
Good
Good
Good

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Jaume Targa, for AEA

Version 04 - February 2011

Site Name/ ID: High Street, Irvine

Adjusted measurement (95% confidence level)
Without periods with CV larger than 20%

Bias calculated using 8 periods of data
Tube Precision: 6 Automatic DC: 98%
Bias factor A: 0.78 (0.7 - 0.87)
Bias B: 28% (14% - 42%)

Information about tubes to be adjusted
Diffusion Tube average: 22 µgm^{-3}
Average Precision (CV): 7
Adjusted Tube average: 17 +/- 2 µgm^{-3}

Adjusted measurement (95% confidence level)
with all data

Bias calculated using 10 periods of data
Tube Precision: 10 Automatic DC: 98%
Bias factor A: 0.79 (0.72 - 0.86)
Bias B: 27% (16% - 38%)

Information about tubes to be adjusted
Diffusion Tube average: 22 µgm^{-3}
Average Precision (CV): 10
Adjusted Tube average: 17 +/- 2 µgm^{-3}

Figure 8: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Irvine 2014 - 2018.

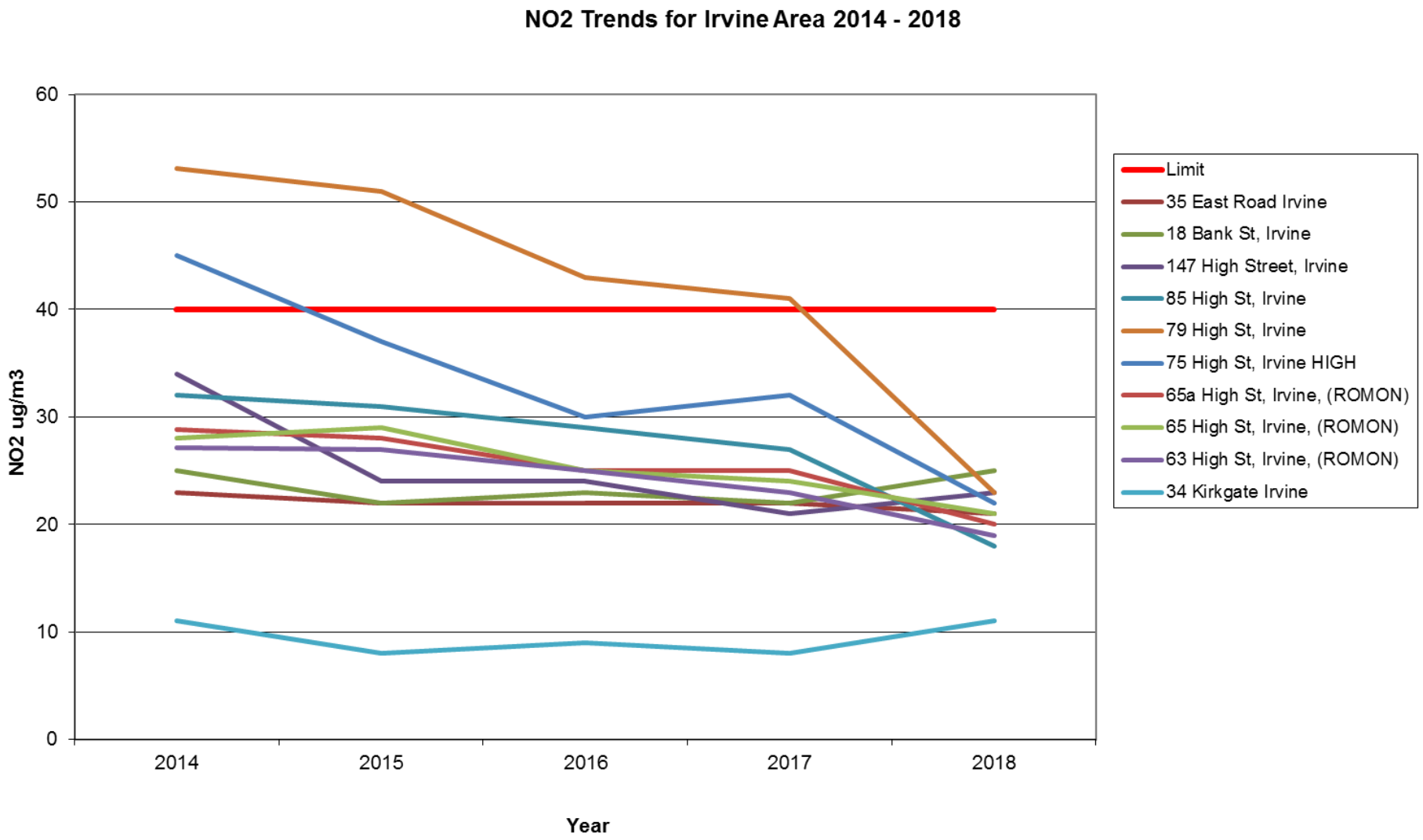


Figure 9: Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites in Dalry 2014 - 2018.

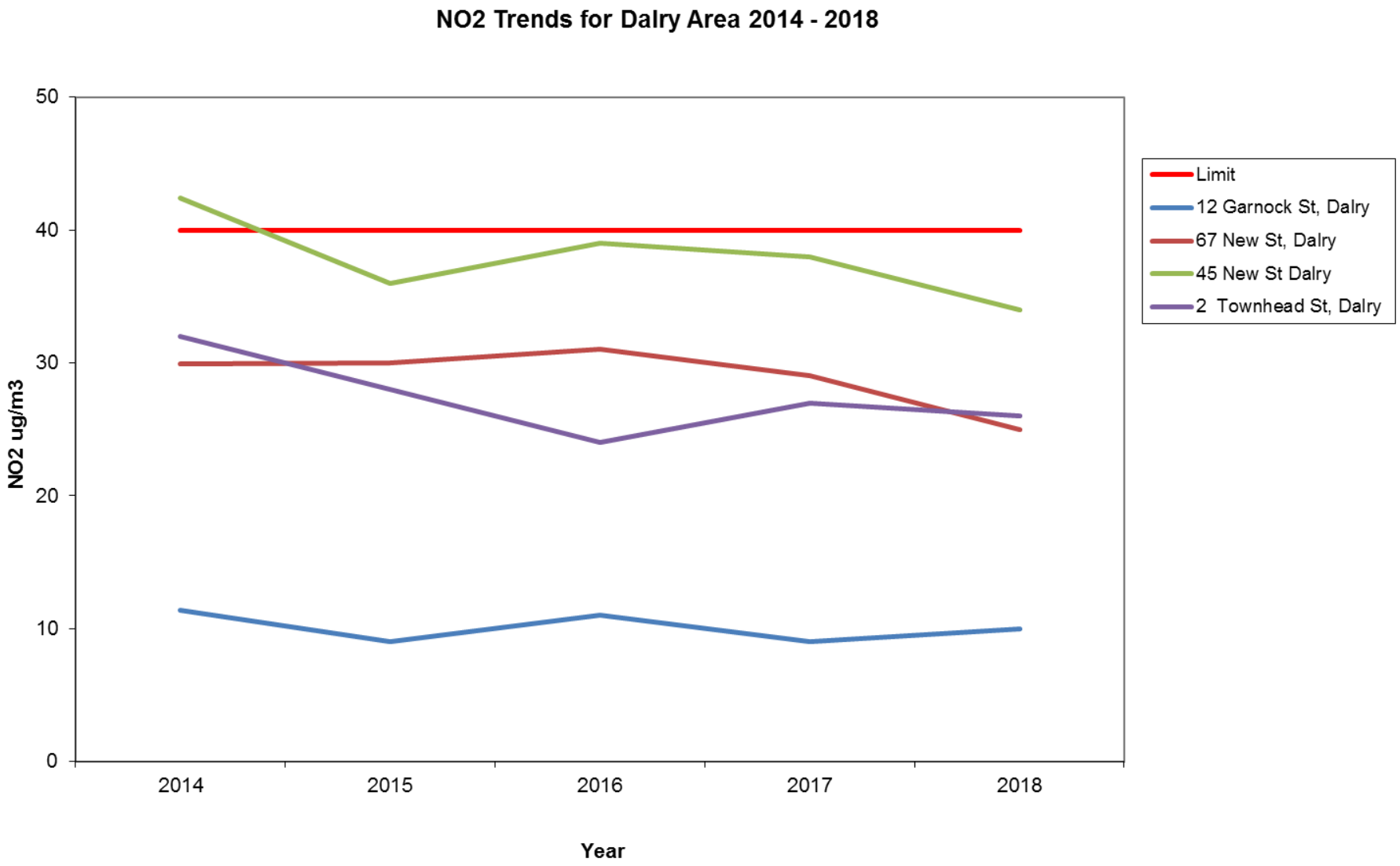


Figure 10: Trends in Annual Mean PM10 Concentrations measured at Automatic Station (ROMON) in High Street, Irvine 2014 - 2018.

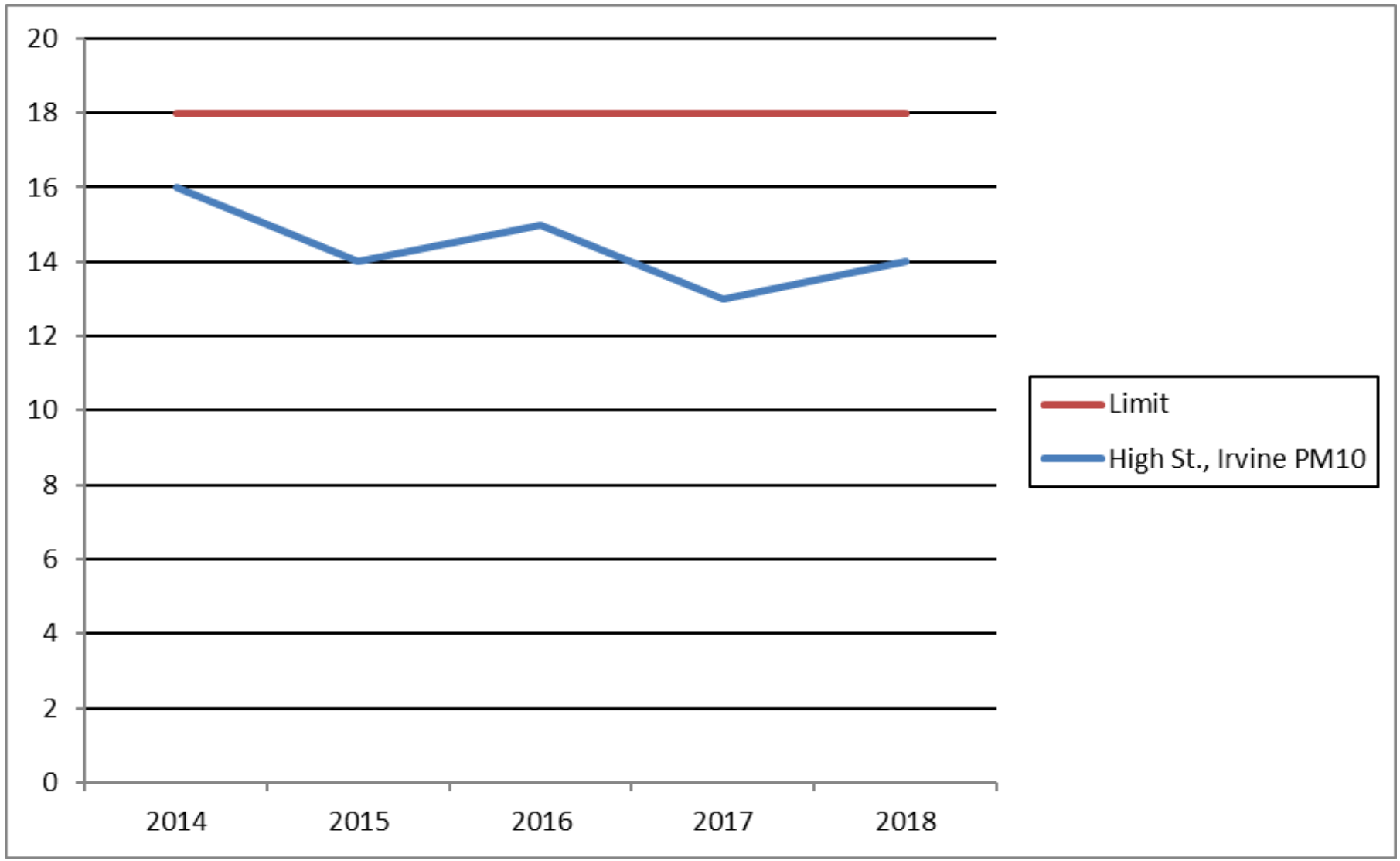


Figure 11: Trends in Annual Mean PM2.5 Concentrations measured at Automatic Station (ROMON) in High Street, Irvine 2015 - 2018.

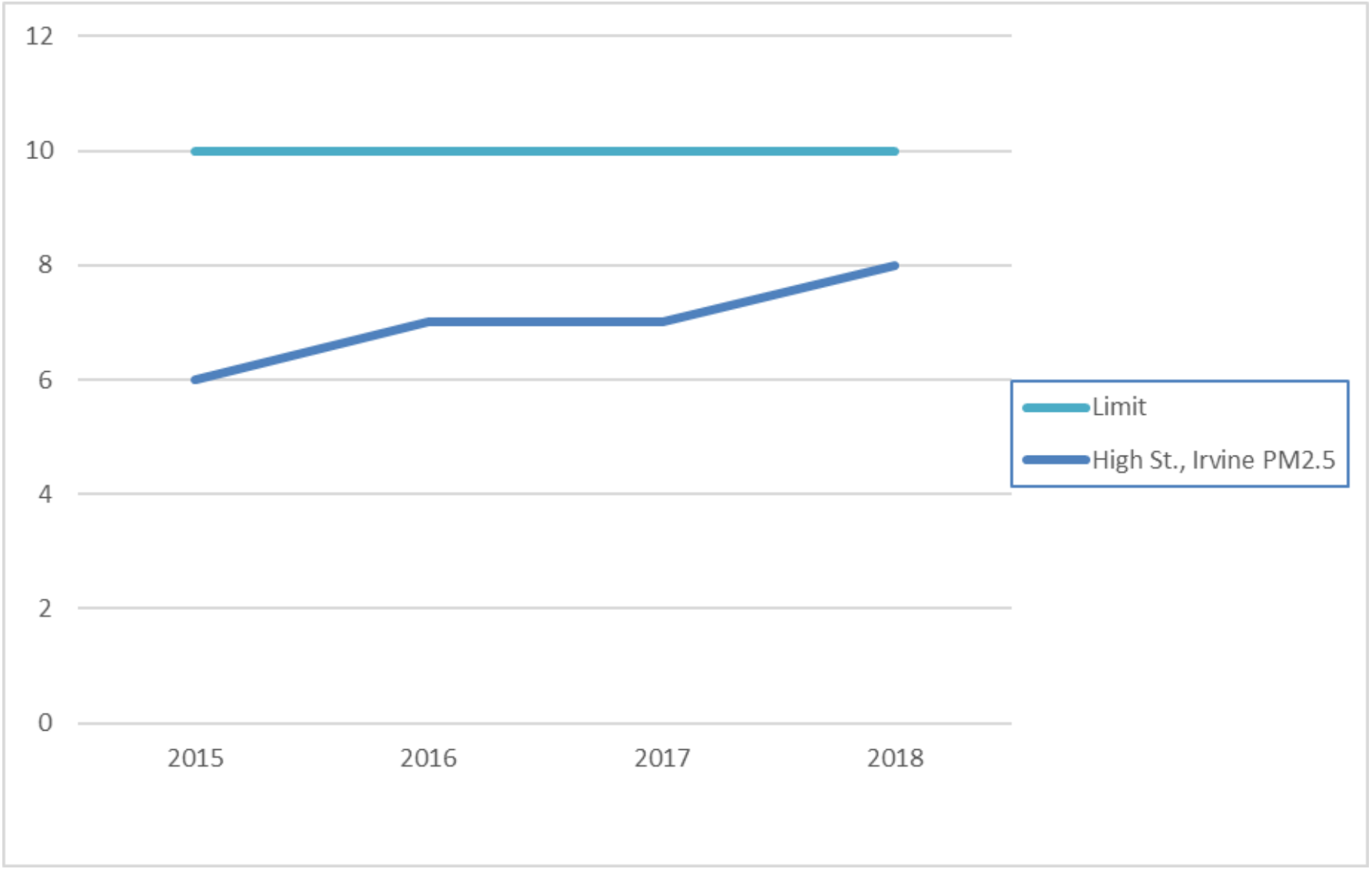
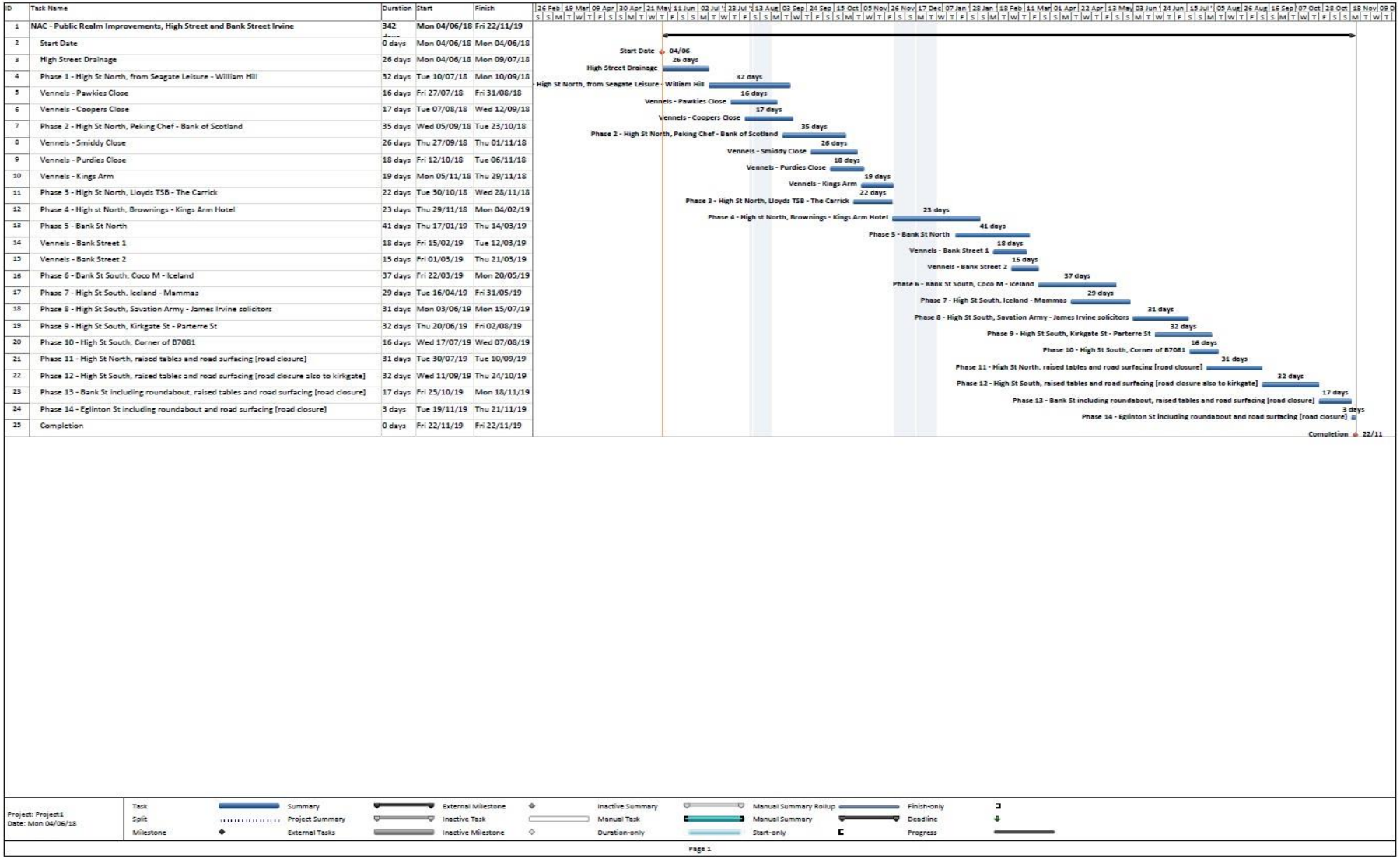


Figure 12: Irvine High Street, Irvine Public Realm Works Timescale



ID	Task Name	Duration	Start	Finish
1	**NAC - Public Realm Improvements, High Street and Bank Street Irvine**	**342 days**	**Mon 04/06/18**	**Fri 22/11/19**
2	Start Date	0 days	Mon 04/06/18	Mon 04/06/18
3	High Street Drainage	26 days	Mon 04/06/18	Mon 09/07/18
4	Phase 1 - High St North, from Seagate Leisure - William Hill	32 days	Tue 10/07/18	Mon 10/09/18
5	Vennels - Pawkies Close	16 days	Fri 27/07/18	Fri 31/08/18
6	Vennels - Coopers Close	17 days	Tue 07/08/18	Wed 12/09/18
7	Phase 2 - High St North, Peking Chef - Bank of Scotland	35 days	Wed 05/09/18	Tue 23/10/18
8	Vennels - Smiddy Close	26 days	Thu 27/09/18	Thu 01/11/18
9	Vennels - Purdies Close	18 days	Fri 12/10/18	Tue 06/11/18
10	Vennels - Kings Arm	19 days	Mon 05/11/18	Thu 29/11/18
11	Phase 3 - High St North, Lloyds TSB - The Carrick	22 days	Tue 30/10/18	Wed 28/11/18
12	Phase 4 - High st North, Brownings - Kings Arm Hotel	23 days	Thu 29/11/18	Mon 04/02/19
13	Phase 5 - Bank St North	41 days	Thu 17/01/19	Thu 14/03/19
14	Vennels - Bank Street 1	18 days	Fri 15/02/19	Tue 12/03/19
15	Vennels - Bank Street 2	15 days	Fri 01/03/19	Thu 21/03/19
16	Phase 6 - Bank St South, Coco M - Iceland	37 days	Fri 22/03/19	Mon 20/05/19
17	Phase 7 - High St South, Iceland - Mammas	29 days	Tue 16/04/19	Fri 31/05/19
18	Phase 8 - High St South, Savation Army - James Irvine solicitors	31 days	Mon 03/06/19	Mon 15/07/19
19	Phase 9 - High St South, Kirkgate St - Parterre St	32 days	Thu 20/06/19	Fri 02/08/19
20	Phase 10 - High St South, Corner of B7081	16 days	Wed 17/07/19	Wed 07/08/19
21	Phase 11 - High St North, raised tables and road surfacing [road closure]	31 days	Tue 30/07/19	Tue 10/09/19
22	Phase 12 - High St South, raised tables and road surfacing [road closure also to kirkgate]	32 days	Wed 11/09/19	Thu 24/10/19
23	Phase 13 - Bank St including roundabout, raised tables and road surfacing [road closure]	17 days	Fri 25/10/19	Mon 18/11/19
24	Phase 14 - Eglinton St including roundabout and road surfacing [road closure]	3 days	Tue 19/11/19	Thu 21/11/19
25	Completion	0 days	Fri 22/11/19	Fri 22/11/19

Appendix D: Supporting Figures

Figure 13: Automatic Monitoring Site Location

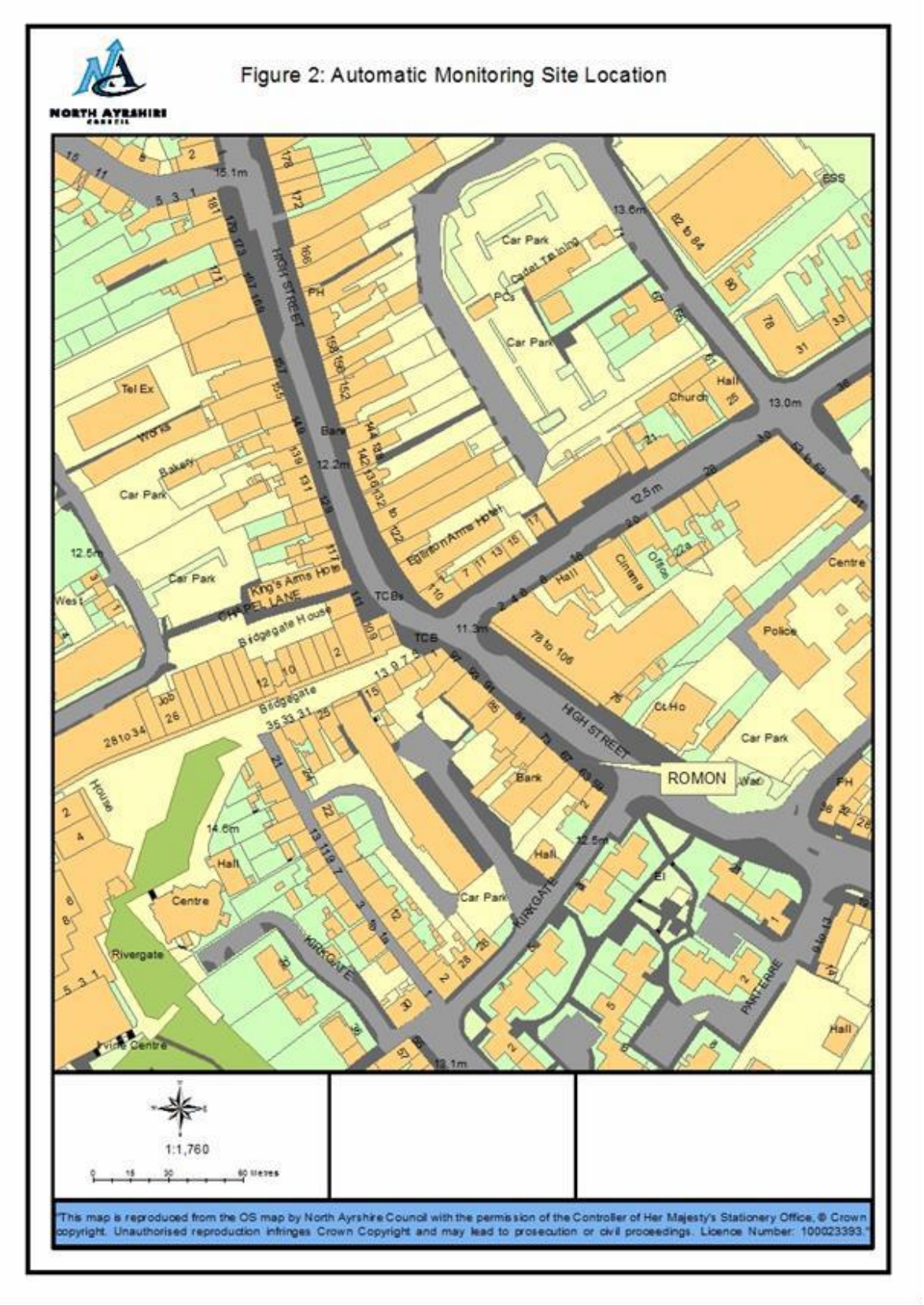


Figure 14: Non-Automatic Monitoring Site Locations

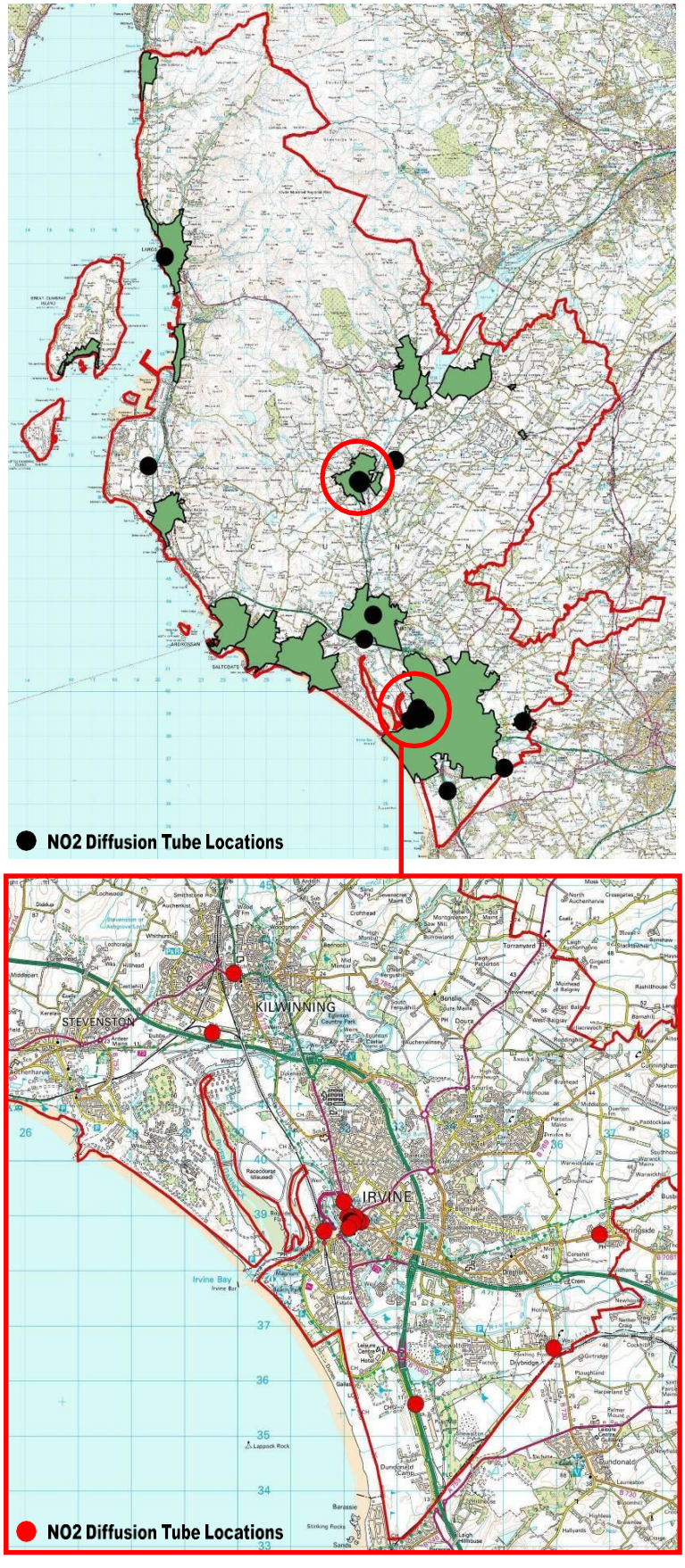


Figure 15: High Street, Irvine Diffusion Tube Site Locations

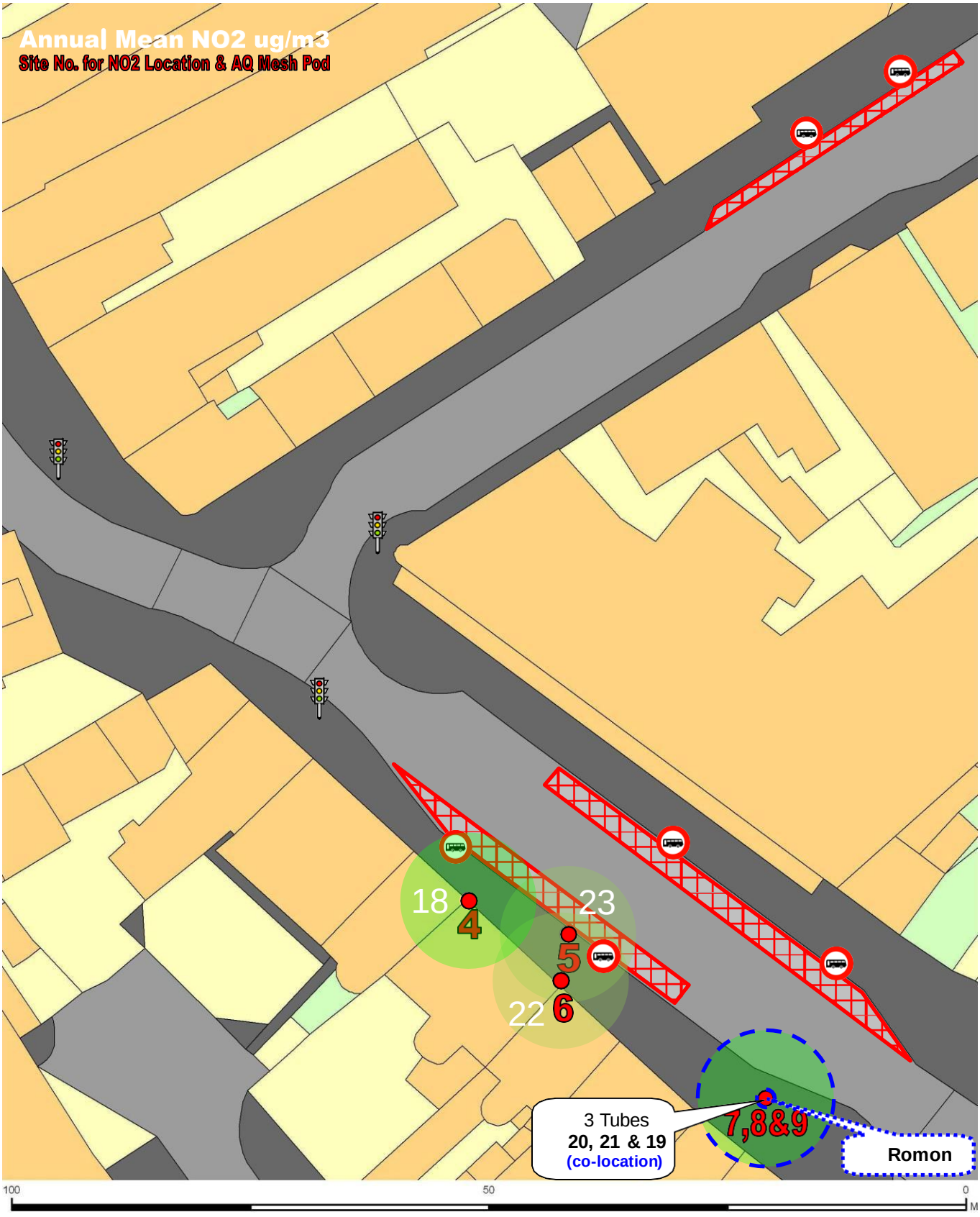


Figure 16: Dalry Diffusion Tube Site Locations

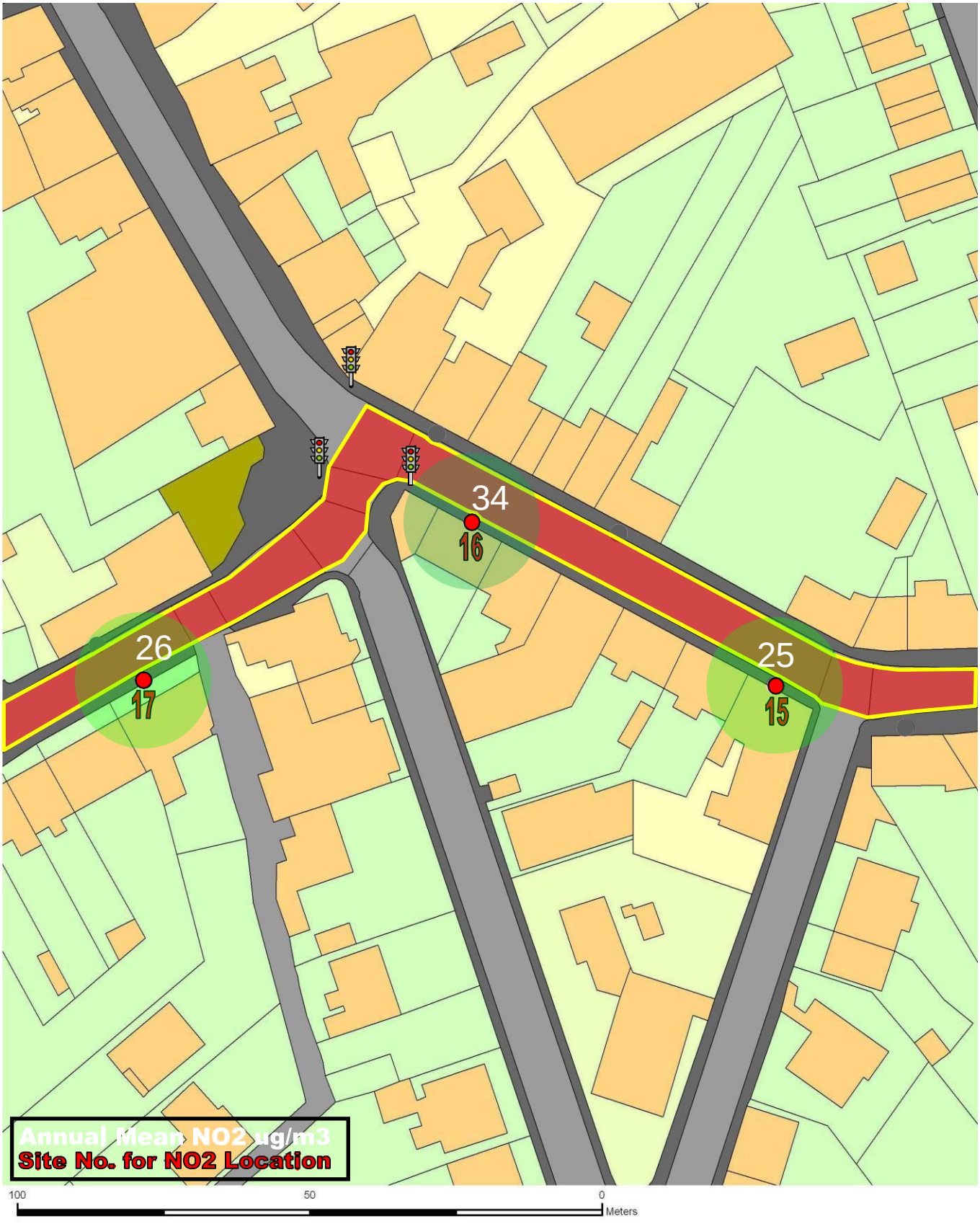
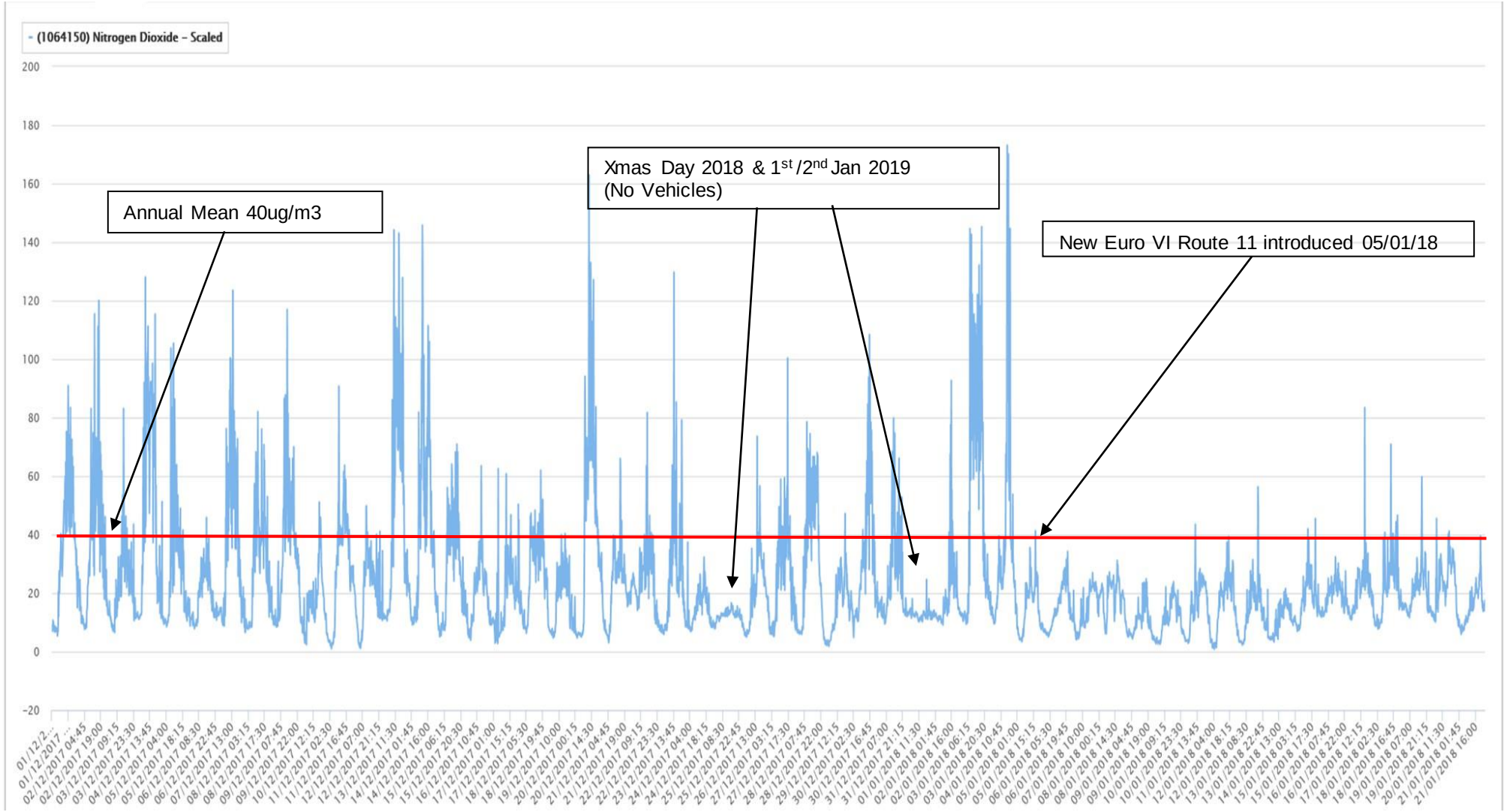


Figure 17: Graph showing potential change in NO2 concentrations following Euro VI buses introduction.



Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

References

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   https://www.north-ayrshire.gov.uk/Documents/CorporateServices/Finance/environmental-sustainability-climate-change-strategy.pdf

3. Local Air Quality Management, Technical Guidance LAQM.TG (16), April 2016.

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