City of BRADFORD METROPOLITAN DISTRICT COUNCIL

2018 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

April 2019

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Executive Summary: Air Quality in Our Area

Air Quality in Bradford

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

The air pollutants of concern in Bradford are nitrogen dioxide NO_2 and particulate matter (PM). A significant source of these pollutants is traffic but industry, heat and power generation, domestic sources and natural activities also contribute.

Bradford has areas of high levels of deprivation and significant levels of health inequality. 27% of the Bradford district population live in areas classed as the 10% most deprived in England[4]. There are above average numbers of deaths from smoking, cancer, heart disease and strokes and it is estimated that emissions of man-made fine particles, $PM_{2.5}$ cause 5.0% of total mortality[5]. Improving public health outcomes and reducing deprivation are significant challenges for City of Bradford MDC.

Poor air quality is closely linked to poor health and is frequently identified in the most deprived wards of the city. City of Bradford MDC fully recognises that improving local air quality is essential to deliver better health outcomes for all. This is particularly important for the above national average numbers of young people in the district (24% of the total population are under 16) whom are particularly sensitive to the

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013
[4] https://ubd.bradford.gov.uk/media/1289/poverty-and-deprivation-ubd-20170206.pdf
[5] https://fingertips.phe.org.uk/search/particulate#page/0/gid/1/pat/6/par/E12000003/ati/102/are/E08000032

effects of poor air quality. They may experience life-long impacts resulting from pollutant exposure in their early years.

For some pollutants the government has set health based objective levels which Local Authorities must comply with. Where these objectives are not met, Local Authorities must declare **Air Quality Management Areas (AQMAs)** and draw **up Air Quality Action Plans (AQAPs)** to improve air quality.

Air Quality Management Areas in Bradford

Bradford has declared four Air Quality Management Areas (AQMAs). These are located close to the city centre at Manningham Lane, Thornton Road, Mayo Avenue / Manchester Road and Shipley Airedale Road. The AQMAs were declared for exceedances of both the annual and hourly objectives for nitrogen dioxide.

There are a number of other locations where nitrogen dioxide concentrations are known to be elevated. Monitoring is on-going at these locations and further AQMA declarations may become necessary in the future.

The approximate location of the AQMAs and other areas of concern identified by City of Bradford MDC are shown in Figure 1.

The detailed boundaries of the current AQMAs are shown in Figure 2.

This report presents air quality data for Bradford MDC for the 2017 calendar year.

During 2017 the annual average NO_2 objective continued to be breached at relevant receptor points in the AQMAs located at Manningham Lane and Shipley Airedale Road.

The annual average NO_2 objective was not exceeded at relevant receptor points in the Mayo Avenue or Thornton Road AQMAs during 2017. The last recorded breach of the annual average objective on Thornton Road occurred in 2014.

The hourly NO_2 objective was not exceeded at any of the AQMAs during 2017. This has been the case for the past four years.

The current AQMAs were originally declared for both the annual and hourly objectives for NO_2. The declaration for hourly objectives at Thornton Road and Mayo Avenue are no longer considered necessary. City of Bradford MDC will amend the AQMA orders to reflect this.

Figure 1: Current AQMAs and additional areas of air quality concern in Bradford

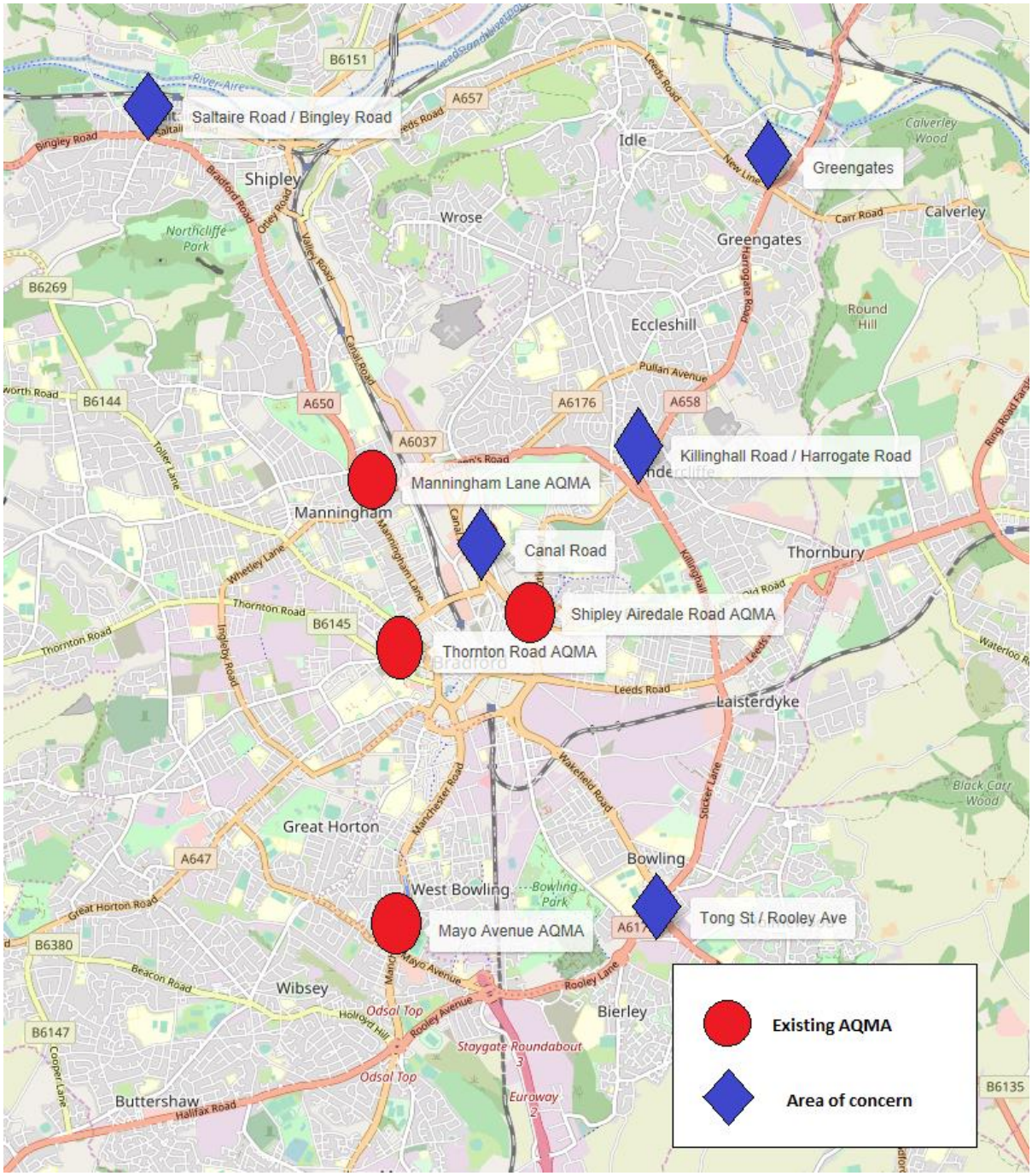
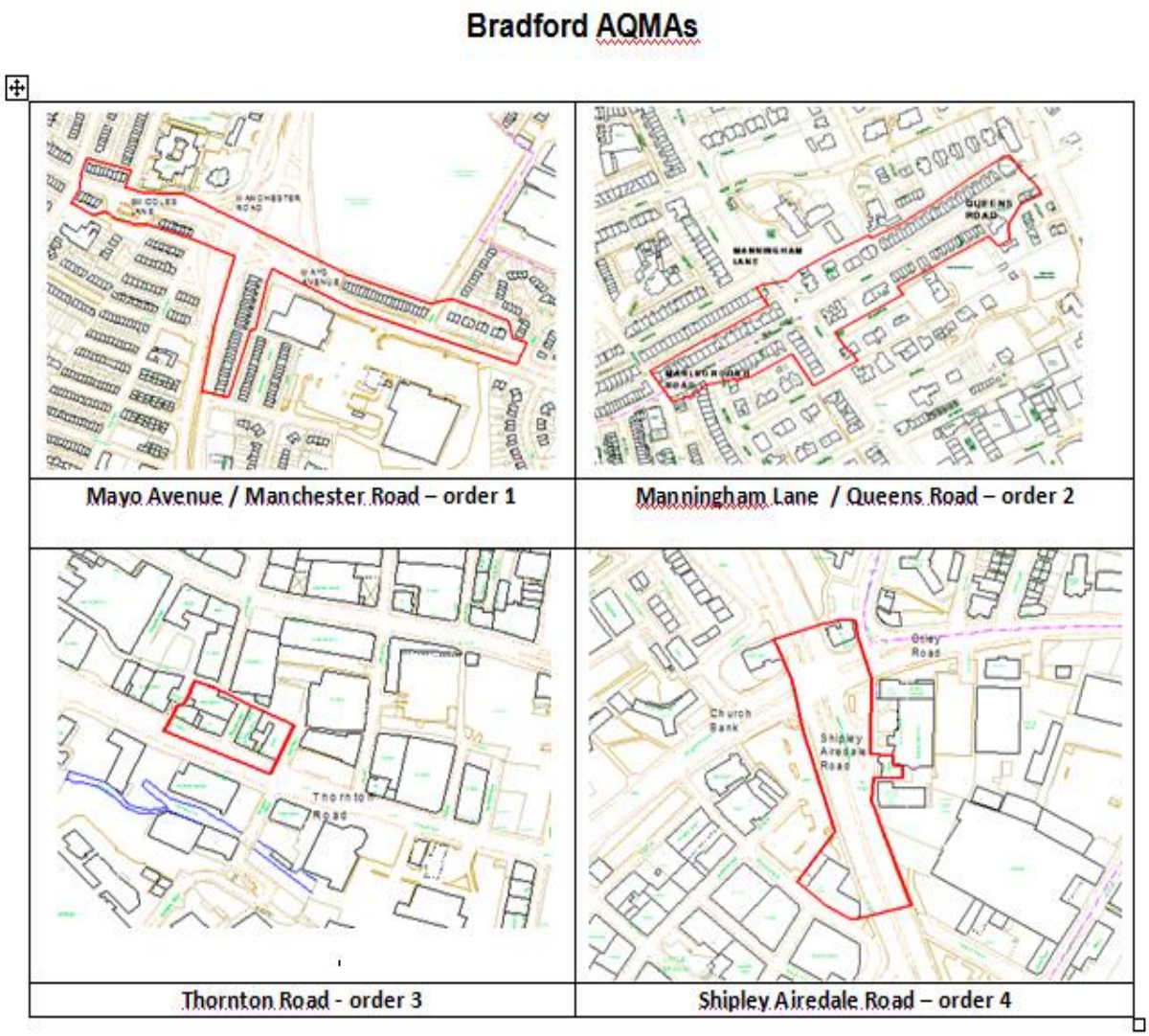


Figure 2: Bradford AQMA boundaries



Air quality trends in the AQMAs

Shipley Airedale Road

The annual average NO_2 concentration recorded at the Shipley Airedale Road real time monitoring site in 2017 was 40µg/m^3. This is significantly lower than values recorded in the previous 5 years which have ranged between 48µg/m^3 and 54µg/m^3. Data capture at this site during the 2017 period was lower than in previous years resulting in the data having to be annualised. This may have had some bearing on the lower than usual result.

Data from the nearest diffusion tube (DT12) also showed a reduction in NO_2 concentration during 2017(compared with the previous 4 years). The results

from this site remain significantly above the annual average objective at 62µg/m^3 (objective level = 40 µg/m^3). The diffusion tube results indicate that the hourly objective may still be at risk in some locations within the Shipley Airedale Road AQMA.

There is some evidence of a downward trend in NO_2 concentration in this AQMA in recent years, but further monitoring is required to confirm this.

Mayo Avenue / Manchester Road

At Mayo Avenue the annual average NO_2 concentration recorded at the real time monitoring site in 2017 was 42µg/m^3. This was lower than the value of 46µg/m^3 recorded in 2016 (but the same as that recorded in 2014 and 2015). The average concentration of NO_2 measured at this site over the last 5 years was 49µg/m^3. Air quality has not improved significantly within the Mayo Avenue AQMA during the past 4 years. Once corrected for distance to the nearest relevant receptor points there were no exceedances of the NO_2 air quality objectives at the Mayo Avenue AQMA in 2017.

During 2017 additional diffusion tubes were deployed to examine current air quality across a wider area of the Mayo Avenue / Manchester Road AQMA. The results from these additional tubes (DT103 through to DT106) confirm that the annual average NO_2 concentration remains elevated across this area but is not exceeded at relevant receptor points. The hourly objective is no longer at risk within this AQMA.

Thornton Road

At the Thornton Road real time site there was a further slight reduction in annual average NO_2 concentration. The concentration recorded in 2017 was 30µg/m^3 (compared with 33 µg/m^3 in 2015, and 31 µg/m^3 in 2016). The five year average for the site was 42µg/m^3. The hourly objective has not been exceeded at this site since 2015.

Since the completion of the 2016 ASR report additional diffusion tube monitoring has been deployed in the Thornton Road area (tubes DT108, DT109 and DT 110). These tubes also indicate that both the annual average and hourly objectives for NO_2 are met in this area.

Under business as usual conditions the AQMA at Thornton Road may be revoked. However, due to the on-going development of the Government mandated air quality plan business case it has been decided to delay the revocation until improved estimates of future volumes and composition of traffic on Thornton Road are available.

Manningham Lane

The annual average concentration of NO_2 measured at the Manningham Lane real time site in 2017 was 39µg/m^3. This is slightly lower than the results from the previous two years (42µg/m^3 in 2015 and 41µg/m^3 in 2016). The diffusion tubes in this area provide a mixed picture, one being lower and one being higher than in previous years. In previous years tube DT72 has indicated a possible breach of the hourly NO_2 objective at a relevant receptor within this AQMA. This was not the case in 2017 but the results from this tube were still well above the annual average objective level at 53 µg/m^3.

It is unclear what the long term air quality trend is within this AQMA and the hourly objective may still be at risk of being breached.

Additional areas of air quality concern in Bradford

Since the declaration of the current AQMAs, City of Bradford MDC has identified five additional areas where elevated NO_2 concentrations have been recorded. These are located at:

- Saltaire Road / Bingley Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads
- Canal Road
- Greengates crossroads

The 2017 monitoring results indicate that the annual average NO_2 objective continues to be exceeded at two relevant locations on Bingley Road and one on Tong Street. The tube on Killinghall Road remains border-line returning a value of 40ug/m^3 in 2017. Further information about current air quality in each of these areas is detailed in section 3 of this report.

Mandated Technical Feasibility Study and Bradford Air Quality Plan Business Case

In addition to the national air quality objectives (which local authorities have a duty to work towards) the UK Government has a legal duty to meet EU air quality standards. The UK has failed to meet these standards in many of its cities. As a result the EU commenced infraction proceedings against the UK in spring 2015.

In April 2015 the UK Government was subject to a Supreme Court Action ruling relating to air quality. Subsequent court challenges have resulted in further rulings against the Government and a requirement to develop new plans to resolve the UK's air quality problems.

A NO_2 reduction plan was produced in 2017 which mandated cities with the worst air quality to undertake technical feasibility studies to identify further measures to improve air quality. The document was challenged in the High Court and subsequently deemed 'illegally inadequate'. The Government was required to undertake further revisions to the plan to ensure that it is taking all possible steps to deliver the EU air quality objectives in the shortest possible timeframe.

In March 2018, City of Bradford MDC was mandated by Ministerial Direction to complete a technical feasibility study to identify interventions that might bring forward Bradford's compliance with the EU limit values for NO_2. Bradford was one of several 'third wave' local authorities required to undertake this type of study.

Bradford's mandated technical feasibility study was submitted to DEFRA in July 2018. It concluded that a scheme incorporating a form of vehicular access control would be required to bring forward compliance.

The full report can be viewed here:

https://uk-air.defra.gov.uk/library/assets/documents/no2ten/Bradford_FINAL.pdf

Following the outcomes of this initial study Government has served a further Ministerial Direction on City of Bradford MDC. This requires further consideration of the options shortlisted in the initial study and the development

of a detailed business case for a new Bradford Air Quality Plan to bring forward compliance in the shortest possible timeframe. The Direction requires that the local authority produces a final business case by 5th October 2019. The development of this business case is currently on-going.

The scale and nature of the measures required to meet the EU limit values are likely to impact on air quality across a wide area of Bradford. This will include the current AQMAs and other areas where AQMA declarations are pending or elevated air quality conditions have been identified.

In the majority of cases the air quality implications of measures likely to be put in place to address the EU limit value exceedances are anticipated to be positive. However, there are risks for traffic to be re-distributed across the road network and for the composition of vehicles to change on some routes.

Due to current uncertainty about the detail of future traffic levels and air quality conditions across the city, City of Bradford MDC has decided to delay revocation of existing AQMAs, or the creation of any new AQMAs, until the outcomes and timescales of the business case and subsequent Bradford Air Quality Plan are known. This will enable air quality resources to be fully concentrated on developing the air quality plan business case and prevent any unnecessary AQMA declarations or revocations.

Significant challenges to improving air quality in Bradford

Significant key challenges to improving air quality in Bradford are:

- Failure of vehicle manufacturers to reduce emissions as quickly as was previously anticipated. This is considered to be a direct result of inadequate emission control tests for new vehicles and the use of emission test defeat strategies by a number of vehicle manufacturers. Consequently 'on the road emissions' of NO_x from many modern vehicles, particularly Euro 5 diesel cars, are much higher than consumers have previously been led to believe.
- The increased uptake of diesel vehicles in the general vehicle fleet, driven by previous central government taxation polices designed to encourage their purchase.

- Development related “emissions creep”, arising from additional vehicle trips linked to development in the city and associated combustion sources for heating and industry.
- Bradford has seen an increase in domestic wood burning, biomass and local electricity generation (CHP and STOR).

Actions to Improve Air Quality in Bradford

The measures currently being taken by the City of Bradford MDC to improve air quality are detailed in the following documents:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES)

These documents can be viewed at:

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/.

The approaches employed to currently improve air quality in Bradford are;

a) **Trip reduction** – measures which aim to reduce the overall numbers of journeys taken in motor vehicles across the district. This includes investment in sustainable transport measures, enabling more people to walk, cycle or use public transport. It also incorporates measures that encourage people to share vehicles (such as car share schemes and car clubs) and measures that encourage working or studying from home.

b) **Emission reduction measures** – these are measures that aim to reduce the total emissions from individual vehicles. This can be achieved by fitting emission abatement equipment to existing vehicles, replacing older vehicles with newer ones or by completely changing the technology and fuels used. For example, ultra-low emission vehicles fuelled by electric or gas are much cleaner than those that use diesel.

Procuring low emission goods and services is a significant element of this strategy

c) **Planning measures** - these are measures designed to reduce the emission impact of future developments in Bradford, primarily in terms of traffic pollution, but also incorporating heating and other combustion sources, dust generation and industrial processes. The aim is to limit any additional trips to a minimum and ensure that the planning approval process assists in the delivery of an infrastructure required to support the future use of sustainable transport or ultra-low emission vehicles. For example, a developer may be required to provide a new cycle lane and / or electric vehicle recharging points for a new development.

d) **Education and research** - measures that help the local population understand the sources of pollutants, how they impact on their health and how emissions and exposure to air pollutants can be reduced or avoided.

The policy document facilitating air quality improvement and associated emission reductions in Bradford during 2017 was the **Bradford Low Emission Strategy (LES)** adopted in 2013. The strategy ensures that low emission measures and the requirement to improve air quality are at the heart of local decision making processes, driving air quality improvements and attracting inward investment for sustainable transport and low emission technology projects. Progress on delivery of the Bradford LES is reported to the Health and Well Being board, ensuring achievement of the best possible air quality and health outcomes for the whole of the Bradford population is a key objective, not solely compliance with air quality objectives.

Table 1 summarises air quality improvement measures in Bradford.

Some of the air quality improvement measures undertaken in Bradford during 2017 are outputs from the West Yorkshire Low Emission Strategy (WYLES). This document was fully adopted in Bradford (December 2016) and the strategy is now being delivered across the whole West Yorkshire region. The document can be viewed in full at https://www.bradford.gov.uk/media/3590/west-yorkshire-low-emissions-strategy.pdf

Future actions to improve air quality in Bradford will be significantly determined by the outcome of the air quality plan business case. The deadline for completion of the study is October 2019 and an update on progress will be provided in the 2020 ASR report.

Table 1.0 Bradford Air Quality Improvement Measures

Strategy / Policy Area	Measures undertaken up to and including 2017	Planned progress for 2018
Bradford Low Emission Strategy (LES)	An over-arching City of Bradford MDC internal strategy to improve air quality through integrated policy development focusing on measures to reduce vehicle emissions. Adopted by Full Council, 5th November 2013. During 2017, the review and update of the Bradford LES commenced in 2016 was continued ,building on the measures outlined below and incorporating additional measures to bring it in line with the recently adopted regional West Yorkshire Low Emission Strategy (WYLES).	Due to the requirement to undertake the mandated technical feasibility study and develop the Bradford air quality plan business case work on updating the Bradford LES has been put on hold. The status and relevance of the Bradford LES will be reviewed following the completion of the air quality plan business case.
West Yorkshire Low Emission Strategy	Bradford MDC has secured funding for, and co-ordinated the development of, the West Yorkshire Low Emission Strategy (WYLES) in partnership with all the West Yorkshire Councils, West Yorkshire Combined Authority (WYCA) and PHE. This is an over-arching county wide strategy to improve air quality in the West Yorkshire region through integrated policy development. Following adoption of the WYLES by City of Bradford MDC in December 2016 the following measures were progressed in 2017. • Formal launch of West Yorkshire Eco-stars scheme • Regional funding obtained for electric taxis and charging infrastructure • CAZ feasibility study in Leeds • Continued consistent low emission mitigation measures applied through the planning process	On-going implementation of WYLES planning measures Progress with implementing the WYLES and consequent updating of local policies has been slower than initially planned due to a number of the West Yorkshire authorities having to complete mandated feasibility studies and develop air quality plan business cases during 2018. In 2018 West Yorkshire LAs and WYCA have successfully obtained joint funding for bus retrofit ~£3m. Implementing the electric taxi project has also commenced through regional partnership working.

Environmental Health & Public Health	In 2015 the results of an innovative Low Emission Zone (LEZ) feasibility study were reported to Bradford Council Elected Members and a decision was taken to investigate the feasibility of implementing a LEZ in Bradford. The decision on whether to implement a LEZ in Bradford has now been superceded by the development of the Bradford air quality plan business case which will determine future air quality improvement policy in Bradford. The Public Health research project 'What factors help or hinder adoption of policies to improve air quality?' was on-going in 2017.	Undertaking mandated feasibility study and development of the Bradford air quality plan business case. Raising public health awareness of emissions and impact on health on Clean Air Day 2018 Working with Health partners including Born In Bradford and national evidence team at Defra to bid for national institute health research funding for health evaluation of the Bradford Air Quality Plan Working with Public Health England to develop the air quality work programme for PHE. Through representation on the Local Air Quality Advisory Group (LAQAG at Defra) Bradford are assisting with proposed changes to the Clean Air Act and Air Quality Strategy implementation.
Highways Management & Transport	On-going partnership work with First Bus to encourage minimum Euro emission Standards for commercial buses. On-going operation of Car club in Bradford during 2017 (including an electric vehicle). Enterprise Car Club[6] On-going development of £19 million Cycle Super-Highway (Bradford-Leeds) separated cycle lane (first phase opened 2016)	On-going liaison with local bus companies to facilitate delivery of improved Euro standards plus retrofit on more routes in Bradford. Current targets agreed with the bus alliance are for 70% of buses to be Euro VI by 2021 and 100% by 2026. These targets may need to be

[6] https://www.enterprisecarclub.co.uk

	Opening of Low Moor railway station in April 2017. This followed opening of Bradford's first new railway station in ten years at Apperley Bridge in December 2015.	revised following the outcome of the Bradford air quality plan business case development. Commencement of Greengates junction improvement scheme Planning for improvement works on Hard Ings Lane, Keighley (including air quality monitoring) Commencement of air quality monitoring prior to improvement works on A650 corridor. Procurement of supplier for West Yorkshire rapid charge network (funded by 2 million OLEV grant) Work on key corridors to develop Transforming Cities bid in 2019
Development Control	Continued implementation of Bradford LES low emission planning policies to ensure emission mitigation measures are implemented at the design stage, including the consideration of damage costs for major schemes. Required measures include: • Plug-in vehicle recharging on all schemes where practical – by the end of 2017 in the region of 6,000 charging points had been secured on new development schemes (since policy adoption in 2013) • Introduction of checklist approach to construction dust management plans • Low Emission Strategies/fleet emission standards on commercial schemes • Cycle lanes and infrastructure for walking • Electric vehicle provision	Continued implementation of Bradford and WYLES planning guidance on every relevant application. Increasing input from Public Health to support air quality and health through the planning process
Bradford Council Fleet Management	Measures introduced / completed : • Whole life costs considered in vehicle purchasing • Hybrid electric cars, electric pool cars and vans	Continued aspiration to have CAZ compliant fleet in City of Bradford MDC (Euro VI/6 in 2021)

	incorporated into council fleet • Feasibility study of introducing gas/bio-methane infrastructure for Refuse collection vehicles (RCV) fleet • Monthly fuel reports for client departments • Assessment of City of Bradford MDC fleet under Eco-stars fleet recognition scheme	Development of vehicle advisory group who track CAZ compliance and provide emissions training and advice relating to vehicle use and purchase for departments
Procurement	Vehicle emission assessment matrix developed and incorporated into all relevant tender evaluations through Social Value procurement policy Vehicle emission standards accorded 5% of evaluation score for relevant contract awards	On-going application of vehicle emissions procurement standards in line WY procurement guidance
Taxi Licensing	Ultra-Low Emission Taxi Study as part of OLEV funded EST study across West Yorkshire undertaken in 2015 Measures include consideration of new West Yorkshire wide emission standards to be integrated into the taxi licensing system in accordance with the WYLES A successful regional bid for an Ultra-Low Emission Vehicle taxi scheme was submitted during 2016.	Procurement of supplier for Ultra Low Emission Vehicle taxi scheme completed in 2018. Project will include provision of 88 electric vehicle recharging points at railway stations and city centre locations across the region to support the uptake of EVs by the taxi trade. Scheme due for completion in 2021. https://www.westyorks-ca.gov.uk/projects/local-transport-plan-and-other-dft-funding/ulev/
Freight & logistics	Measures to improve vehicle emissions include: • Continued consideration of vehicle emissions through Social Value public procurement • Continued requirement for fleet standards on some new commercial development schemes • Formal launch of Eco-stars scheme completed in 2017	Continued implementation of fleet procurement and low emission planning fleet requirements. Continued operation of WY Eco-stars scheme

Conclusions and Priorities

Bradford has taken a proactive and innovative approach to local air quality management. It was one of the first local authorities in the UK to adopt a Low Emission Strategy (in 2013). Bradford has well established low emission planning and procurement policies and has shared these with partners across the region. To this end Bradford secured funding, project managed and lead the development and adoption of the West Yorkshire Low Emission Strategy. There has been significant local investment in the retrofitting of service and school buses, development of a cycle superhighway and the opening of new railway stations, all reducing the impact of vehicle emissions. The City of Bradford MDC also continues to reduce emissions from its own vehicle fleet and is encouraging private partners to match this through the West Yorkshire Eco-stars scheme and new initiatives to reduce taxi emissions.

The latest monitoring shows that some areas of Bradford have experienced slight improvements in annual average air quality concentrations in recent years, but other areas of the city continue to show little or no improvement over the last 5 years. Without further interventions at a local level that reduce transport emissions, long term air quality conditions in Bradford are unlikely to significantly improve.

Bradford has been mandated by the Government to develop a business plan to bring forward compliance with the EU limit values within the shortest possible timeframe. The development of this business plan is currently on-going and may incorporate some form of access restriction for higher emission vehicles. Once a detailed proposal has been defined it will be subject to a full public consultation exercise.

In the period since the original declaration of the AQMAs in 2006, peak hour concentrations of NO_2 across the city have significantly reduced. Peak hour concentrations now rarely exceed the hourly objective level of 200µg/m^3. The declaration of AQMAs for the hourly objective at Thornton Road and Mayo Avenue are no longer relevant. City of Bradford MDC will amend the current AQMA declarations for Thornton Road and Mayo Avenue to clarify that they only apply to exceedances of annual average objectives. Further monitoring

is required at Manningham Lane and Shipley Airedale Road before the same action can be considered for these AQMAs.

Concentrations of NO_2 in the Thornton Road area of the city have fallen significantly in recent years and are now consistently meeting both the annual average and hourly objectives for NO_2. City of Bradford MDC would like to revoke this AQMA but will await the completion of the on-going air quality plan business case as this will provide a better indication of future air quality conditions in this area.

In the 2016 ASR report it was highlighted that a new AQMA was in need of declaration around the Bingley Road / Saltaire Road junction. The 2017 data continues to support this requirement and also indicates that a new AQMA may be appropriate at Tong Street.

Under business as usual conditions City of Bradford MDC would progress the declaration of these additional AQMAs as soon as practicable. However, as these areas are included in the modelling being undertaken for the air quality plan business case development it would be premature to declare them now. City of Bradford MDC is proposing a delay to declaring of any further AQMAs until the air quality plan business case study is complete. If, on completion, no practicable means of improving air quality in these areas has been identified (and approved) then AQMA declarations will follow.

Further monitoring data for all the current AQMAs and areas of additional concern will be provided in the 2019 ASR. The need for further AQMA declarations in these areas will be reviewed in the 2020 ASR (once the projected impacts of the air quality plan business case are available).

In summary the next steps to be taken by City of Bradford MDC are:

- Amend the current AQMA declarations for Mayo Avenue and Thornton Road to remove references to the annual average objective;
- Continue monitoring air quality within the current AQMAs and other areas of concern and provide an update on concentrations in the 2019 ASR report;
- Incorporate the current AQMAs and other areas of identified exceedance in the modelling work being undertaken for the air quality

plan business case development and work towards the identification of solutions for all these areas;

- Postpone any further AQMA declarations and AQMA revocations until 2020 when the Bradford air quality plan business case has been completed and longer term air quality conditions across the city can be predicted with greater certainty.

Local engagement and how to get involved

In order to improve air quality in Bradford and reduce exposure to pollution, Bradford MDC advises residents to make simple changes to their everyday life;

- If able, reduce your vehicle use by walking and cycling for shorter journeys, highlighting the value for health and the environment. Consider using the 'walk it' app (https://walkit.com/) which helps plan journeys in Bradford (and other cities). Try and pick routes which are not as heavily trafficked (e.g. through parks and lesser used streets) to reduce the amount of pollution exposure.
- Make the most of public transport as an alternative to using a car, this can save money and reduce impact on the environment. Check out the information on the Council website for local transport provision and see if it can help better plan journeys - https://www.bradford.gov.uk/transport-and-travel/public-transport/public-transport/
- If you have children who are travelling to school consider the advice on the Council website to help make this journey more sustainable and improve their health ; https://www.bradford.gov.uk/education-and-skills/travel-assistance/sustainable-travel-to-school/
- Think about how homes are heated and to ensure compliance with the legal requirements for smokeless zones. Residents are advised that if they fail to comply they could risk a fine of up to £1,000 per offence https://www.google.co.uk/#q=defra+smoke+control+areas)

- If you live in an urban area, consider buying a ‘low nitrogen oxide’ boiler the next time it requires replacement.
- If you own a vehicle which is regularly driven in urban areas, think about the impact on the environment when the time comes to replace it. Low emission vehicles (tax band A and B) are usually better environmental options for urban driving and even older petrol vehicles are less polluting in most cases than diesel vehicles. Consider low emission alternatives, such as hybrids and electric vehicles, although the initial purchase price may seem high in the longer term they may prove more cost effective through reduced fuel and tax costs. Government grants are available to help with the purchase of some low emission vehicles. https://www.gov.uk/plug-in-car-van-grants/eligibility

Whatever vehicle you drive the Council encourages drivers to try and follow the green driving tips below;

Green driving tips

- **Lift-Share**

  Check if it is possible to share your vehicle or take a lift to reduce the impact of journeys. Consider using the West Yorkshire lift share website to help with this; https://wy.liftshare.com/

- **Check your tyres**
  Under-inflated tyres mean an engine has to work harder and will produce more emissions.

- **Clear the clutter**
  Remove unnecessary clutter from your boot and reduce engine workload.

- **Stick to the speed limit**
  High speeds produce more emissions. At 70mph a driver could be using up to 15 per cent more fuel than at 50mph.

- **Slow down as you approach traffic jams**
  Stop-start traffic jams use more fuel. Slow down early and take your foot off the accelerator.

- **Don't over-rev**
  Changing up a gear early can reduce revs. For diesel cars change up when the rev counter reaches 2000rpm. For petrol cars, change up at 2500rpm.

- **Switch off your engine**
  If likely to be at a standstill for more than three minutes switch off your engine.

- **Close windows**
  Keeping windows closed at higher speeds will use less fuel.

- **Cut down on air-conditioning**
  Air-conditioning increases fuel consumption and produces more emissions.

If you would like to see more done to improve air quality in your area then you could contact the local Councillor or MP and tell them about your concerns or ideas. To find out who your local Councillor or MP is and how to contact them;

- https://bradford.moderngov.co.uk/mgMemberIndex.aspx?bcr=1
- http://www.parliament.uk/mps-lords-and-offices/mps/

For more information on national campaigns to improve air quality and opportunities to undertake your own monitoring visit;

- https://www.foe.co.uk/page/air-pollution-campaign-clean-air
- http://www.clientearth.org/
- http://cleanair.london/

Daily national air quality updates, pollution forecasts and advice about how to protect yourself from the impacts of poor air quality can be found at:

https://uk-air.defra.gov.uk/

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in City of Bradford MDC during 2017. 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 Status Report (ASR) is an annual requirement showing the strategies employed by City of Bradford MDC to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2.0 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 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of the AQMAs declared by City of Bradford MDC can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries, are available online at

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/review-and-assessment-of-air-quality-in-the-bradford-metropolitan-district/

The results of the monitoring undertaken in 2017 indicate additional exceedances of the annual average air quality objective for NO_2 at;

- Bingley Road /Saltaire Road
- Tong Street

In addition, one diffusion tube at Killinghall Road indicates a concentration which is border-line with the annual average NO_2 objective.

These areas have been included in the study area for the Government mandated air quality plan business case being undertaken to identify the most appropriate measures for bringing forward compliance with EU limit values in Bradford. It is anticipated that the types of measures under consideration will deliver compliance in these areas such that the declaration of further AQMAs will be unnecessary.

Updates on air quality in these areas will be provided in the 2019 ASR report and the requirement for further AQMA declarations will be reviewed upon completion of the air quality plan business case (scheduled for October 2019) and presented in the 2020 ASR.

Since the declaration of the AQMAs in 2006, peak hour concentrations of NO_2 across the city have significantly reduced. Peak hour concentrations now rarely exceed the hourly objective level of 200µg/m^3 and the declaration of AQMAs for the hourly objective at Thornton Road and Mayo Avenue are no longer relevant. City of

Bradford MDC will amend the current AQMA declarations for Thornton Road and Mayo Avenue to clarify that they only apply to exceedances of annual average objectives. Further monitoring is required at Manningham Lane and Shipley Airedale Road before the same action can be considered.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)		Action Plan		
						At Declaration	Now	Name	Date of Publication	Link
Mayo Avenue / Manchester Road (order 1)	2006	NO_2 Annual Mean	Bradford	Terrace housing	NO	57 µg/m3	38 µg/m3	Bradford Air Quality Action Plan	2009	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	
Manningham Lane / Queen's Road (order 2)	2006	NO_2 Annual Mean	Bradford	Mixed housing	NO	33 µg/m3	33 µg/m3	Bradford Air Quality Action Plan	2009	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	
Thornton Road (order 3)	2006	NO_2 Annual Mean	Bradford	Student housing	NO	35 µg/m3	30 µg/m3	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	

Shipley Airedale Road (order 4)	2006	NO_2 Annual Mean	Bradford	Apartments	NO	68 µg/m^3	37 µg/m^3	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	
Mayo Avenue / Manchester Road (order 1)	2006	NO_2 1 Hour Mean	Bradford	Terrace housing	NO	unknown	179.52 µg/m3 (at monitor)	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	
Manningham Lane / Queen's Road (order 2)	2006	NO_2 1 Hour Mean	Bradford	Mixed housing	NO	unknown	128.35 µg/m3 (at monitor)	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	
Thornton Road (order 3)	2006	NO_2 1 Hour Mean	Bradford	Student housing	NO	µg/m3	178.64 µg/m3 (at monitor)	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	

Shipley Airedale Road (order 4)	2006	NO_2 1 Hour Mean	Bradford	Apartments	NO	unknown	176.2 µg/m3 (at monitor)	Bradford Air Quality Action Plan	2009	https://ww.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district
								Bradford Low Emission Strategy	2013	
								West Yorkshire Low Emission Strategy	2016	

☐ **City of Bradford MDC confirm the information on UK-Air regarding their AQMA(s) is up to date**

2.2 Progress and Impact of Measures to address Air Quality in Bradford

Defra's appraisal of 2017 ASR concluded that the report was well structured, very detailed, and provided the information specified in the Guidance. The following advice was provided for future reports.

It would be beneficial for the Council to provide more detail regarding the dates for planning, implementing, and completing measures.

City of Bradford MDC comment: Dates have been included where possible in Table 2.2. Due to the requirement to undertake the Government mandated feasibility study and develop the air quality plan business case a number of workstreams have had to be put on hold in order to resource the feasibility work. For some workstreams it is currently unclear if these will remain relevant in the future or when work will be able to recommence.

It is noted that the figures reported in Table A.3 (Annual Mean NO_2 Monitoring Results) are uncorrected for distance. Please ensure the figures for which all corrections have been applied (as reported in Table B.1) are used in Table A.3. For further guidance please refer to LAQM Technical Guidance 16 (TG16).

City of Bradford MDC comment: The instructions at the top of table A.3 in the ASR spreadsheet template clearly state that the values entered in table A.3 should be bias corrected values at the monitoring point and not corrected for distance. This instruction has been followed in this report as previously.

While the report provides maps of AQMA boundaries and monitoring sites, it would be useful for the maps illustrating the AQMA boundaries to be included in Appendix D.

For the purpose of this report all maps of AQMA boundaries and monitoring sites have been collated in Annex D

There are a number of sites which have recorded continuously low concentrations (such as DT40, DT21, and DT78) over the past few years. The council may wish to consider reallocating or reviewing these

resources, targeting areas of concern and areas where large developments are due to be constructed, as outlined in the report.

City of Bradford MDC comment: City of Bradford MDC undertakes a regular annual review of its monitoring sites to ensure the limited monitoring resources are effectively deployed. The aim is to achieve a balance between monitoring areas of current concern and obtaining baseline data in areas where air quality changes are considered likely from approved developments.

Monitoring was ceased at site DT40 at the end of 2017.

DT21 is the only long term true background monitoring site in the city and will be retained long term to monitor trends in background concentration.

DT78 is collecting baseline data prior to the opening of a large Energy from Waste plant recently approved in this area. It will remain for the foreseeable future.

A number of new sites were added to the monitoring network for 2018 and a number of others removed. Those removed represented locations which have had consistently low levels and/or where sufficient baseline data is considered to have been obtained.

It should be noted that the Council is considering revoking Thornton Rd AQMA depending on monitoring results during the next reporting period. This site has experienced substantial improvement over the last five years and concentrations have remained well below objective levels for the past two years.

City of Bradford MDC comment: For reasons explained further within this report the Thornton Road revocation has been delayed until completion of the air quality plan business case. Monitored levels during 2017 confirmed that a revocation under current traffic conditions would be acceptable. Monitoring will continue until such time as the council is fully satisfied that revocation can be sustained over the longer term.

It should be noted that the council intends to declare an additional AQMA for Bingley Rd. This decision is supported as concentrations have been far above objective levels for a number of years. Furthermore data

suggests that the situation in this area is getting worse. As such direct measures and actions are required to mitigate future emissions.

City of Bradford MDC comment: As explained within this report the study area for the development of the Bradford air quality plan business case has been expanded to include the Bingley Road / Saltaire junction. A further decision on whether to declare an additional AQMA in this area will be undertaken once the outcomes of the air quality plan business case are known.

Automatic monitoring results indicate the Council did not record any exceedances for the NO_2 hourly mean AQO inside of any AQMAs. However, some diffusion tubes recorded annual concentrations greater than 60 µg/m3 (such as DT72 inside Manningham Ln AQMA, and DT12 inside Shipley Airedale Rd AQMA) indicate that hourly objectives may be vulnerable to exceedance.

City of Bradford MDC comment: The council recognises that the hourly objective may still be at risk in some locations where it is not feasible to undertake real time monitoring. This is why the AQMAs were originally declared for both the annual mean and hourly objectives.

Further to point (7), there appear to have been no exceedances of NO_2 hourly mean in Mayo Avenue AQMA or Thornton Rd AQMA for the past few years. The council should review the status of all AQMAs in relation to the NO_2 hourly mean AQOs, especially for AQMAs where exceedances have not been recorded for a number of years.

City of Bradford MDC comment: As detailed in this report further consideration as been given to the likelihood of the annual average objective being exceeded in all the current AQMAs. As detailed in this report the reference to the hourly objective for the Mayo Avenue and Thornton Road AQMA declarations will now be removed.

In the period since the 2017 ASR report City of Bradford MDC implemented a number of direct measures in pursuit of improving local air quality. Details of all measures completed, in progress or planned as of December 2018 are set out in Table 0.2.

More detail on these measures can be found in following documents:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES)

These documents can be viewed at:

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/.

Key previously completed measures are:

- Adoption of Bradford Low Emission Strategy (2013) and West Yorkshire Low Emissions Strategy in (2017). Together these two documents have resulted in:
    - On-going routine application of low emission planning guidance (since 2013) which requires EV charging facilities and construction dust management plan conditions on most planning applications and wider emission mitigation and travel planning on larger developments.
    - Bio-methane / natural gas feasibility study for refuse vehicles (2013)
    - Whole life costing for council fleet vehicle purchases resulting in introduction of hybrid and full electric vans and cars into City of Bradford MDC fleet (since 2014)
    - Completion of West Yorkshire Low Emission Zone feasibility study in 2015 (superceded by Government mandated technical feasibility studies and development of air quality plan business cases across West Yorkshire).
    - £400k secured through Clean Vehicle Technology Fund (CVTF, DfT, 2014/15) to retrofit 26 Euro III commercial, diesel buses with selective catalytic reduction and particle traps (SCRT) in 2015 in partnership with First Bus and Transdev.

- Enterprise car club introduction in Bradford during 2015 (including an electric vehicle).
- Retrofitting of 165 Euro III school buses across West Yorkshire in partnership with West Yorkshire Combined Authority (WYCA) using Clean Bus/Vehicle Technology Fund (DfT) completed in 2016
- Partnership work with First Bus to encourage minimum Euro IV Standard for commercial buses from 2018, with further improved standards for 2020 and beyond, commenced during 2016. First operate 86% of commercial bus routes in Bradford.
- Launch of West Yorkshire Eco-stars scheme in 2017
- West Yorkshire Electric Vehicle Strategy
- Vehicle emission assessment matrix developed and incorporated into all relevant tender evaluations through Social Value procurement policy

Other significant infrastructure improvements in the city to assist with sustainable transport provision include:

- Opening of £19 million Cycle Super-Highway (Bradford-Leeds) in 2016 providing 14km of segregated cycle path.
- Opened new railway stations at Apperley Bridge (December 2015) and Low Moor (April 2017)

In addition City of Bradford MDC has supported a number of public health research projects relating to air quality and health.

City of Bradford MDC expects to pursue the following measures over the course of the next reporting year:

- Junction improvements at Greengates crossroads to commence
- Planning and baseline monitoring for highways improvement works at Hard Ings Road Keighley

  https://www.bradford.gov.uk/transport-and-travel/major-highways-schemes/hard-ings-road-improvement-scheme/?Folder=1+Scheme+details
- Consultation on major (£42million) highway improvement scheme between Shipley and Bradford and commencement of baseline monitoring

https://www.yourvoice.westyorks-ca.gov.uk/bradfordshipley

- Consultation on junction improvement works for A6177 Outer Ring Road https://www.yourvoice.westyorks-ca.gov.uk/westbradford
- Consultation on improved access to Leeds / Bradford Airport https://www.yourvoice.westyorks-ca.gov.uk/airport
- Procurement of supplier for West Yorkshire rapid charger scheme to be completed. Up to 88 rapid chargers to be supplied across West Yorkshire region (for use by public and electric taxis)

  https://news.leeds.gov.uk/eighty-eight-new-free-electric-vehicle-charge-points-to-be- installed-across-west-yorkshire/
- Government mandated EU limit value technical feasibility study and air quality plan business case development (business plan due for completion October 2019)
- Updating the Bradford LES (to reflect WYLES adopted December 2016). Progress on this has been slower than expected due to the requirement to undertake the Government mandated technical feasibility study and development of the air quality plan business case. The outcomes of this study are likely to trigger a complete review of the measures currently set out in the Bradford LES.

Whilst the measures stated above and in Table 0.2 will contribute towards compliance, City of Bradford MDC anticipates that further additional measures (not yet prescribed) may be required to achieve compliance and hence enable the revocation of the AQMAs at Manningham Lane, Mayo Avenue and Shipley Airedale Road. These additional measures are the subject of the on-going air quality plan business case development.

Thornton Road AQMA is already in compliance but the revocation of this AQMA is being delayed until the full outcome of the air quality plan business case is known and there is certainty about future air quality conditions on Thornton Road.

Table 0.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	On-going implementation and review of the Bradford LES	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC	Completed 2013	Adopted Nov 2013 Review and Implementation on-going	Update and review of Bradford LES by end of 2017	Emissions from all existing and new sources to be reduced as far as possible using measures within Bradford LES	Good	Live document subject to on-going delivery and review in response to national, regional and local policy developments	Measures within the Bradford LES continue to be implemented at a local level. Review to incorporate WYLES measures is on-going but delayed by the requirement to undertake the Government mandated technical feasibility study and develop the air quality plan business case. A full review of the Bradford LES will be required on completion of the air quality plan business case after October 2019.
2	Adoption of West Yorkshire Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC in conjunction with other partners	Completed 2016	Adopted Dec 2016. Review and Implementation on-going	Adoption of WYLES by City of Bradford MDC by end of 2016 - met	Emissions from all existing and new sources to be reduced as far as possible across West Yorkshire region using measures	Good	Live document subject to on-going delivery and review in response to national, regional	The development of the WYLES has been led by City of Bradford MDC. Many of the ideas and concepts within it have their origins within the Bradford LES. A

								within the WYLES.		and local policy developments	full review of the WYLES will be required on completion of air quality plan business cases across West Yorkshire.
3	Low emission planning guidance	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	City of Bradford MDC	Completed 2013	Adopted Nov 2103 Review and implementation on-going	Number of EV charging points delivered on new development	Emissions from all new developments to be reduced as far as practically possible and opportunities for increased exposure to air pollution minimised.	LES planning guidance routinely applied to all planning applications since 2014	Live document subject to on-going delivery and review in response to national, regional and local policy developments	Since implementation the LES planning guidance has resulted in the conditioning of over 5000 EV charging points on new developments and numerous other low emission fleet measures. The Bradford LES planning policy is currently being reviewed to align it with the WYLES planning guidance.
4	LEZ feasibility study	Promoting Low Emission Transport	Low Emission Zone (LEZ)	City of Bradford MDC in conjunction with other partners	Completed 2015	LEZ feasibility study completed and reported to members in 2015	Not applicable	The LEZ feasibility study indicated that an LEZ could reduce NO_x emissions within the outer ring road by 195.6 tonnes	Project superceded by Bradford air quality plan development	Bradford air quality plan business case to be completed by October 2019. This will determine future of LEZ / CAZ policies in Bradford	Council decision to consider the implementation of a LEZ in on hold pending outcome of Government mandated technical feasibility study and air quality plan business case development.

5	WYLES procurement guidance	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	City of Bradford MDC in conjunction with other partners	completed	On-going	Low emission procurement contracts	Emissions in relation to all new procurement contracts to be reduced as far as practically possible. Operators to be rewarded for LEV practices.	LEV procurement policy 5% of award decision as part of procurement policy (social values)	On-going implement ation	All procurement decisions (including delivery of goods and services) with a transport or heating impact to be considered in relation to the emissions matrix
6	Identifying barriers to walking to school	Promoting Travel Alternatives	School Travel Plans	City of Bradford MDC and Born in Bradford	completed	On-going	Developmen t of school travel plan toolkit by Dec 2017	Reduction in pollution in all areas, in particular around school gates and playgrounds	Completed	Dec-17	This work has been completed in partnership with Born in Bradford and the Bradford Institute of Health Research (NHS). Papers were published in 2018.
7	Bus retrofit projects	Vehicle Fleet Efficiency	Vehicle Retrofitting programm es	City of Bradford MDC	completed	completed 2015	25 buses successfully retrofitted, 11 in the city centre and 14 on Manningha m Lane	Real world (PEMS) emission testing of the buses showed retrofit achieved a 95% reduction in NOx emissions. Improvements in air quality in Manningham Lane.	Completed 2015	Completed 2015	This was possible due to a successful CVTF fund application worth £400,000. The application was supported by evidence from the LEZ study. Future projects will source alternative funding streams where available and operators will be encouraged to invest in their own fleets.
8	Car clubs	Alternatives to private vehicle use	Car Clubs	City of Bradford MDC	completed	scheme operational	Number of registered car club owners	Not quantified	scheme operational	completed	Further car clubs / car club vehicles will be introduced in the district as

											demand increases. Planning is being used as a measure to facilitate this, particularly on new housing schemes.
9	Cycle Super Highway	Transport Planning and Infrastructure	Cycle network	City of Bradford MDC	completed	opened June 2016	Not identified	Not quantified	scheme operational	completed	None
10	Staff Travel Plan	Promoting Travel Alternatives	Workplace Travel Planning	City of Bradford MDC	Corporate travel plan published 2015	On-going	Reduce single occupancy car trips by 5% over 5 years Reduce car commuter trips by staff from 62% (2014) to 57% by 2029	Not quantified	Staff travel plan in operation. Review scheduled for 2019	On-going delivery and review (first review scheduled for 2019)	Promotion and development of the Travel plan has been slower than expected due to loss of key staff resources
11	Eco-stars Fleet Recognition Scheme	Vehicle Fleet Efficiency	Fleet efficiency and recognitio n schemes	WYLES steering group / City of Bradford MDC	Completed 2015	2016	Number of Bradford fleets joining the scheme	Not quantified	Scheme to launched early 2017.	On-going implement ation and developm ent	The introduction of the West Yorkshire ECO-stars scheme is a measure in the WYLES. Scheme is funded by West Yorkshire Combined Authority
12	CNG	Vehicle Fleet Efficiency	City CNG Station	City of Bradford MDC	Feasibility study completed 2013	Implementation date not yet identified	CNG station build	77 tonnes NOx (from 2013 feasibility study)	Feasibility study completed. Vehicle trial completed	No implement ation date identified	Good political support for project but no decision yet made due to funding uncertainties and practical considerations

13	Low emission procurement policies for City of Bradford MDC fleet	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	City of Bradford MDC	completed	On-going implementation	Implementation of WYLES procurement guidance	Reduction of 332t/CO2e 2014/15-2015/16	7 electric vans and 2 electric pool cars with 3 additional charging stations	On-going application and review of policy	Introduction of whole life costs into vehicle procurement considerations including air quality damage costs
14	Voluntary emission standards for buses	Promoting Low Emission Transport	Other	City of Bradford MDC / Bus operators	2015 (WYLES measure)	2016 to 2026	Current target is 70% of buses to be Euro VI by 2021 and 100% by 2026. Revised figure for new target not yet available.	24.7 tonnes of NOx reduction estimated for previous target of Euro IV by 2018.	Bus Alliance have now agreed the revised Euro VI targets	Current target by 2026 (subject to outcome of air quality plan business case)	. These targets may need to be revised following the outcome of the air quality plan business case study
15	Delivery of new railway stations at Apperley Bridge and Low Moor	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	WYLES	2009 to 2011	2011 to 2017	Passenger numbers for 2018 Apperley Bridge 372,000 Low Moor 133,060 (opening year)	Not quantified	Apperley Bridge opened Dec 2015 Low Moor opened May 2017	complete	Passenger numbers at both stations are expected to grow further
16	Encouraging uptake of low emission taxis	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	City of Bradford MDC / WYCA	2016 - 2017	2018 - 2020	Number of rapid chargers installed across West Yorkshire Region	5.1% of WY taxis replaced with electric equating to an 18% reduction in NOx emissions and a health cost saving of £189,000 per annum (WYCA)	Funding for 88 rapid charge points across WY obtained in 2018. Supplier appointed. Installations to commence during 2019.	2020	Work on going to identify suitable locations for charging points within the various authorities

17	Public awareness	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Number of petition signatories	N/A	Local action taken to promote Clean Air Day during 2018	On-going	Raising public awareness through the use of street infographics and air quality and health online petition in partnership with Doctors and academics at the University of Leeds
18	Health and air quality economics	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Toolkit development and workshops to share with stakeholders	Policy influence	Uptake on-going.	completed	Development of CAPTOR toolkit and published papers to quantify the health impact of Low Emission Policy change in partnership with NHS and economics experts at University of York
19	Identifying barriers to Low Emission Policy change	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	2017-18	Published papers	Policy influence	completed	completed	Project to identify the barriers to policy change
20	Public health reporting of Air Quality	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	On-going	Air quality in key council documents	Policy influence	On-going	On-going	Air quality in the JSNA, directors PH report, Health and Well Being Strategy and Transformation Plan. Raising the profile of air quality and reporting to the Health and Well Being Board.

21	WY Bus retrofit	Vehicle fleet efficiency	Vehicle Retrofitting programmes	City of Bradford MDC/ WYCA	2017	On-going	Retrofit of 63 buses in Bradford	52 tonnes of NOx from WY bus fleet (total of 230 buses to be retrofitted)	On-going	2020	Competition to invite bus companies to apply for retrofit now open Further retrofit bids submitted during 2019

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions and cardiovascular diseases.

In Bradford, emissions of man-made fine particles $PM_{2.5}$ are estimated to cause 4.2% of total mortality, representing 2,300 years of life lost. Road transport emissions are the most significant source of fine particulates, leading to exceedances, but locally elevated concentrations can also arise from biomass combustion, heating, industry and wind-blown dust. The World Health Organisation (WHO) classifies diesel exhaust emissions as carcinogenic.

No areas within the Bradford district are considered likely to exceed the EU Limit Value for $PM_{2.5}$ (annual average concentration of 25µg/m^3) but there are areas, near to major roads, experiencing concentrations of $PM_{2.5}$ which exceed the recommended World Health Organisation (WHO) target level of 10µg/m^3.

There are marked differences in people's health within the Bradford district indicating the existence of significant health inequalities. For example, people living in Wharfedale to the north of the district typically live five years longer than people living in Tong in the south. Similarly, when the Bradford district is compared to the rest of the UK, average life expectancy is reduced. In Bradford there are more deaths as a resulting from smoking, cancer, heart disease, and strokes, and higher rates of mortality in children, than in many other cities.

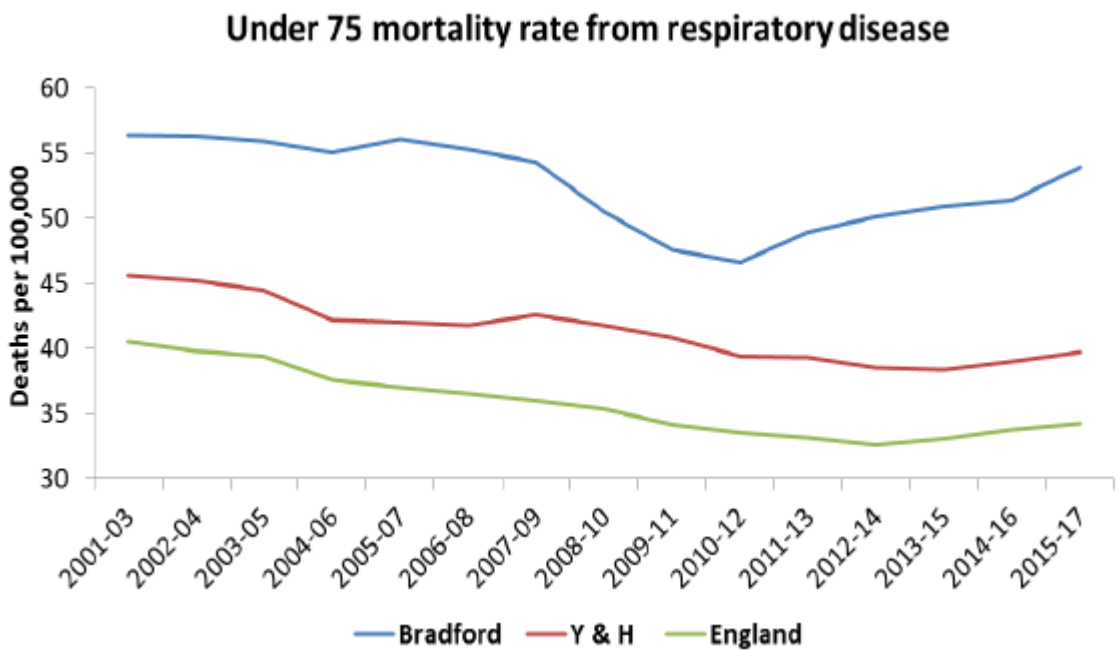
Figure 3[7] shows the under 75 mortality rate from all respiratory disease in Bradford. Although the under 75 mortality rate from respiratory disease in Bradford District has decreased overall since 2001, in recent years rates have begun to increase.

Bradford District continues to have a higher mortality rate from respiratory disease than Yorkshire & Humber and England.

[7] JSNA report on Respiratory Disease Mortality in Bradford, City of Bradford MDC (2018) https://jsna.bradford.gov.uk/documents/Public%20Health%20Intelligence%20resources/Public%20Health%20Intelligence%20Bulletins/Under%2075%20Respiratory%20Disease%20mortality%20-%20December%202018.pdf

The gap between England and Bradford District for this measure has increased over time.

Figure 3: Under 75 mortality rate from respiratory disease



Through research carried out by environmental epidemiologists at the Bradford Institute of Health Research (BIHR) many of these illnesses have been proven to have direct linkages to local air pollution exposure. The data demonstrates that Bradford has a higher rate of 'at risk' people whom will be more vulnerable to the ill-health effects associated with air pollution exposure.

Within the City of Bradford MDC, air quality and public health specialists collaborate to deliver the key outcomes in the Bradford LES and the WYLES (as detailed in table 1). They are supported by colleagues from other Council departments such as transport, planning, highways, fleet management and procurement.

Within Bradford there is a strong emphasis on improving the understanding of how air pollution impacts on health, and effectively communicating this to other professionals and members of the public.

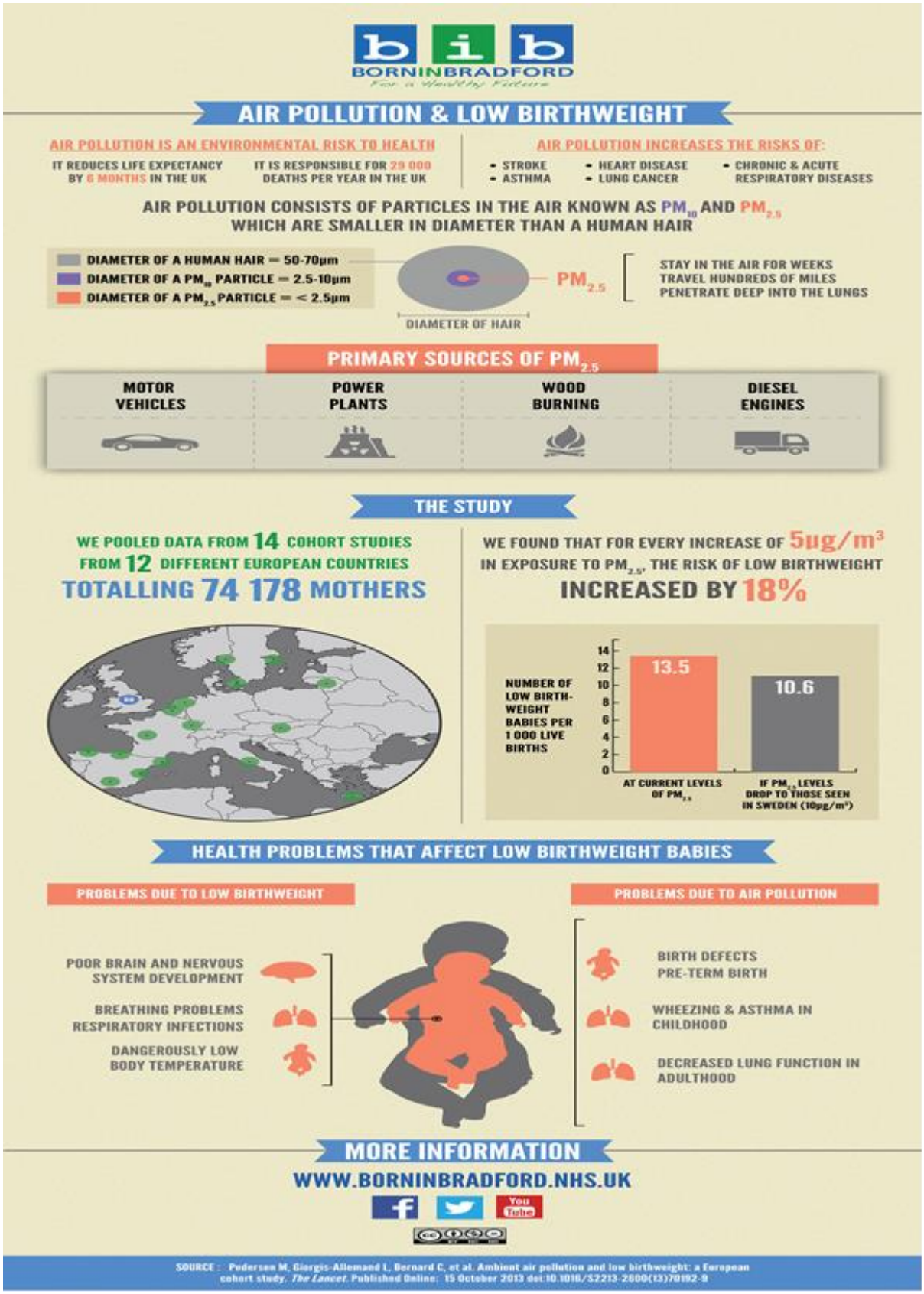
The Public Health Department has funded $PM_{2.5}$ monitoring at three of the existing air pollution stations (Bingley, Keighley and Shipley Airedale Road). The data is used to inform major research programmes (such as the 'Born in Bradford (BiB)' and daily updates are provided to the public via the council's website.

Born in Bradford is one of the largest and most important medical research studies currently being undertaken in the UK. It is tracking the lives of 13,500 Bradford born babies (and their families) to ascertain more about the causes of childhood illness. The work has already identified a number of important linkages between air pollution exposure and health as detailed in the info-graphic below (figure 4).

The Bradford LES and WYLES measures which aim to reduce emissions from diesel vehicles and biomass boilers will be the most effective at reducing local $PM_{2.5}$ emissions (as these are the main sources of this pollutant in Bradford).

Further air quality improvement measures will be presented in the Bradford air quality plan business case (due for completion in October 2019).

Figure 4: Outcomes from BiB study



3.0 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

City of Bradford MDC undertook automatic (continuous) monitoring at 7 sites during 2017. Table A.1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead unless local circumstances indicate there is a problem.

The monitoring equipment in Bradford is owned and operated by Bradford MDC. The Mayo Avenue automatic monitoring site was affiliated to the national AURN monitoring network during 2015. Results from this site can be viewed at http://uk-air.defra.gov.uk/networks/network-info?view=aurn

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

3.1.2 Non-Automatic Monitoring Sites

City of Bradford MDC undertook non- automatic (passive) monitoring of NO_2 at 62 sites during 2017. Table A.2 in Appendix A details the sites.

Maps showing the location of the monitoring sites are provided in Appendix D.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g.“annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

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

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. The data in table A.3 is bias corrected data for the monitoring site. It has not been corrected for distance to the nearest receptor.

For diffusion tubes, the full 2017 dataset of monthly mean values is provided in Appendix B. This data includes both the annual mean at the monitoring point and the distance corrected annual mean at the nearest relevant receptor point.

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.

Results for Manningham Lane AQMA (2017)

Map 2 in Annex D details the location of the monitoring undertaken in the Manningham Lane AQMA during 2017. The results from these sites are as follows:

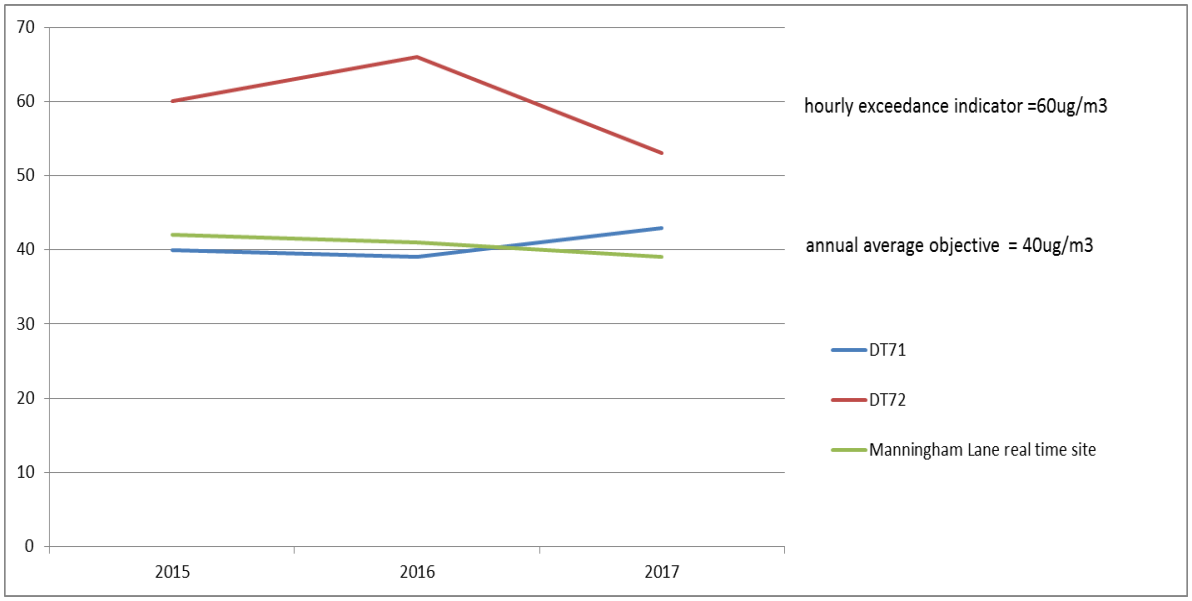
Monitoring site	Type	Bias corrected annual average concentration at monitoring point (µg/m^3)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug/m3)?
CM3	Real time	39	33	128	0	n/a
DT71	Diffusion tube	43	38	n/a	n/a	no
DT72	Diffusion tube	53	53	n/a	n/a	no

At Manningham Lane the real time analyser (CM3) and the co-located diffusion tube (DT71) indicated a roadside concentration of nitrogen dioxide between 39 to 43 µg/m^3 during 2017. The nearest relevant receptor point to the real time monitoring

site (and tube DT71) is a house façade located approximately 4m back from the monitoring position. The distance corrected results for CM3 and DT71 fall below the 40 µg/m^3 objective level to 33µg/m^3 (CM3) and 38 µg/m^3 (DT71). The other tube located within this AQMA (DT72) recorded a concentration of 53µg/m^3 during 2017. This tube is located at a relevant location (post directly in line with front façade of the nearest residential property) and does not require distance correction.

In the past there have been technical issues with the real time analyser at Manningham Lane and limited collection of diffusion tube data, consequently reliable data only exists for the past three years. Figure 5 summarises the Manningham Lane AQMA monitoring results (at the monitoring position) for the last 3 years . There is little evidence of any major improvement in air quality within this AQMA during this period.

Figure 5 – Manningham Lane 3 year trend - annual average NO_2 (µg/m3)



Although there was no evidence of a breach of the houly NO_2 objecitve during 2017, diffusion tube data for site DT72 was above 60µg/m^3 in both 2015 and 2016. Further monitoring is required to confirm that the houlry objective is no longer at risk within the Manningham Lane AQMA.

On the basis of these results the AQMA declaration at Manningham Lane is still considered relevant for both the annual average and hourly objective and will remain in place subject to further review in the 2019 ASR.

15 additional diffusion tube monitoring sites have recently been established along the A650 and surrounding area to obtain baseline data for a planned traffic improvement scheme. Initial results from this wider monitoring will be provided in the 2019 ASR.

Results for Shipley Airedale Road AQMA (2017)

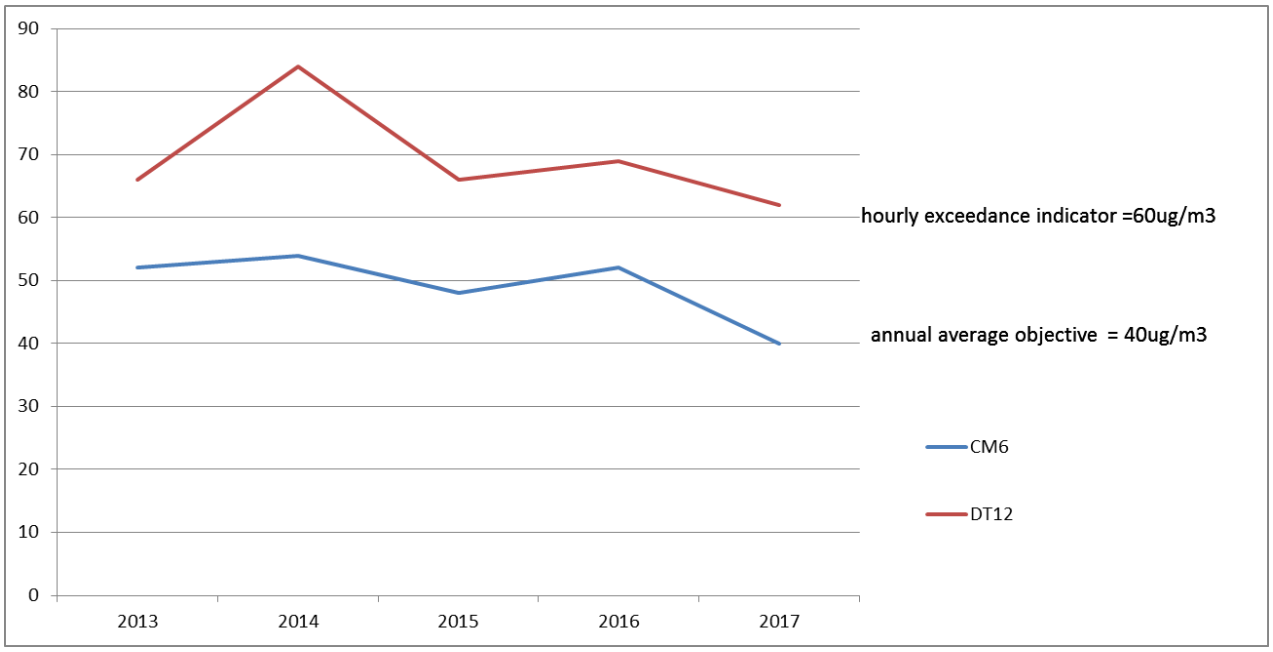
Map 3 in Annex D details the location of the monitoring undertaken in the Shipley Airedale Road AQMA during 2017. The results from these sites are as follows:

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug/m3)?
CM6	Real time	40	37	176	0	n/a
DT12	Diffusion tube	62	58	n/a	n/a	Not at relevant location

Both the Shipley Airedale Road monitoring sites recorded concentrations above the annual average objective for NO_2 at the monitoring sites in 2017. When corrected for distance to the nearest relevant receptors, the result from the real time site falls below the objective (37 $\mu g/m^3$), but the tube result still indicates a breach of the objective (58$\mu g/m^3$).

Figure 6 below details the 5 year trend for the monitoring sites in the Shipley Airedale Road AQMA (at the monitoring locations). There is some evidence of a downward trend in NO_2 concentrations in recent years but further monitoring is required to confirm this.

Figure 6 - Shipley Airedale Road 5 year data



The results for 2017 indicate that both the annual average objective and the hourly objective may still be breached at some locations within the Shipley Airedale Road AQMA but conditions may be improving.

On the basis of these results the AQMA declaration at Shipley Airedale Road is still considered relevant for both the annual average and hourly objective and will remain in place subject to further review in the 2019 ASR.

Results for Mayo Avenue AQMA (2017)

Map 4 in Annex D details the location of the monitoring undertaken in the Mayo Avenue / Manchester Road AQMA during 2017.

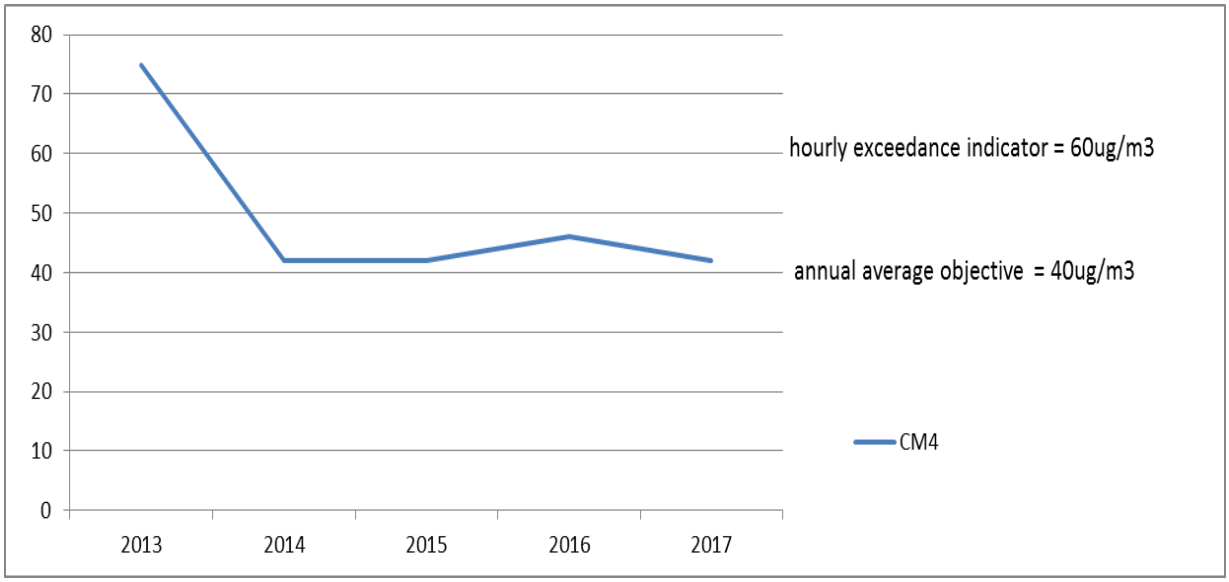
Since the previous ASR report the amount of monitoring in this AQMA has been increased with the addition of 5 new diffusion tube sites.

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug/m3)?
CM4	Real time	42	38	179.5	none	n/a
DT103	Diffusion tube	40	35	n/a	n/a	no
DT104	Diffusion tube	43	38	n/a	n/a	no
DT105	Diffusion tube	37	37	n/a	n/a	no
DT106	Diffusion tube	27	26	n/a	n/a	no
DT107	Diffusion tube	23	23	n/a	n/a	no

There is good correlation between the real time station (CM4) and the diffusion tubes DT103 and DT104 which are all located along on Mayo Avenue in front of a row of terrace housing. The results indicate relevant receptor points on Mayo Avenue still experience annual average NO_2 concentrations that are approaching the objective level. Exceedance of the hourly objective is unlikely. Within the wider AQMA concentrations are lower and well within the objective levels.

Figure 7 below details the 5 year trend for the real time monitoring site (CM4). This is the only monitoring site within this AQMA for which long term data exists. The trend results show that since 2014 there has been no further improvement in air quality in this area.

Figure 7 - Mayo Avenue 5 year trend



On the basis of these results the AQMA declaration for the annual average NO_2 objective at Mayo Avenue is still considered relevant and will remain in place subject to further review in the 2019 ASR. The hourly objective is considered no longer at risk of being breached and the AQMA order for this AQMA will be amended to reflect this improvement.

Results for Thornton Road AQMA (2017)

Map 5 in Annex D details the location of the monitoring undertaken in the Thornton Road AQMA during 2017.

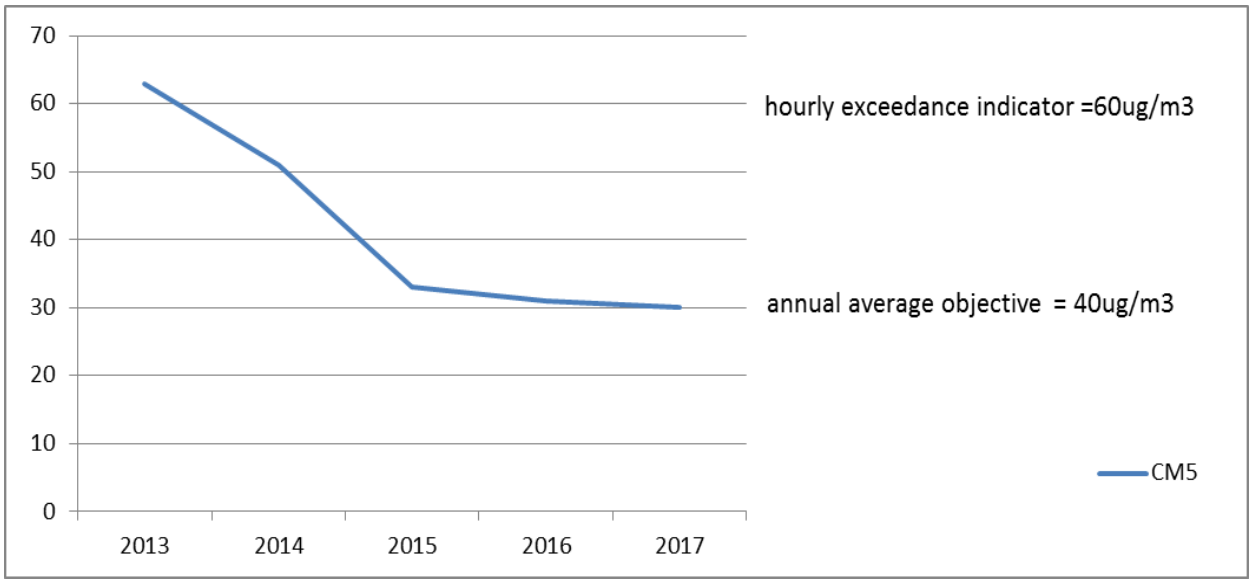
Since the previous ASR report the amount of monitoring in this AQMA has been increased with the addtion of 3 new diffusion tube sites.

The table below shows the concentrations of NO_2 monitored in the Thornton Road area during 2017. There were no exceedances of the air quality objectives.

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug/m3)?
CM5	Real time	30	30	178.64	0	n/a
DT108	Diffusion tube	34	34	n/a	n/a	no
DT109	Diffusion tube	35	35	n/a	n/a	no
DT110	Diffusion tube	28	26	n/a	n/a	no

Figure 8 below details the 5 year trend for the real time monitoring site (CM5). This is the only monitoring site within this AQMA for which long term data exists. The trend results show that since 2015 concentrations of NO_2 in the Thornton Road AQMA have been well below the annual average objective of 40µg/m^3, but show little sign of further improvement in the past three years.

Figure 8 - Thornton Road 5 year trend



The 2017 monitoring data for the Thornton Road AQMA continues to indicate that this AQMA could be revoked for both the annual average and hourly NO_2 objectives (as concluded in the 2017 ASR). However, due to the on-going air quality plan business case study development it is recommended that only the declaration for the hourly objective is revoked. The measures being modelled as part of the air quality plan business case development have the potential to significantly change the future volume and composition of traffic that will travel through the Thornton Road AQMA. Whilst this is unlikely to impact on future compliance with the hourly objective there is less certainty around future annual average concentrations. Until long term compliance with the annual average air quality objective in this area can be ascertained it would be premature to completely revoke the AQMA.

It is intended to continue monitoring in this area throughout 2018 and to review the likelihood of continued compliance with the annual average NO_2 objective once the air quality plan business case is completed (scheduled for October 2019). The AQMA declaration for the hourly objective will be revoked.

Trends in urban background air quality in Bradford

Urban background air pollution levels in Bradford have previously been reported for two real time locations, Keighley and Bingley. During 2016 the Bingley site was relocated to a roadside location on Tong Street to help investigate possible exceedances of the annual average NO_2 objective in this area. Only urban background real time data from Keighley was available for this report.

The Keighley real time monitoring site (CM2) is representative of an urban centre being located about 5m back from the nearest road in the centre of Keighley. There are three diffusion tubes co-located with the inlet (DT68, DT69, DT70).

In addition to the Keighley centre site there is a background diffusion tube (DT21) located on Prospect Street. This tube is located at a significant distance from the major road network and is representative of sub-urban background concentrations.

The 2017 results for the Keighley sites are detailed in the table below.

The location of the Keighley monitoring sites are shown on map 6 in Annex D.

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
CM2	Real time	24	n/a	271	4	n/a
DT68	Diffusion tube (co-located with CM1))	25	n/a	n/a	n/a	no
DT69	Diffusion tube (co-located with CM1))	28	n/a	n/a	n/a	no
DT70	Diffusion tube (co-located with CM1)	27	n/a	n/a	n/a	no
DT21	Diffsuion tube (sub-urban background)	12	12	n/a	n/a	no

The four exceedances of the hourly NO_2 objective at CM2 occurred between 12am and 3pm on 15th November 2017 (Figure 9). Exceedances did not arise at any of the other monitoring sites in Bradford during this period indicating the exceedances were due to a localised source. This could have been an excessive temporary build-up of traffic in the area, an un-abated piece of construction machinery or occurrence of a fire nearby. There is no evidence of an analyser fault during this period.

The hourly NO_2 objective allows a total of 18 exceedances of 200µg/m^3 in any single year. The hourly objective was therefore not breached at Keighley in 2017 despite this short period of elevated concentrations.

Figure 9 - Exceedance of NO_2 hourly objective at site CM2 on 15th November 2017

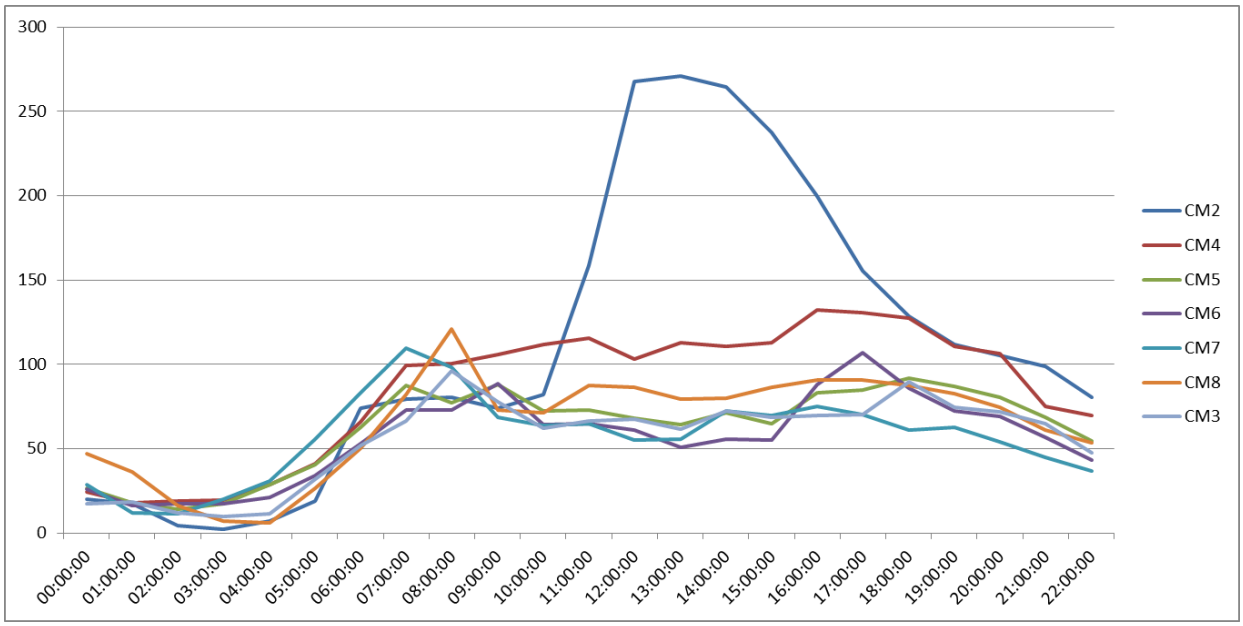
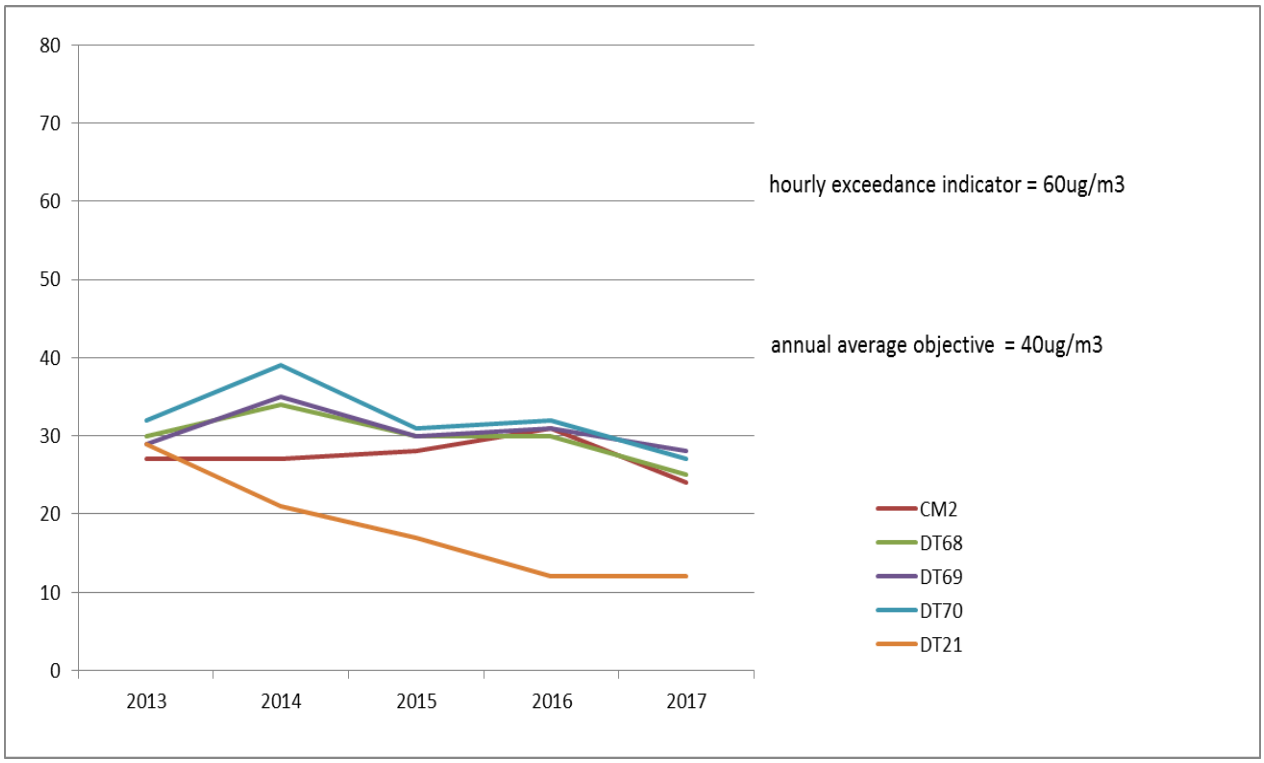


Figure 10 below shows the 5 year trend data for the Keighley sites.

Figure 10 - Keighley 5 year trend



The annual average concentrations of NO_2 measured at the real time site (CM2) and the co-located diffusion tube sites (DT68, DT69, DT70) during 2017 were the lowest measured over the past 5 years. The sub-urban background site returned the same result as 2016. When viewed over a 5 year period the Keighley results show a general improvement in background concentrations of NO_2.

Compliance with NO_2 hourly objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2017 identified only two sites with annual average concentrations above 60µg/m^3 (DT50 and DT12). A concentration >60 µg/m^3 is indicative that the hourly NO_2 objective may be exceeded. Once corrected for distance to nearest receptor points both these sites had concentrations < 60 µg/m^3.

Compliance with annual average NO_2 objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2017 identified the following sites as having exceedance of the 40 µg/m^3 annual average objective at relevant receptor points (based on distance corrected results as shown in table B.1).

Site ID	Location	2017 value at relevant receptor point µg/m^3	Has this tube exceeded the annual average objective previously? yes	Is it in an AQMA?
DT12	Treadwell mills	58	yes	yes
DT50	Bradford Road	54	yes	no
DT64	Tong Street	42	yes	no
DT72	Queen's Road	53	yes	yes

The following sites were at the objective levels of 40 µg/m^3 (at nearest relevant receptor)

- DT42 Killinghall
- DT31 80 Bradford Road

- DT91 Saltaire Road

The following tubes exceeded the annual average objective at the monitoring site but are not associated with relevant locations:

- DT19 – Cock and Bottle pub
- DT73 – Canal Road garden centre
- DT95 – Harrogate Road

The following tubes were approaching the annual average objective at relevant locations (38µg/m^3 or greater)

- DT104 – Lampost to right of Mayo Ave air pollution station
- DT71 – Manningham Lane adjacent to air pollution station
- DT45 – Rook Lane

The diffusion tube monitoring undertaken during 2017 did not highlight any additional areas of air quality concern in Bradford (over and above those identified in the 2017 ASR)

Update on areas of air quality concern in Bradford (outside AQMAs)

The 2017 ASR report identified the following additional areas of air quality concern.

- Saltaire Road / Bingley Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads
- Canal Road
- Greengates junction

Current situation Saltaire Road / Bingley Road junction

Map 7 (Appendix D) shows the location of the diffusion tubes around the Saltaire Road / Bingley Road junction. The number of monitoring sites in this area was increased during 2017 to investigate the extent of the exceedance of the annual average NO_2 objective along Bingley Road.

The 2017 results for these sites are shown in the table below:

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
DT30	Diffusion tube	37	34	n/a	n/a	no
DT31	Diffusion tube	49	**40**	n/a	n/a	no
DT49	Diffusion tube	31	27	n/a	n/a	no
DT50	Diffusion tube	63	**54**	n/a	n/a	yes
DT90	Diffusion tube	25	25	n/a	n/a	no
DT91	Diffusion tube	40	**40**	n/a	n/a	no
DT101	Diffusion tube	36	32	n/a	n/a	no
DT102	Diffusion tube	44	29	n/a	n/a	no

These results show that exceedances of the annual average NO_2 objective continued to arise at relevant receptor points in this area during 2017.

Figure 11 - Trends around Saltaire Road / Bingley Road junction

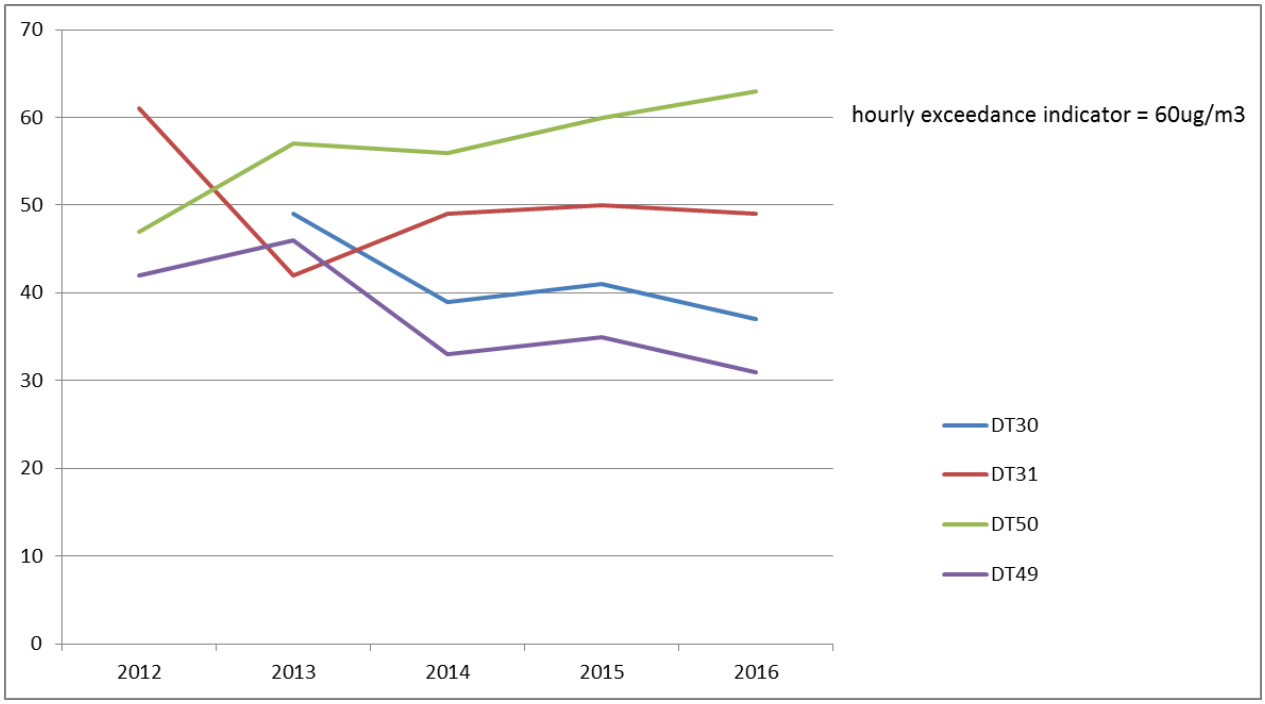


Figure 11 details the bias corrected measured value at four long term monitoring sites in the Saltaire Road / Bingley Road area (with no distance correction applied). Over a 5 year period the NO_2 concentration on Bingley Road (tubes DT31 and DT50) has not improved significantly and in recent years appears to have increased, particularly since 2014. This coincides with junction improvement work at this location which may have impacted on the queue locations and requires further investigation. In contrast tubes DT30 and DT49 (on Saltaire Road and Moorhead Lane respectively) show a marked reduction in NO_2 concentration since 2014. This may also be as a result of the junction works.

The new tubes in this area (DT101 and DT102) indicate that concentrations of NO_2 further down Bingley Road are lower than those close to the junction with Saltaire Road, but remain elevated. Once corrected for distance receptor points close to the new tubes are predicted to be below the 40µ/m^3 objective level. Based on the 2017 monitoring data any AQMA declared in this location would not be required to include properties close to sites DT101 and DT102.

The area around the Saltaire Road and Bingley Road is included in the modelling work being undertaken as part of the air quality plan business case study. The types

of measures being considered in this study have the potential to reduce concentrations of NO_2 in this area and bring it into compliance.

There is no immediate stand-alone solution to improve air quality in this area which could be implemented ahead of the measures being developed in the air quality plan business case. The declaration of a further AQMA whilst the air quality plan business case development is on-going would create unnecessary bureaucracy during a period when Bradford is already working towards the identification of an holistic air quality solution for the city. If air quality issues are predicted to remain in this area, irrespective of measures in the final air quality plan, then it will be appropriate to declare an AQMA at that time.

A further update on air quality in this area will be provided in the 2019 ASR report.

Current situation Rook Lane / Rooley Lane /Tong Street area

The 2016 ASR report identified elevated concentrations of NO_2 in several locations within this area. After a full review of appropriate distance corrections the 2017 ASR reported only one remaining exceedance at site DT64 on Tong Street.
During 2017 monitoring continued at all the previous diffusion tube sites in this area and a real time monitoring site was established on Tong Street (CM8).

The distance corrected results for each of these sites during 2017 are shown in the table below. The location of these tubes are shown on Map 7 (Annex D).

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
CM7	Real time	31	30	144.1	0	n/a
CM8	Real time	32	32	121.7	0	n/a
DT45	Diffusion tube	38	38	n/a	n/a	no
DT76	Diffusion	33	29	n/a	n/a	no

	tube					
DT77	Diffusion tube	31	27	n/a	n/a	no
DT88	Diffusion tube	34	34	n/a	n/a	no
DT89	Diffusion tube	25	34	n/a	n/a	no
DT66	Diffusion tube	25	23	n/a	n/a	no
DT64	Diffusion tube	42	**42**	n/a	n/a	no

As in 2016 the only point of exceedance was DT64.

Figure 12 - Trends around Rook Lane / Rooley Lane /Tong Street area

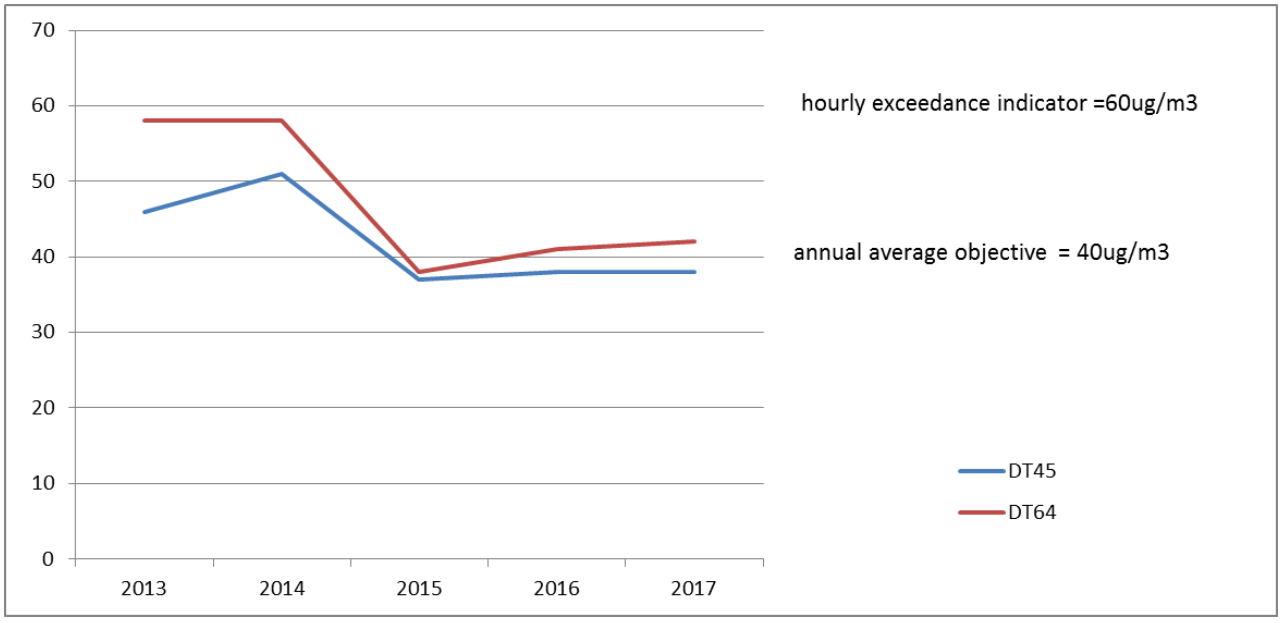


Figure 12 details the bias corrected measured value at the two long term monitoring sites in the Rook Lane / Rooley Lane /Tong Street. NO_2 concentrations dropped significantly around 2015 at both sites (the reason for this is unclear) but since then concentrations have remained stable and are currently borderline with the annual average objective level.

Monitoring will continue in this area during 2018. The need for an AQMA declaration will be reviewed again following completion of the air quality plan business case.

Current situation Harrogate Road / Killinghall Road

The 2016 ASR report identified exceedance of the annual average NO_2 in the vicinity of the Harrogate Road / Killinghall Road junction. During 2017 additional monitoring was undertaken in this area to consider the extent of this exceedance.

The distance corrected results for each of these sites during 2017 are detailed in the table below.

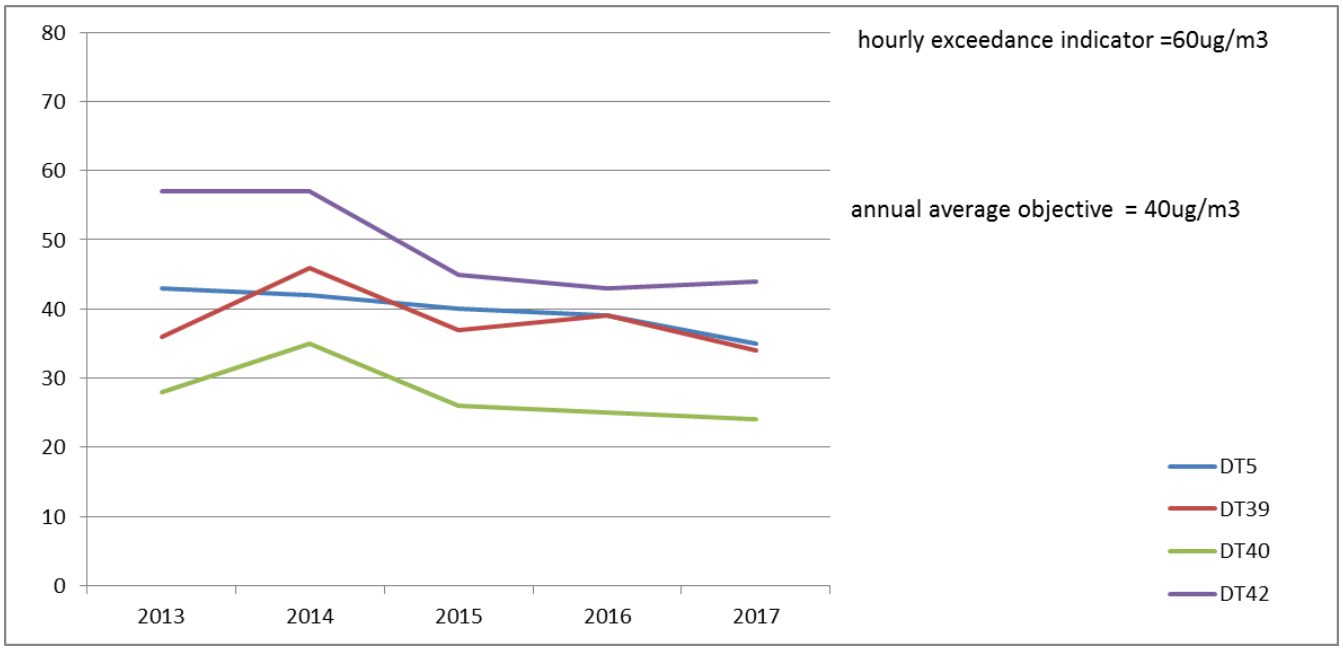
Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
DT5	Diffusion tube	35	35	n/a	n/a	no
DT39	Diffusion tube	34	31	n/a	n/a	no
DT40	Diffusion tube	24	24	n/a	n/a	no
DT42	Diffusion tube	44	**40**	n/a	n/a	no
DT86	Diffusion tube	28	28	n/a	n/a	no
DT99	Diffusion tube	25	25	n/a	n/a	no
DT100	Diffusion tube	26	26	n/a	n/a	no

In the 2017 ASR report sites DT5 and DT42 were reported as being at risk of breaching the annual average NO_2 objective. During 2017 the annual average concentration at site DT5 fell from 39 $\mu g/m^3$ (2016) to 35 $\mu g/m^3$ (2017). The concentration at site DT42 remained elevated at 40$\mu g/m^3$. Site DT42 is located close to the Killinghall Road / Harrogate Road junction. The nearest relevant receptor point is an upstairs flat with only one very small window on the Killinghall Road façade. This does not appear to serve a habitable room.

The new tubes (DT99 and DT100) confirm that the air quality issues in this area are confined to the area immediately around the junction and do not extend into the more densely populated area on Harrogate Road.

Figure 13 details the trend in measured annual average NO_2 concentration around the Killinghall Road / Harrogate Road junction (at measurement position not distance corrected).

Figure 13 - Trends around Killinghall Road / Harrogate Road junction



Concentrations in this area improved slightly between 2016 and 2017, with the exception of the area immediately adjacent to the junction. At site DT42 there was a very slight increase during this period. Once corrected for distance, site DT42 is currently at the objective level, but the risk of exposure in this area is considered low.

Based on the concentrations measured in 2017 the declaration of a further AQMA in this area is no longer considered necessary but monitoring will be continued to ensure levels remain at or below the objective level. An update on concentrations in this area will be provided in the 2019 ASR report.

Current situation Canal Road

The national PCM air pollution model operated on behalf of Defra has identified potential exceedance of EU limit values in the Canal Road area (as well as in other areas of the city). Monitoring was established in the Canal Road area in 2016 close to the site of a large mixed use planning application. This monitoring was extended in 2017 to include further relevant locations in the area.

The results of the 2017 monitoring in the Canal Road area are detailed in the table below. A map of the monitoring sites can be found in Appendix D (Map10). There are no long term trend results available for this area.

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
DT73	Diffusion tube	46	No relevant receptors at present	n/a	n/a	no
DT74	Diffusion tube	23	No relevant receptors at present	n/a	n/a	no
DT111	Diffusion tube	39	34	n/a	n/a	no
DT112	Diffusion tube	31	24	n/a	n/a	no

At some locations along Canal Road concentrations continue to approach or exceed the 40 $\mu g/m^3$ annual average objective (as predicted by the Defra PCM model and reported in the 2017 ASR report). Existing properties along Canal Road are set back from the roadside. Once distance corrections are applied the concentrations measured in 2017 are below the objective level at residential facades. There is no requirement to declare an AQMA in this area at present. Monitoring will be continued along Canal Road to support development of the air quality plan business case and

establish longer term trends. A further update on concentrations in this area will be provided in the 2019 ASR report.

Current situation Greengates crossroads

In the 2017 ASR report it was reported that elevated concentrations of NO_2 had been observed around the Greengates junction following the installation of monitoring to support a planning application for a major junction improvement scheme.

The junction improvement was approved in 2018 (planning reference17/00916/FUL) and is currently being implemented (scheduled to complete during 2019). Monitoring has continued throughout the works and the 2017 results are provided in the table below. The monitoring site locations are shown in Appendix D (map 11).

Monitoring site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m3)	Maximum hourly concentration at monitoring point (µg/m3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objecitve (annual average>60ug /m3)?
DT92	Diffusion tube	33	No relevant receptor	n/a	n/a	no
DT93	Diffusion tube	36	36	n/a	n/a	no
DT94	Diffusion tube	26	25	n/a	n/a	no
DT95	Diffusion tube	**43**	No relevant receptor	n/a	n/a	no
DT96	Diffusion tube	36	28	n/a	n/a	no

The results show that only site DT95 exceeded the objective level during 2017. This is not at a relevant receptor point. The air quality impact assessment submitted with the planning application indicates that air quality will improve in the area as a result of the improvement works. Monitoring work will be continued until the full impacts of the junction works can be assessed.

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 40µg/m^3.

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 35 times per year.

During the 2017 period there were no exceedances of the objectives for PM_{10} in Bradford.

Compliance with annual average objective

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the previous 5 years with the air quality objective of 40µg/m^3.

There were no exceedances of the annual average air quality objective for PM_{10} recorded at any of the continuous monitoring sites in Bradford during 2017.

The background levels of PM_{10} recorded at Keighley in 2017 were similar to the range of values as those recorded over the previous 5 years and slightly lower than the result obtained for 2016. Some annual variation in background concentration is to be expected due to the influence of weather conditions. There is no evidence of a long term reduction in background concentrations of PM_{10} at Keighley.

Long term trend data for the roadside PM_{10} site at Shipley Airedale Road is not available due to a break in PM_{10} monitoring between 2013 and late 2015. This was to allow levels of $PM_{2.5}$ to be assessed at the same site. In 2012 the annual average PM_{10} concentration at Shipley Airedale Road was recorded as 30µg/m^3. The 2017 data indicates this has fallen considerably to 18.6µg/m^3. There was also a reduction in concentration compared with the value of 21 µg/m^3 recorded in 2016.

This level of improvement in PM_{10} over time can most probably be attributed to the significant reduction in emissions of PM_{10} from improved vehicle exhaust technology, particularly the increased uptake of particulate traps on diesel vehicles. Emission abatement technology appears to have been more successful at reducing particulate emissions than oxides of nitrogen.

The new roadside monitoring site at Tong Street recorded an annual average PM_{10} concentrationof 16.3 µg/m^3 during 2017. This is well below the annual average objective level and is not of concern.

Compliance with daily mean objective

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the previous 5 years with the air quality objective of 50µg/m^3, which is not to be exceeded more than 35 times per year.

There were 2 exceedances of the 50µg/m^3 daily mean objective at Keighley during 2017.

These were:

- 52.1 µg/m3 recorded on 14th February 2017
- 59.3 µg/m3 recorded on 13th December 2017

There were 5 exceedances of the 50µg/m^3 daily mean objective at Shipley Airedale Road during 2017.

These were:

- 56.3 µg/m^3 recorded on 23rd January 2017
- 54.8 µg/m^3 recorded on 27th January 2017
- 55.7 µg/m^3 recorded on 28th March 2017
- 71.4 µg/m^3 recorded on 5th November 2017
- 106.9µg/m^3 recorded on 6th November 2017

There were 4 exceedances of the 50µg/m^3 daily mean objective at Tong Street during 2017.

These were:

- 51.5 µg/m^3 recorded on 13th February 2017
- 51.9 µg/m^3 recorded on 14th February 2017
- 51.5 µg/m^3 recorded on 28th March 2017
- 80.1 µg/m^3 recorded on 5th November 2017

35 exceedances of the 50µg/m^3 objective are allowed at any one site per annum, therefore the 24 hour daily mean objective was complied with in Bradford during 2017.

The highest concentrations of PM_{10} recorded in Bradford during 2017 were associated with bonfire night celebrations around 5th and 6th November.

3.2.2 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

The levels of $PM_{2.5}$ measured in Bradford during 2017 were all below the current EU annual average limit value of 25µg/m^3 and very similar to those recorded in 2016.

As expected the $PM_{2.5}$ concentrations observed at Tong Street during the first year of monitoring were found to be higher than those at the Keighley background site but lower than those at Shipley Airedale Road.

$PM_{2.5}$ monitoring is continuing at Keighley, Shipley Airedale Road and Tong Street.

3.2.3 Sulphur Dioxide (SO_2)

There is no ratified SO_2 monitoring data available for Bradford for 2016. SO_2 monitoring undertaken previously in Bradford recorded levels well below the national air quality objective levels and there are no reasons to suggest that this position will have changed.

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)
CM2	Keighley	Urban Centre	406058	441273	NO2; PM10	NO	Chemiluminescent	n/a	5	2.7
CM3	Manningham Lane	Roadside	415582	434457	NO2	YES	Chemiluminescent	4	1.5	1.5
CM4	Manchester Road / Mayo Avenue	Roadside	415933	430569	NO2	YES	Chemiluminescent	2	2	1.5
CM5	Thornton Road	Roadside	415887	433047	NO2	YES	Chemiluminescent	0	2	1.5
CM6	Shipley Airedale Road	Roadside	416974	433245	NO2; PM10	YES	Chemiluminescent	2	2	2.7
CM7	Rook Lane	Roadside	417860	430705	NO2	YES	Chemiluminescent	1	1.5	1.5
CM8	Tong Street	Roadside	419188	430213	NO2; PM10	NO	Chemiluminescent	0	5.8	2.7

Notes:

(1) 0m 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?	Height (m)
DT5	Harrogate Road	kerbside	417982	434886	NO2	no	0	1	NO	2.5 - 2.6
DT39	Harrogate Road	roadside	417927	434799	NO2	no	2	2	NO	2.5 - 2.6
DT40	Dudley Hill Road	roadside	417886	434827	NO2	no	0	1.5	NO	2.5 - 2.6
DT42	Killinghall	kerbside	417902	434751	NO2	no	1.3	1	NO	2.5-2.6
DT12	Treadwell Mills	roadside	416967	433268	NO2	yes	1	1.5	NO	2.5 - 2.6
DT45	Rook Lane lampost 17	roadside	417877	430717	NO2	no	0	1.5	NO	2.5 - 2.6
DT30	29 Saltaire Road	roadside	413861	437772	NO2	no	2	2	NO	2.5 - 2.6
DT31	lampost 233 80 Bradford Road	roadside	413527	437713	NO2	no	4	1.5	NO	2.5 - 2.6
DT49	9 Moorhead Lane	roadside	413604	437658	NO2	no	4	1.5	NO	2.5 - 2.6
DT50	203 Bradford Road	roadside	413510	437732	NO2	no	2.5	2	NO	2.5 - 2.6
DT68	Co-Located at AQ Station	roadside	406060	441274	NO2	no	n/a	5	YES	3
DT69	Co-Located at AQ Station	roadside	406060	441274	NO2	no	n/a	5	YES	3
DT70	Co-Located at AQ Station	roadside	406060	441274	NO2	no	n/a	5	YES	3
DT64	Tong Street	roadside	419379	430091	NO2	no	0	1.5	NO	2.5 - 2.6
DT66	Holme Lane	kerbside	419341	430225	NO2	no	3	1	NO	2.5 - 2.6

DT19	Cock & Bottle Public House	roadside	416948	433436	NO2	yes	n/a	1.5	NO	2.5 - 2.6
DT21	12 Prospect Street, Keighley	background	404719	440613	NO2	no	0	>5	NO	2.5 - 2.6
DT71	post 53 Manningham Lane adj ST NOx unit	roadside	415585	434455	NO2	yes	4	1.5	NO	2.5 - 2.6
DT72	post 2 Queens Rd (traffic lights)	roadside	415573	434521	NO2	yes	0	2	NO	2.5 - 2.6
DT73	post 61 Canal Rd (opp garden centre)	Kerbside	415448	435812	NO2	no	n/a	1	NO	2.5 - 2.6
DT74	post 4 Gaisby Ln (above cycle path)	Kerbside	415549	435918	NO2	no	n/a	<0.5	NO	2.5 - 2.6
DT76	post 12 junc Rook Ln/Tong St	Kerbside	418268	430732	NO2	no	3.5	0.5	NO	2.5 - 2.6
DT77	bus stop 535 Rooley Lane	Kerbside	417982	431058	NO2	no	4	0.5	NO	2.5 - 2.6
DT78	post 11 Aireworth Road KLY	Kerbside	407380	441811	NO2	no	3	1	NO	2.5 - 2.6
DT79	Centenary Square	urban background	416282	432966	NO2	no	0	70	NO	2.5 - 2.6
DT80	Lampost 40 City Exchange	Kerbside	416388	432817	NO2	no	1	1	NO	2.5 - 2.6
DT81	Lampost 5 Interchange bus entrance	Kerbside	416413	432674	NO2	no	1	1	NO	2.5 - 2.6
DT82	Sharpe St (Give Way sign)	Kerbside	416288	432652	NO2	no	30	0	NO	2.5 - 2.6
DT83	Sharpe St (Car Park ent.)	Kerbside	416154	432638	NO2	no	25	0	NO	2.5 - 2.6
DT84	Wilton St- Omar Khan's	Kerbside	416054	432675	NO2	no	5	<1	NO	2.5 - 2.6

DT85	Ice Rink-Corner Wardley Hse	Kerbside	416092	432676	NO2	no	6	<1	NO	2.5 - 2.6
DT86	Otley Rd lamp post no 2	Roadside	417894	434753	NO2	no	0	2	NO	2.5 - 2.6
DT88	Tong Street lamp post no 181	Roadside	418829	430399	NO2	no	0	2	NO	2.5 - 2.6
DT89	Tong St/Broadstone Way Car Park	Roadside	419188	430213	NO2	no	3	3	NO	2.5 - 2.6
DT90	George Street / Bingley Rd Saltaire	Roadside	413807	437664	NO2	no	0	1	NO	2.5 - 2.6
DT91	Dove Street / Saltaire Road	Roadside	413697	437723	NO2	no	0	1.5	NO	2.5 - 2.6
DT92	Harrogate Rd	Roadside	419006	437217	NO2	no	n/a	1.5	NO	2.5 - 2.6
DT93	New Line (former school)	kerbside	419003	437308	NO2	no	0	1	NO	2.5 - 2.6
DT94	Stockhill Rd (school)	Roadside	419103	437337	NO2	no	2.5	3.5	NO	2.5 - 2.6
DT95	Harrogate Rd	kerbside	419111	437322	NO2	no	n/a	1	NO	2.5 - 2.6
DT96	New Line (ped crossing)	kerbside	419152	437209	NO2	no	7	1	NO	2.5 - 2.6
DT99	Charnwood Grove/Harrogate Rd LP below junc	Roadside	418033	434970	NO2	no	0	7.5	NO	2.5 - 2.6
DT100	Killinghall Rd opp car park LP former soc ser	Roadside	417949	434693	NO2	no	0	2.4	NO	2.5 - 2.6
DT101	Bingley Rd Saltaire LP 37 nearest shops	Roadside	413418	437725	NO2	no	8	1.4	NO	2.5 - 2.6
DT102	Bingley Rd Saltaire LP nr house 43	Roadside	413338	437720	NO2	no	7.7	2.4	NO	2.5 - 2.6

DT103	Mayo Ave first LP left of AQMS	Roadside	415925	430572	NO2	no	4.9	3.6	NO	2.5 - 2.6
DT104	Mayo Ave first LP right of AQMS	Roadside	415961	430558	NO2	no	4.9	4.4	NO	2.5 - 2.6
DT105	Manchester Rd LP nearest house 793	Roadside	415780	430504	NO2	no	0	6.8	NO	2.5 - 2.6
DT106	Smiddles Lane LP nearest fence to Bankfoot School	Roadside	415702	430702	NO2	no	2.4	4	NO	2.5 - 2.6
DT107	Broadway Ave off Manch Rd adj City bathrooms	Roadside	415833	430837	NO2	no	0	5.2	NO	2.5 - 2.6
DT108	Thornton Rd LP 24 after Street NOx	Roadside	415858	433061	NO2	no	0.6	4.5	NO	2.5 - 2.6
DT109	Thornton Rd LP below Street NOx	Roadside	415891	433045	NO2	no	0.5	3	NO	2.5 - 2.6
DT110	Thornton Rd Lp adj to student accom	Roadside	415806	433061	NO2	no	1.7	4.4	NO	2.5 - 2.6
DT111	Canal Rd/ Midland Terr LP nr post box	Roadside	416015	435028	NO2	no	3.5	3.1	NO	2.5 - 2.6
DT112	Canal Rd LP nearest flats by car wash	Kerbside	415024	436743	NO2	no	9.16	0.7	NO	2.5 - 2.6
DT113	Young Street lp1	Roadside	414014	433357	NO2	no	0	2.6	NO	2.5 - 2.6
DT114	Young Street fence adj to lp 2	Roadside	414009	433405	NO2	no	0	2.8	NO	2.5 - 2.6
DT115	Buller Street lp4	urban background	418421	432214	NO2	no	0	n/a	NO	2.5 - 2.6

DT116	Sticker Lane lp41	Roadside	418564	432218	NO2	no	0	3	NO	2.5 - 2.6
DT117	Parry lane lp4	kerbside	418192	432208	NO2	no	0	0.7	NO	2.5 - 2.6
DT118	Fearnville Drive lp1	Roadside	418666	432470	NO2	no	4	4.1	NO	2.5 - 2.6
DT119	Laisterdyke LP5 adj NO9	Roadside	418626	432945	NO2	no	0.5	2.4	NO	2.5 - 2.6

Notes:

(1) 0m 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.

In ASR 2017 the location of tube DT92 was incorrectly reported. The co-ordinates in this report are correct.

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 2017 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2013	2014	2015	2016	2017
CM2	Urban Centre	Automatic	n/a	91.59%	27	27	28	31	24
CM3	Roadside	Automatic	92.10%	80.46%	no data	35	**42**	**41**	39
CM4	Roadside	Automatic	n/a	95.12%	**75**	**42**	**42**	**46**	**42**
CM5	Roadside	Automatic	n/a	93.80%	**63**	**51**	33	31	30
CM6	Roadside	Automatic	90.13%	61.12%	**52**	**54**	**48**	**52**	**40**
CM7	Roadside	Automatic	n/a	92.71%	no data	**57**	34	36	31
CM8	Roadside	Automatic	n/a	93.89%	no data	no data	no data	no data	32
DT5	kerbside	Diffusion Tube	100%	100%	**43**	**42**	**40**	39	35
DT39	roadside	Diffusion Tube	100%	100%	36	**46**	37	39	34
DT40	roadside	Diffusion Tube	100%	100%	28	35	26	25	24
DT42	kerbside	Diffusion Tube	100%	100%	**57**	**57**	**45**	**43**	**44**
DT12	roadside	Diffusion Tube	100%	100%	**66**	**84**	**66**	**69**	**62**
DT45	roadside	Diffusion Tube	100%	100%	**46**	**51**	37	38	38
DT30	roadside	Diffusion Tube	100%	100%	no data	**49**	39	**41**	37
DT31	roadside	Diffusion Tube	91.60%	91.60%	**61**	**42**	**49**	**50**	**49**
DT49	roadside	Diffusion	100%	100%	**42**	**46**	33	35	31

		Tube							
DT50	roadside	Diffusion Tube	91.60%	91.60%	**47**	**57**	**56**	**60**	**63**
DT68	roadside	Diffusion Tube	100%	100%	30	34	30	30	25
DT69	roadside	Diffusion Tube	100%	100%	29	35	30	31	28
DT70	roadside	Diffusion Tube	100%	100%	32	39	31	32	27
DT64	roadside	Diffusion Tube	83.30%	83.30%	**58**	**58**	38	**41**	**42**
DT66	kerbside	Diffusion Tube	100%	100%	34	39	32	28	25
DT19	roadside	Diffusion Tube	100%	100%	**66**	**74**	**53**	**58**	**54**
DT21	background	Diffusion Tube	100%	100%	29	21	17	12	12
DT71	roadside	Diffusion Tube	91.60%	91.60%	no data	no data	**40**	39	**43**
DT72	roadside	Diffusion Tube	100%	100%	no data	no data	**60**	**66**	**53**
DT73	Kerbside	Diffusion Tube	100%	100%	no data	no data	**51**	**51**	**46**
DT74	Kerbside	Diffusion Tube	100%	100%	no data	no data	25	22	23
DT76	Kerbside	Diffusion Tube	91.60%	91.60%	no data	no data	**41**	34	33
DT77	Kerbside	Diffusion Tube	100%	100%	no data	no data	**51**	**44**	**40**
DT78	Kerbside	Diffusion Tube	100%	100%	no data	no data	27	23	23
DT79	urban background	Diffusion Tube	66.67%	66.67%	no data	no data	33	29	33
DT80	Kerbside	Diffusion Tube	83.30%	83.30%	no data	no data	34	33	33

DT81	Kerbside	Diffusion Tube	75%	75%	no data	no data	36	34	37
DT82	Kerbside	Diffusion Tube	100%	100%	no data	no data	37	34	34
DT83	Kerbside	Diffusion Tube	100%	100%	no data	no data	29	28	29
DT84	Kerbside	Diffusion Tube	100%	100%	no data	no data	32	32	32
DT85	Kerbside	Diffusion Tube	91.60%	91.60%	no data	no data	31	32	29
DT86	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	32	28
DT88	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	35	34
DT89	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	36	38
DT90	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	28	25
DT91	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	35	**40**
DT92	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	38	33
DT93	kerbside	Diffusion Tube	100%	100%	no data	no data	no data	**40**	36
DT94	Roadside	Diffusion Tube	100%	100%	no data	no data	no data	27	26
DT95	kerbside	Diffusion Tube	83.30%	83.30%	no data	no data	no data	**51**	43
DT96	kerbside	Diffusion Tube	100%	100%	no data	no data	no data	38	36
DT99	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	25
DT100	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	26
DT101	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	**44**

DT102	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	36
DT103	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	**40**
DT104	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	**43**
DT105	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	37
DT106	Roadside	Diffusion Tube	80.00%	66.67%	no data	no data	no data	no data	27
DT107	Roadside	Diffusion Tube	90%	75%	no data	no data	no data	no data	23
DT108	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	34
DT109	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	35
DT110	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	28
DT111	Roadside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	39
DT112	Kerbside	Diffusion Tube	100.00%	83.30%	no data	no data	no data	no data	31
DT113	Roadside	Diffusion Tube	100.00%	50%	no data	no data	no data	no data	24
DT114	Roadside	Diffusion Tube	100.00%	50%	no data	no data	no data	no data	21
DT115	urban background	Diffusion Tube	100.00%	33.30%	no data	no data	no data	no data	23
DT116	Roadside	Diffusion Tube	100.00%	41.67%	no data	no data	no data	no data	28
DT117	kerbside	Diffusion Tube	60%	25%	no data	no data	no data	no data	no data
DT118	Roadside	Diffusion Tube	100.00%	41.67%	no data	no data	no data	no data	31
DT119	Roadside	Diffusion Tube	100.00%	41.67%	no data	no data	no data	no data	34

☐ **Diffusion tube data has been bias corrected - YES**

☐ **Annualisation has been conducted where data capture is <75% - YES**

This data has not been corrected for distance as per instruction in ASR excel template

Notes:

Exceedances 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 exceedance 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 Boxes 7.9 and 7.10 in LAQM.TG16 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 2017 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2013	2014	2015	2016	2017
CM2	Urban Centre	automatic	n/a	91.59%	0	0	0	0	4
CM3	Roadside	automatic	92.10%	80.46%	no data	0(116)	0	0 (114.3)	0 (99.98)
CM4	Roadside	automatic	n/a	95.12%	84(193)	34	0	2	0
CM5	Roadside	chemiluminescence	n/a	93.80%	0	141(306)	0	0	0
CM6	Roadside	automatic	90.13%	61.12%	0	0(135)	0	0	0 (137.97)
CM7	Roadside	automatic	n/a	92.71%	no data	106 (293)	0	0	0
CM8	Roadside	automatic	n/a	93.89%	no data	no data	no data	no data	0

Notes:

Exceedances 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 2017 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2013	2014	2015	2016	2017
CM2	Urban Centre	n/a	87.40%	16.6	12.4	14	15.5	14.2
CM6	Roadside	n/a	92.30%	n/a	n/a	n/a	21.2	18.6
CM8	Roadside	n/a	86.20%	n/a	n/a	n/a	n/a	16.3

☐ **Annualisation has been conducted where data capture is <75%**

Notes:

Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ 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 Boxes 7.9 and 7.10 in LAQM.TG16, 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 2017 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2013	2014	2015	2016	2017
CM2	Urban Centre	n/a	87.40%	**2(25.2)**	**3(23.3)**	**1**	**1**	2
CM6	Roadside	n/a	92.30%	**n/a**	**n/a**	**2**	**8**	5
CM8	Roadside	n/a	86.20%	**n/a**	**n/a**	**n/a**	**n/a**	4

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 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 90.4th percentile of 24-hour means is provided in brackets.

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2013	2014	2015	2016	2017
CM2	Urban Centre	n/a	88.00%	n/a	n/a	9.5	9.3	8.9
CM6	Roadside	n/a	92.30%	10.4	11	13.1	13.0	12.2
CM8	Roadside	n/a	86.20%	n/a	n/a	n/a	n/a	10.4

☐ **Annualisation has been conducted where data capture is <75%**

Notes:

(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 Boxes 7.9 and 7.10 in LAQM.TG16, 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 2017

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2017

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.78) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
DT5	51	59	46	42	41	39	42	40	42	50	41	53	46	35	35
DT39	63	53	42	34	43	32	36	37	41	38	51	49	43	34	31
DT40	51	36	36	24	30	22	26	19	29	30	36	35	31	24	24
DT42	94	63	56	48	49	46	54	53	42	51	63	65	57	**44**	**40**
DT12	146	98	81	82	69	48	48	72	74	81	101	54	80	**62**	**58**
DT45	58	50	55	42	43	38	43	50	41	49	62	58	49	38	38
DT30	64	50	52	42	49	39	38	42	50	46	48	50	48	37	34
DT31	82	46	67	76	no data	57	40	41	55	61	80	85	63	**49**	**40**
DT49	48	44	45	42	42	36	37	29	33	26	43	50	40	31	27
DT50	105	74	89	74	73	67	62	no data	61	93	93	92	80	**63**	**54**
DT68	53	15	35	26	33	27	27	28	28	33	42	42	32	25	n/a
DT69	56	46	39	32	33	22	29	27	25	34	43	43	36	28	n/a
DT70	53	37	35	30	32	26	29	31	24	34	41	42	35	27	n/a
DT64	70	58	52	50	49	34	40	50	no data	no data	67	64	53	**42**	**42**
DT66	58	42	31	22	26	23	22	23	19	30	39	44	32	25	23

DT19	85	78	82	75	55	57	63	68	68	37	86	79	69	54	n/a
DT21	30	16	19	12	12	9	9	11	13	16	17	22	16	12	12
DT71	66	94	60	47	31	48	48	48	49	48	71	no data	55	43	38
DT72	110	54	52	64	53	69	77	69	57	44	87	86	69	**53**	**53**
DT73	91	32	62	47	98	48	49	39	21	61	75	77	58	46	n/a
DT74	44	45	30	14	41	14	20	21	26	29	37	36	30	23	n/a
DT76	56	44	49	39	37	28	30	no data	41	37	49	50	42	33	29
DT77	82	56	59	47	49	34	39	48	42	55	53	57	52	40	33
DT78	41	29	34	23	22	18	22	26	27	24	39	43	29	23	20
DT79	59	48	no data	no data	54	22	no data	no data	43	45	30	55	45	33	33
DT80	58	55	no data	no data	41	31	35	28	39	38	46	50	42	33	32
DT81	64	56	48	40	36	no data	no data	no data	34	46	48	54	47	37	35
DT82	63	52	43	37	45	32	39	41	37	40	48	50	44	34	n/a
DT83	50	48	43	32	33	25	28	31	28	40	44	40	37	29	n/a
DT84	63	54	41	41	41	31	34	29	40	32	39	47	41	32	30
DT85	57	no data	44	37	34	25	30	25	25	40	41	45	37	29	28
DT86	57	40	29	32	42	22	33	34	32	36	42	39	37	28	28
DT88	69	49	48	43	39	30	31	35	38	44	47	50	44	34	34
DT89	77	42	56	47	37	33	40	42	46	50	48	61	48	38	34
DT90	55	39	42	26	29	24	25	25	16	25	43	41	33	25	25
DT91	77	56	52	40	38	37	41	46	46	58	62	61	51	**40**	**40**
DT92	58	45	37	51	33	38	30	38	21	43	56	56	42	33	n/a
DT93	68	55	37	40	46	35	39	43	37	43	59	52	46	36	36
DT94	46	49	41	25	29	19	20	28	21	30	45	45	33	26	25
DT95	60	66	39	56	61	47	58	64	51	52	no data	no data	55	**43**	n/a
DT96	63	46	45	45	48	36	43	44	31	45	54	50	46	36	28
DT99	no data	no data	36	31	29	27	27	27	26	31	46	42	32	25	25

DT100	no data	no data	30	32	26	24	27	31	29	40	44	48	33	26	26
DT101	no data	no data	68	54	41	43	53	38	50	50	77	86	56	**44**	32
DT102	no data	no data	68	48	36	37	38	35	46	36	48	67	46	36	29
DT103	no data	no data	63	48	50	42	42	50	58	53	59	47	51	**40**	35
DT104	no data	no data	57	60	48	44	45	52	60	63	54	66	55	43	38
DT105	no data	no data	75	41	55	37	44	39	47	45	36	56	48	37	37
DT106	no data	no data	45	30	no data	24	31	24	33	no data	35	45	33	27	26
DT107	no data	no data	41	25	34	no data	23	24	23	28	26	36	29	23	23
DT108	no data	no data	54	41	35	34	33	36	45	49	58	53	44	34	34
DT109	no data	no data	55	41	39	34	36	39	33	50	59	57	44	35	35
DT110	no data	no data	39	33	24	26	32	31	39	45	44	50	36	28	26
DT111	no data	no data	56	45	47	39	44	43	49	57	57	57	49	39	34
DT112	no data	no data	48	37	17	34	40	35	36	52	42	58	40	31	24
DT113	no data	no data	no data	no data	no data	no data	22	31	21	33	39	34	30	24	24
DT114	no data	no data	no data	no data	no data	no data	19	24	20	32	33	31	27	21	21
DT115	no data	no data	no data	no data	no data	no data	no data	no data	27	37	11	45	30	23	23
DT116	no data	no data	no data	no data	no data	no data	no data	24	37	38	39	44	36	28	28
DT117	no data	no data	no data	no data	no data	no data	no data	31	28	no data	no data	48	36	30	30
DT118	no data	no data	no data	no data	no data	no data	no data	24	21	47	53	52	39	31	29
DT119	no data	no data	no data	no data	no data	no data	no data	33	17	53	70	48	44	34	31

☐ **National bias adjustment factor used - Yes**

☐ **Annualisation has been conducted where data capture is <75% - Yes**

☐ **Where applicable, data has been distance corrected for relevant exposure - Yes**

Notes:

Exceedances 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 exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

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

C 1.0 Diffusion tube preparation

All diffusion tubes used in conjunction with this report were prepared by West Yorkshire Analytical services using 50% TEA in acetone.

WYAS participate in the Inter-laboratory comparison scheme AIR PT. This is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR PT offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air. One such sample is the AIR NO_2 test sample type that is distributed to participants in a quarterly basis. The results of this scheme are published annually.

The AIR PT NO2 diffusion tube results for WYAS for the period covered by this progress report are shown in Table C.1

Table C.1 AIR PT NO2 diffusion tube results for WYAS (2017)

AIR round	Result for WYAS
January – February 2017	100 %
April – May 2017	100%
July – August 2017	100%
September– October 2017	100%

The average WASP result for the 2015 period was 100%.

C 2.0 Nitrogen Dioxide Bias Factors

Local nitrogen dioxide diffusion tube bias factors are not available from the Bradford district monitoring network. The NO_2 tube results reported within this report have been corrected for bias using the factors provided on the LAQM support website (DEFRA spreadsheet version 03/18). These factors are derived from co-location studies in other areas using WYAS tubes.

The bias factor used in this report was **0.78**

C 3.0 PM Monitoring Adjustment

The PM_{10} and $PM_{2.5}$ data within this report was collected using PM_{10}/ $PM_{2.5}$ FDMS measurement systems. It has been subject to ratification and verification checks, but has not been corrected for volatility as this is not necessary for FDMS measurements.

C 4.0 QA/QC of Automatic Monitoring

The City of Bradford Metropolitan District Council's air quality analysers are type approved as recommended in LAQM.TG1 (00) *Review and Assessment: Monitoring air quality* and LAQM.TG4 (00) *Review and assessment: Pollutant specific guidance.*

The Council's own automatic network is operated by council officers trained by the instrument supplier. Signal Group provide routine maintenance and emergency repair services. All the real time data provided in this report is from council operated analysers with the exception of the Mayo Avenue site (CM4) which is affiliated to the AURN network and operated by DEFRA.

Bradford MDC air quality staff undertake Local Site operator duties at the Mayo Avenue monitoring station on behalf of DEFRA. Annual auditing of this site and data management is managed by DEFRA using their own contractors. Data management of all the other Bradford sites is undertaken in house by City of Bradford MDC AQ staff.

The City of Bradford MDC monitoring sites have a programme of routine operational checks and programmed fortnightly site visits which include:

- Daily checks on data transfer, telephone lines and analyser operation

- Carrying out of repairs under a service agreement with the equipment supplier (Signal Group).
- Fortnightly manual calibration checks, site inspections of equipment status, site safety and security (by Bradford MDC staff).
- Programmed six-monthly servicing and calibration by equipment suppliers under service agreement (Signal Group)

Maintenance systems

The Council's monitoring network of automatic continuous monitors is maintained in accordance with a schedule which is essentially similar to that employed for the AURN and affiliated sites. All analysers are maintained and serviced according to manufacturer's specifications and have a six-monthly service and recalibration by Signal Ambitech, the suppliers of the equipment. The servicing, calibration, and repair documentation is kept in a central record. Routine maintenance is carried out at the two-weekly calibration site visit, and any faults are recorded with the calibration log for the visit. These records are kept on site and centrally at the Environmental Health Services Scientific and Technical Services Team office.

Calibration Routines

A zero and span calibration check is performed during the site inspection visit. The methodology used is essentially that found in the AURN Local Site Operators Manual issued by NETCEN, and the manufacturer's instruction manual.

The basic steps are:

- Pre-calibration check of the general site condition and status of the analyser, before the zero and span checks are performed.
- Zero check to verify the performance of the analyser in the absence of the gas being monitored.
- Span check to verify the response of the analyser to gas of a known concentration.
- Post calibration check of the general site condition and status of the analyser on completion of all calibration routines.

A record of each analyser zero and span check is fully documented and a record kept on site and also centrally.

Calibration Gas Standards

The gases used for onsite span calibration checks are supplied by Air Liquide Ltd and are traceable via European Accreditation DIN EN 45001 and DIN EN ISO 900. The tolerance of the nitrogen dioxide and nitric oxide in air mixes is typically ±5%, and for a sulphur dioxide in air mix, it is typically ±5%.

Zero air is generated internally in the Ambirak, and the scrubbers are changed when necessary in accordance with manufacturer's recommendations and the NETCEN LSO Site Manual for the Ambirak.

Data scaling, validation and ratification

Unscaled data is gathered every hour by an Ambidesk system located in the Scientific and Technical Services Team office. Scaling factors are applied automatically by the Ambidesk software using factors derived during the fortnightly calibration check and the daily automatic internal calibration checks at the Ambirak.

A daily report is generated to enable unusual readings to be identified. Monthly reports are produced for further checks on data capture rates, and any other unusual variations in measured scaled data. The original raw unscaled data is retained on disk at the Ambirak in the event of anomalous scaled data events.

All scaled hourly results downloaded from the Ambirak system are subject to detailed checking by an air quality officer at Bradford MDC on an annual basis as part of the ASR reporting.

Where unusual or unexpected results are obtained from an individual site, comparisons are undertaken with data from other monitoring locations inside and outside the Bradford district and the past history of the analyser in terms of reliability and recent breakdowns is taken into consideration. Any data considered to be unrepresentative of actual ambient conditions is removed from the data set prior to preparation of summary reports. A full record is kept of any adjustments to data on an hour by hour basis.

Short-term to Long-term Data Adjustment

Short to long term data adjustment has been undertaken for diffusion tube data (where applicable). No annualisation of PM_{10} or $PM_{2.5}$ data was required for this report

Annualisation of NO_2 diffusion tube data

Where diffusion tube monitoring is only undertaken for part of a year and/or where annual data capture is less than 75%, the annual averages require annualisation to take account of any seasonal variation in concentration.

The diffusion tube measurements undertaken in Bradford during 2017 have been annualised using NO_2 data from the Keighley. The calculations are detailed below.

DT79			
Month	Keighley Real Time mean	DT79	Keighley when DT79 present)
4/1/2017 (11:00) to 7/2/2017 (11:00)	34	59	34.00
7/2/2017(12:00) to 8/3/2017 (11:00)	27	48	27
8/3/2017(12:00) to 5/4/2017(11.00)	25		
5/4/2017(12.00) to 3/5/2017 (11.00)	23		
03/05/2017(12:00) to 6/6/2017 (11:00)	21	54	21
6/6/2017 (11.00) to 17/7/2017(12.00)	19	22	19
17/7/17 (12.00) to 8/8/2017 (11:00)	19		
8/8/2017 (12:00) to 6/9/2017 (12:00)	20		
6/9/2017 (12:00) to 5/10/2017 (11.00)	21	43	21
5/10/2017 (12:00) to 9/11/2017 (11.00)	24	45	24
9/11/2017 (11.00) to 6/12/2017 (11.00)	31	30	31
6/12/2017 (12.00) to 29/12/2017 (01:00)	27	55.00	27.00
	24.25	44.50	25.50
			0.950980392

DT106			
Month	Keighley Real Time mean	DT106	Keighley when DT79 present)
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26	45	26
3/4/2017(14.00) to 2/5/2017 (13.00)	23	30	23
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19	24	19
13/7/17 (12.00) to 7/8/2017 (12:00)	18	31	18
7/8/2017 (13:00) to 6/9/2017 (14:00)	20	24	20
6/9/2017 (14:00) to 4/10/2017 (14.00)	21	33	21
4/10/2017 (14:00) to 8/11/2017 (14.00)	23		

8/11/2017 (15.00) to 6/12/2017 (15:00)	31	35	31
6/12/2017 (16:00) to 29/12/2017 (01:00)	27	45.00	27.00
	24.17	33.38	23.13
			1.045045045

DT113			
Month	Keighley Real Time mean	DT106	Keighley when DT79 present)
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	25		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 8/8/2017 (14:00)	19	22	19
8/8/2017 (14:00) to 5/9/201 (11:00)	20	31	20
5/9/2017 (12:00) to 3/10/2017 (13:00)	22	21	22
3/10/2017(13:00) to 8/11/2017 (12:00)	23	33	23
8/11/2017 (13:00) to 6/12/2017 (11:00)	31	39	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	34.00	27.00
	24.25	30.00	23.67
			1.024647887

DT114			
Month	Keighley Real Time mean	DT106	Keighley when DT79 present)
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	25		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 8/8/2017 (14:00)	19	19	19
8/8/2017 (14:00) to 5/9/2017 (11:00)	20	24	20
5/9/2017 (12:00) to 3/10/2017 (13:00)	22	20	22
3/10/2017(13:00) to 8/11/2017 (12:00)	23	32	23
8/11/2017 (13:00) to 6/12/2017 (11:00)	31	33	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	31.00	27
	24.25	26.50	23.67
			1.024647887

DT115			
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		

6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 2/8/2017 (14:00)	19		
2/8/2017 (15:00) to 5/9/2017 (11:00)	19		19
5/9/2017 (12:00) to 4/10/2017 (13:00)	22	27	22
4/10/2017(13:00) to 8/11/2017 (13:00)	23	37	23
8/11/2017 (13:00) to 6/12/2017 (12:00)	31	11	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	45.00	27
	24.25	30.00	24.40
			0.993852459

DT116			
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 2/8/2017 (14:00)	19		
2/8/2017 (15:00) to 5/9/2017 (11:00)	19	24	19
5/9/2017 (12:00) to 4/10/2017 (13:00)	22	37	22
4/10/2017(13:00) to 8/11/2017 (13:00)	23	38	23
8/11/2017 (13:00) to 6/12/2017 (12:00)	31	39	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	44.00	27
	24.25	36.40	24.40
			0.993852459

DT117			
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 2/8/2017 (14:00)	19		
2/8/2017 (15:00) to 5/9/2017 (11:00)	19	31	19
5/9/2017 (12:00) to 4/10/2017 (13:00)	22	28	22
4/10/2017(13:00) to 8/11/2017 (13:00)	23		
8/11/2017 (13:00) to 6/12/2017 (12:00)	31		
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	48.00	27
	24.25	35.67	22.67
			1.069852941

DT118			
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		

13/7/17 (16.00) to 2/8/2017 (14:00)	19		
2/8/2017 (15:00) to 5/9/2017 (11:00)	19	24	19
5/9/2017 (12:00) to 4/10/2017 (13:00)	22	21	22
4/10/2017(13:00) to 8/11/2017 (13:00)	23	47	23
8/11/2017 (13:00) to 6/12/2017 (12:00)	31	53	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	52.00	27
	24.25	39.40	24.40
			0.993852459

DT119			
4/1/2017 (11:00) to 7/2/2017 (11:00)	34		
7/2/2017(12:00) to 8/3/2017 (11:00)	27		
8/3/2017(14:00) to 3/4/2017(14.00)	26		
3/4/2017(14.00) to 2/5/2017 (13.00)	23		
02/05/2017(14:00) to 6/6/2017 (14:00)	21		
6/6/2017 (15.00) to 13/7/2017(11.00)	19		
13/7/17 (16.00) to 2/8/2017 (14:00)	19		
2/8/2017 (15:00) to 5/9/2017 (11:00)	19	33	19
5/9/2017 (12:00) to 4/10/2017 (13:00)	22	17	22
4/10/2017(13:00) to 8/11/2017 (13:00)	23	53	23
8/11/2017 (13:00) to 6/12/2017 (12:00)	31	70	31
6/12/2017 (12:00) to 29/12/2017 (01:00)	27	48.00	27
	24.25	44.20	24.40
			0.993852459

Appendix D: Map(s) of Monitoring Locations and AQMAs

The maps below show the location of all the Bradford diffusion tube monitoring sites.

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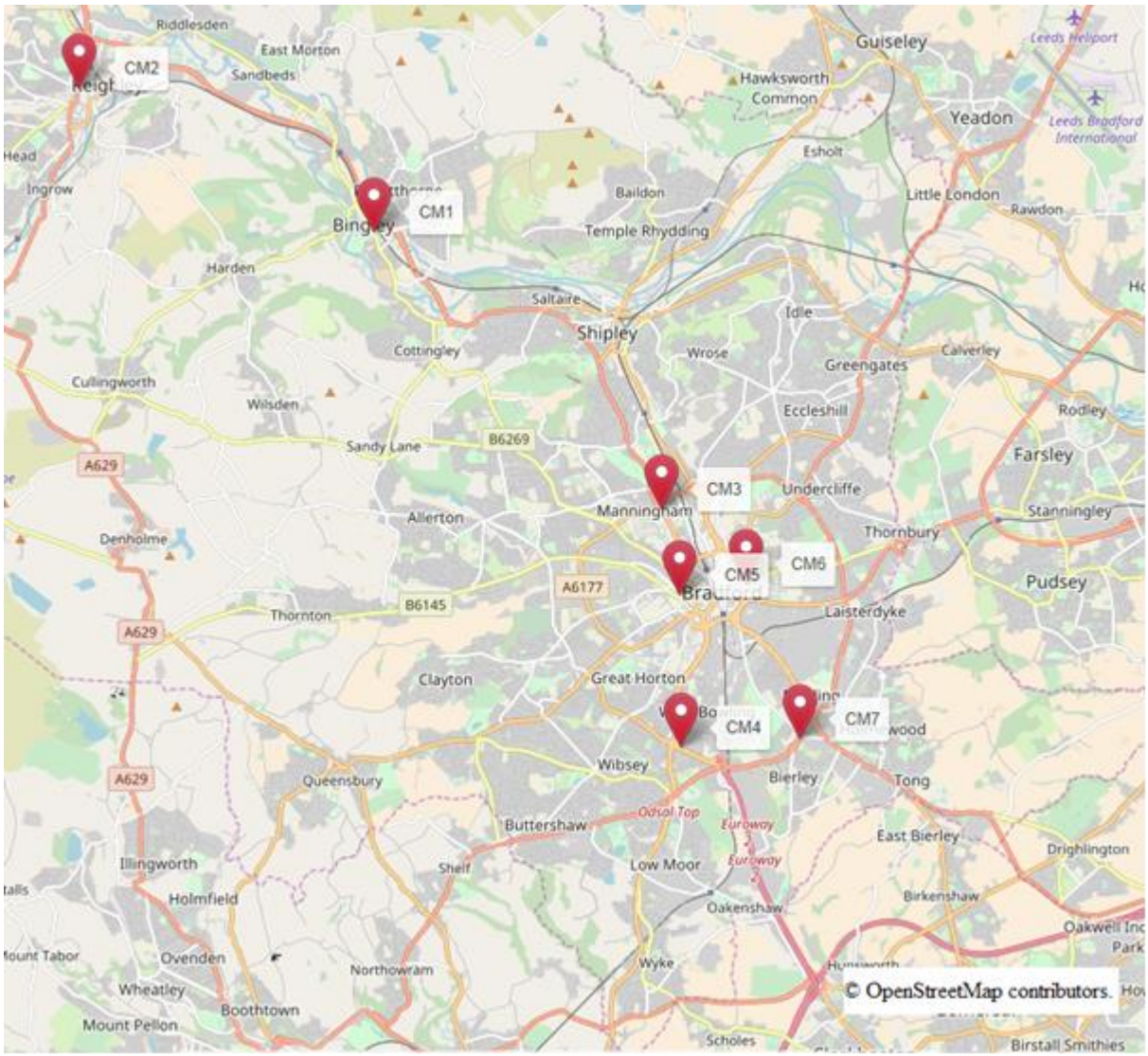
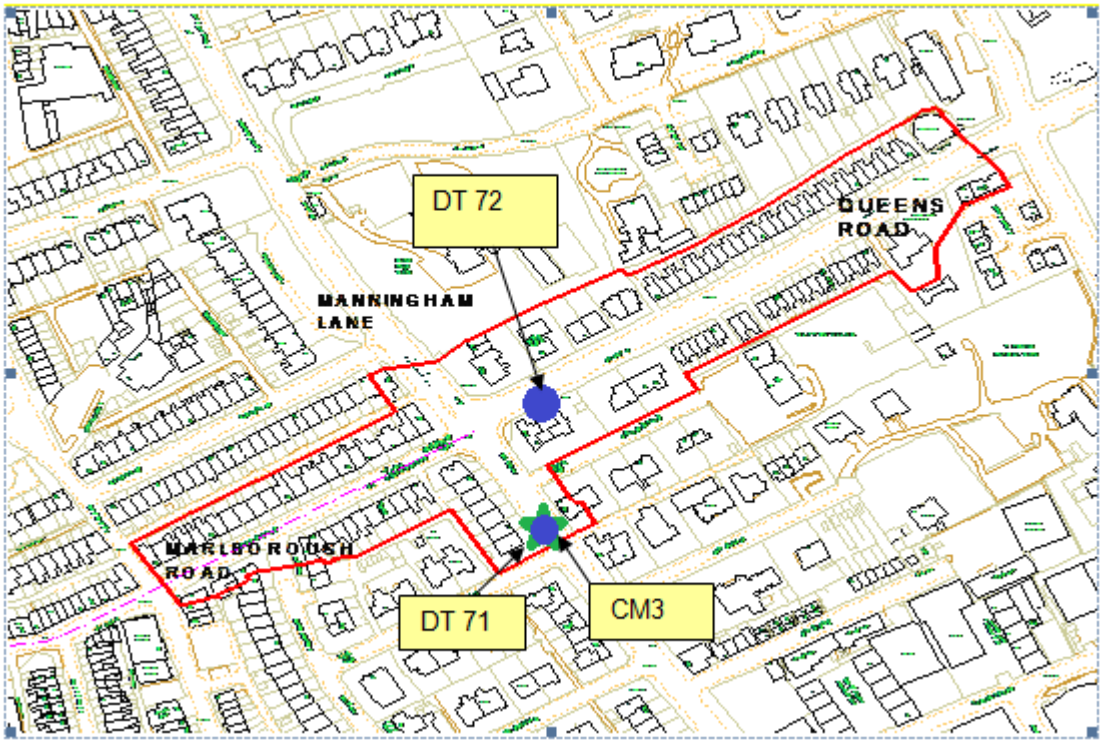
Map 1: Bradford real time monitoring sites (overview)



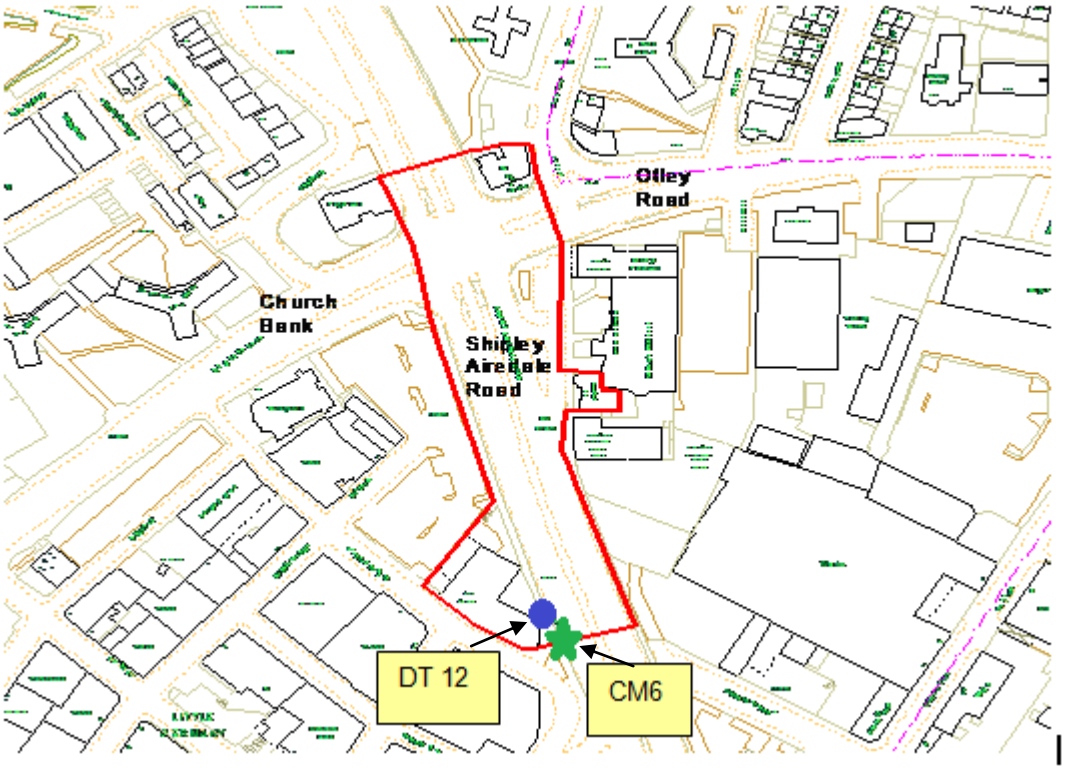
Key for maps 2 to 4

	Diffusion tube
	Real time site
	AQMA boundary
	Monitoring site reference

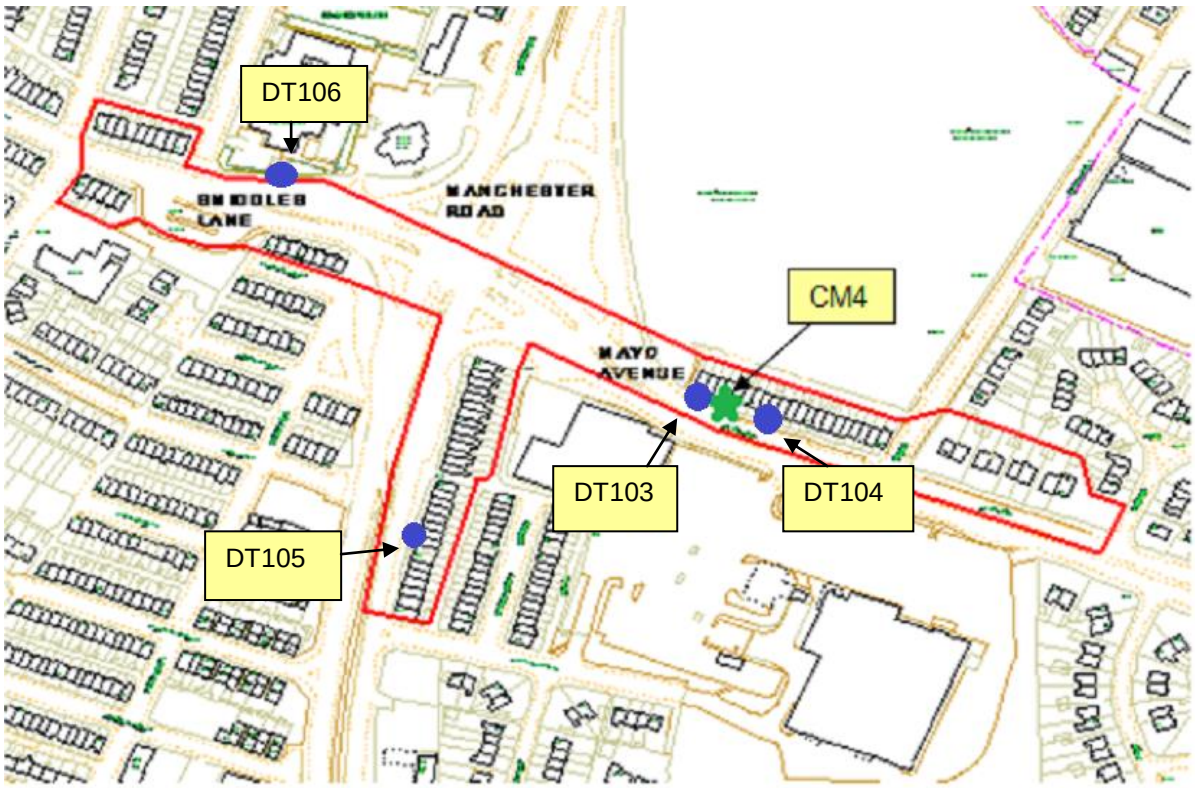
Map 2: Monitoring in Manningham Lane AQMA



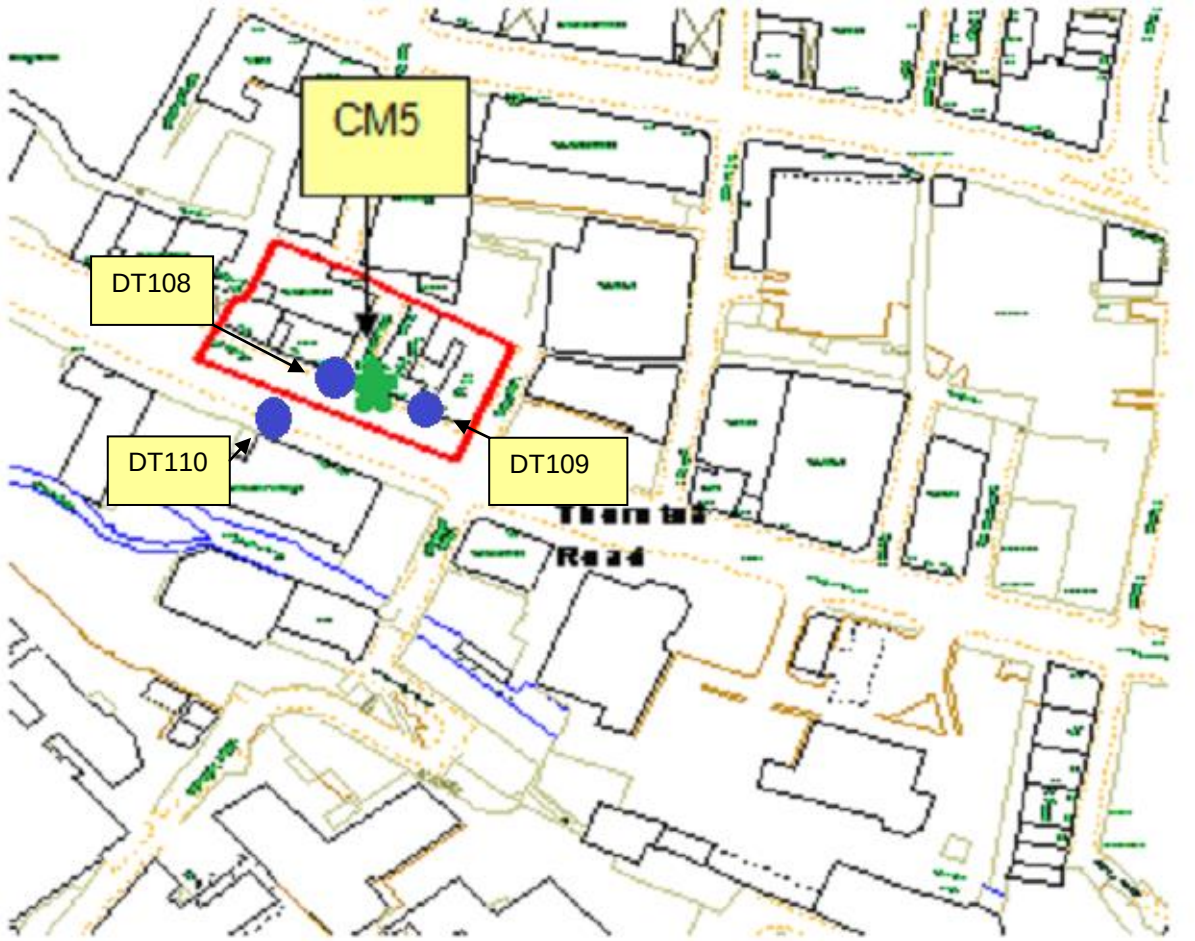
Map 3: Monitoring in Shipley Airedale Road AQMA



Map 4: Monitoring in Mayo Avenue

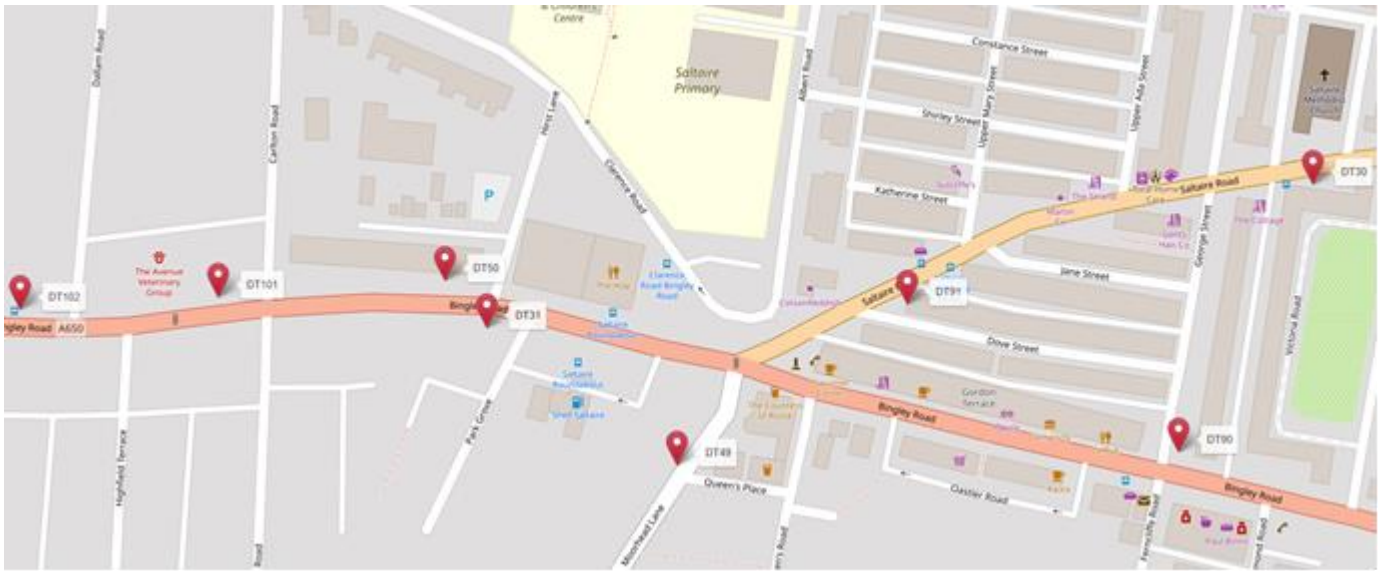


Map 5: Monitoring in Thornton Road AQMA

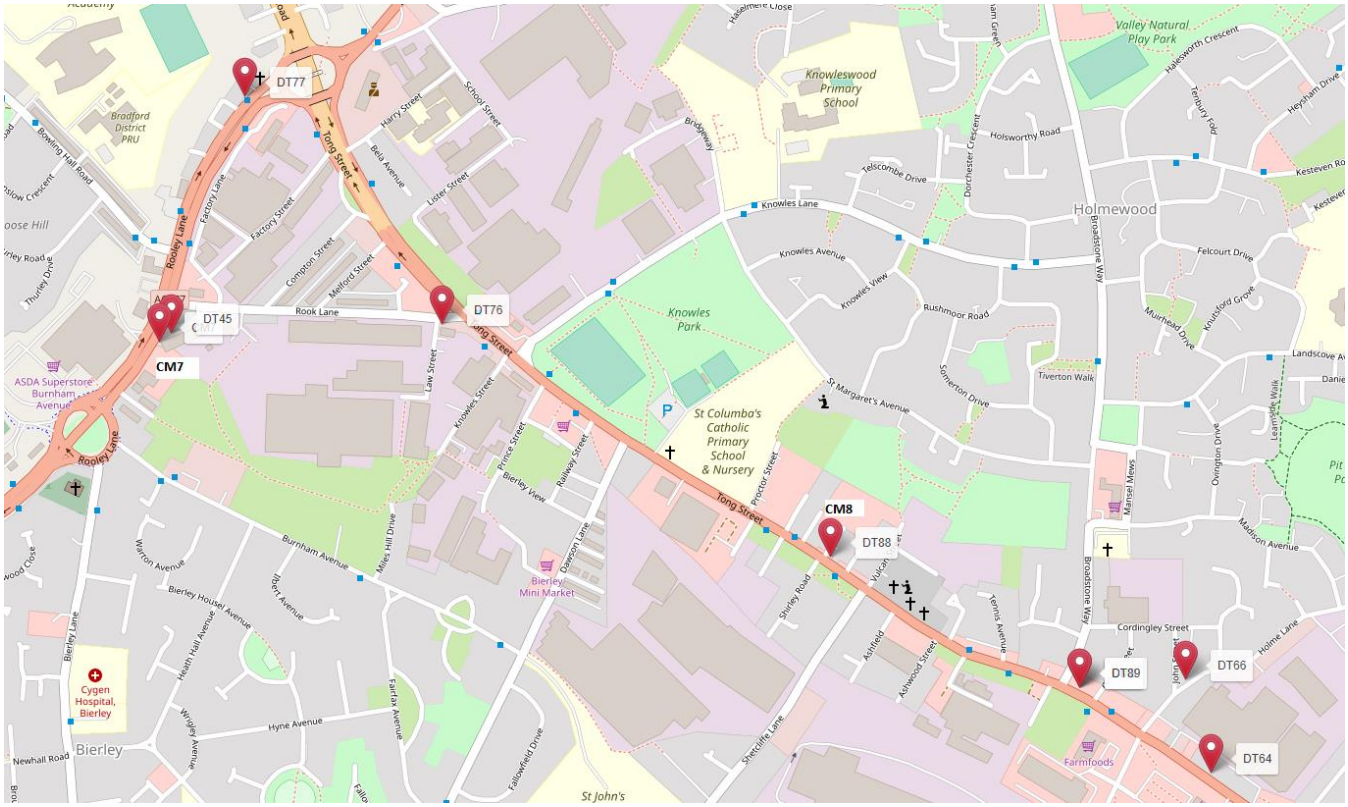


Map 6: Keighley monitoring sites

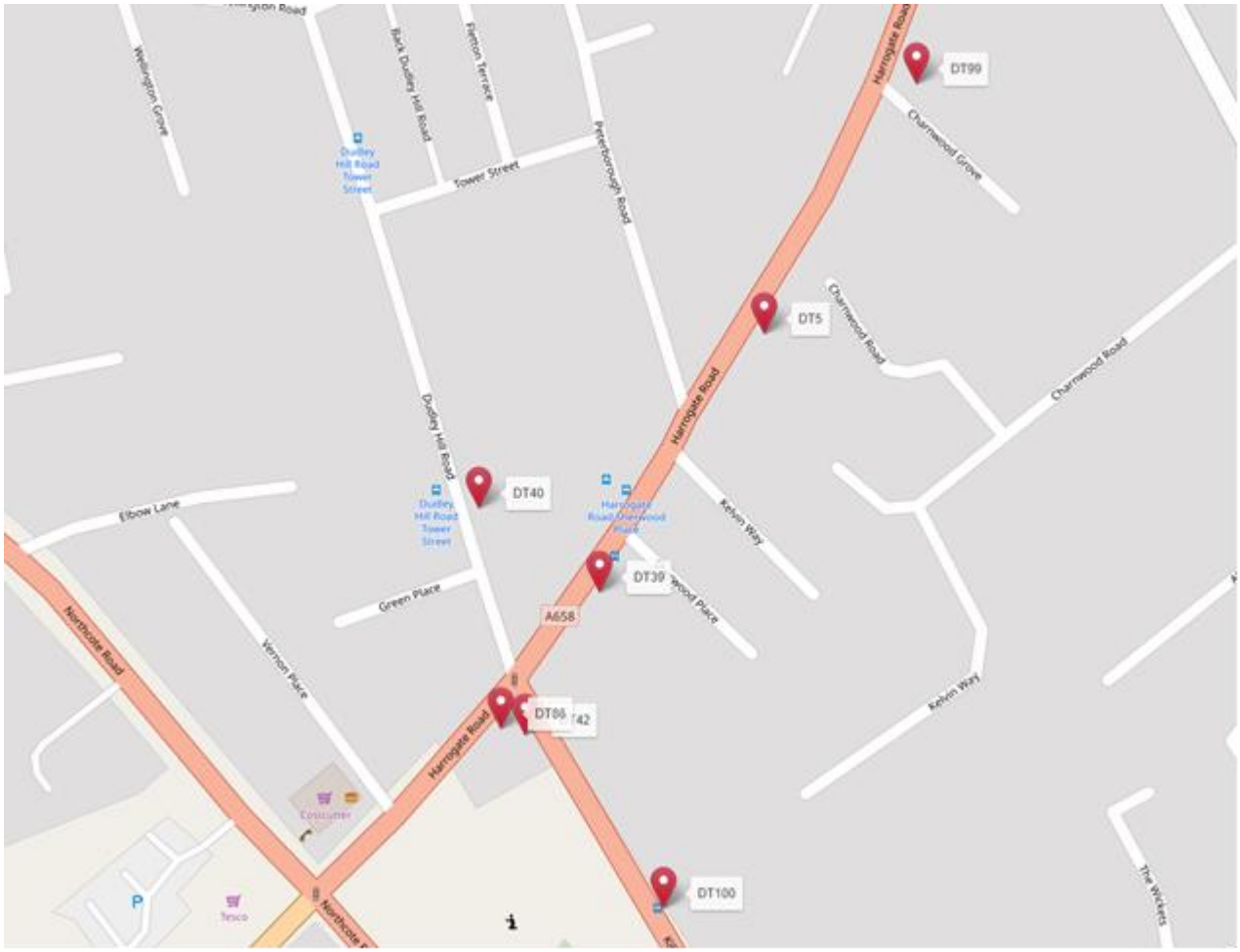
Map 7: Bingley Road / Saltaire Road junction



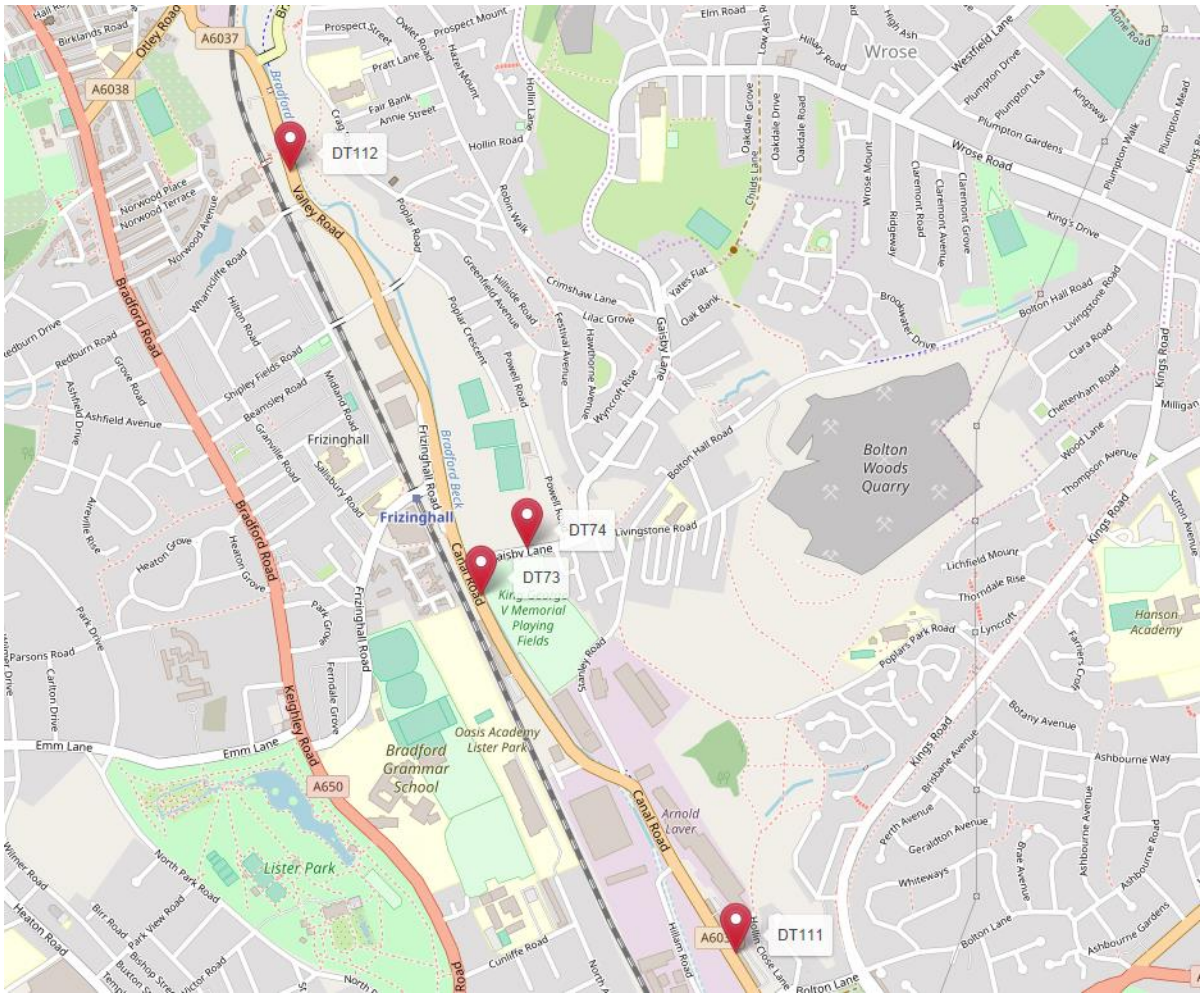
Map 8: Tong Street / Rooley Avenue



Map 9: Harrogate Road / Killinghall Road

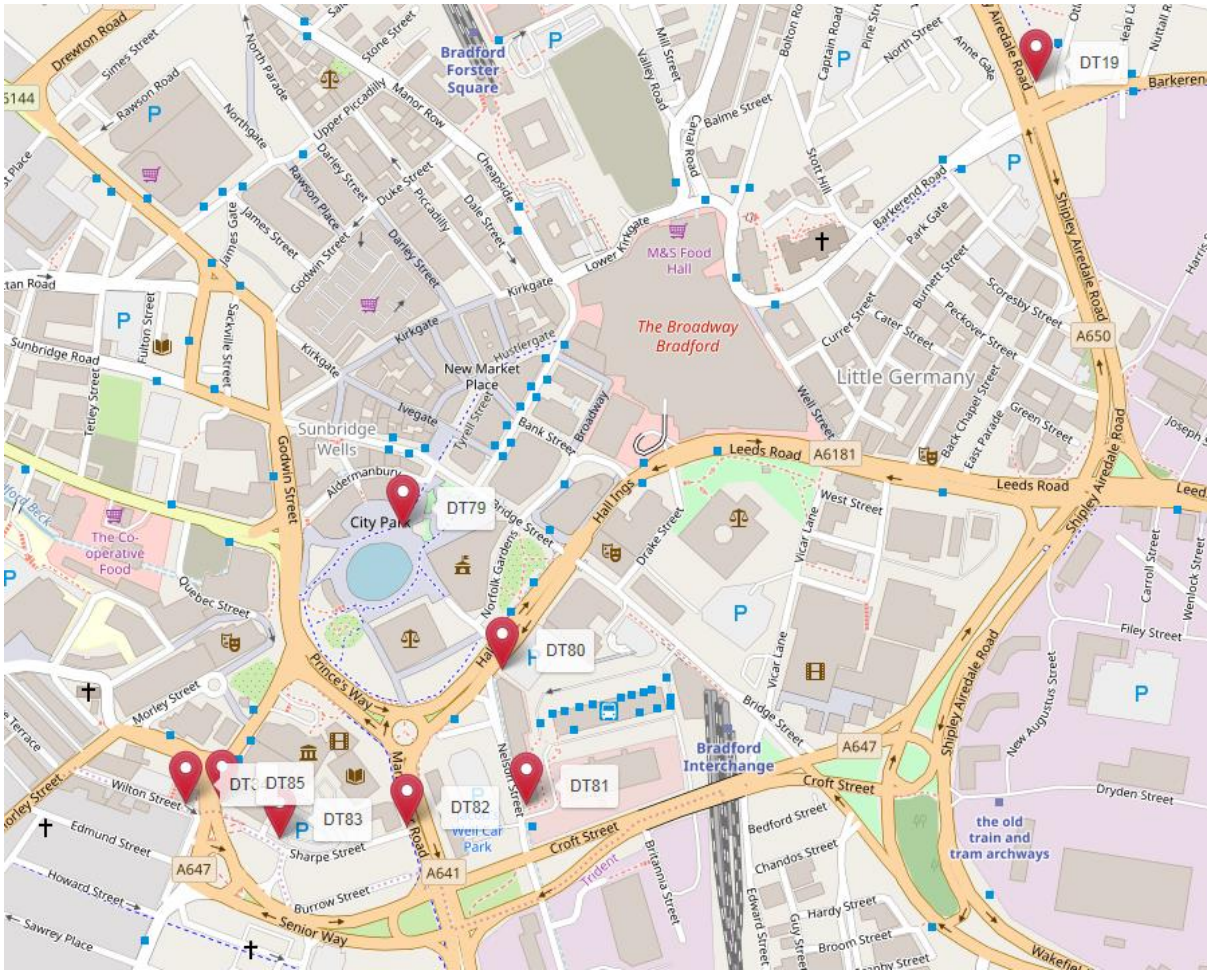


Map 10: Canal Road

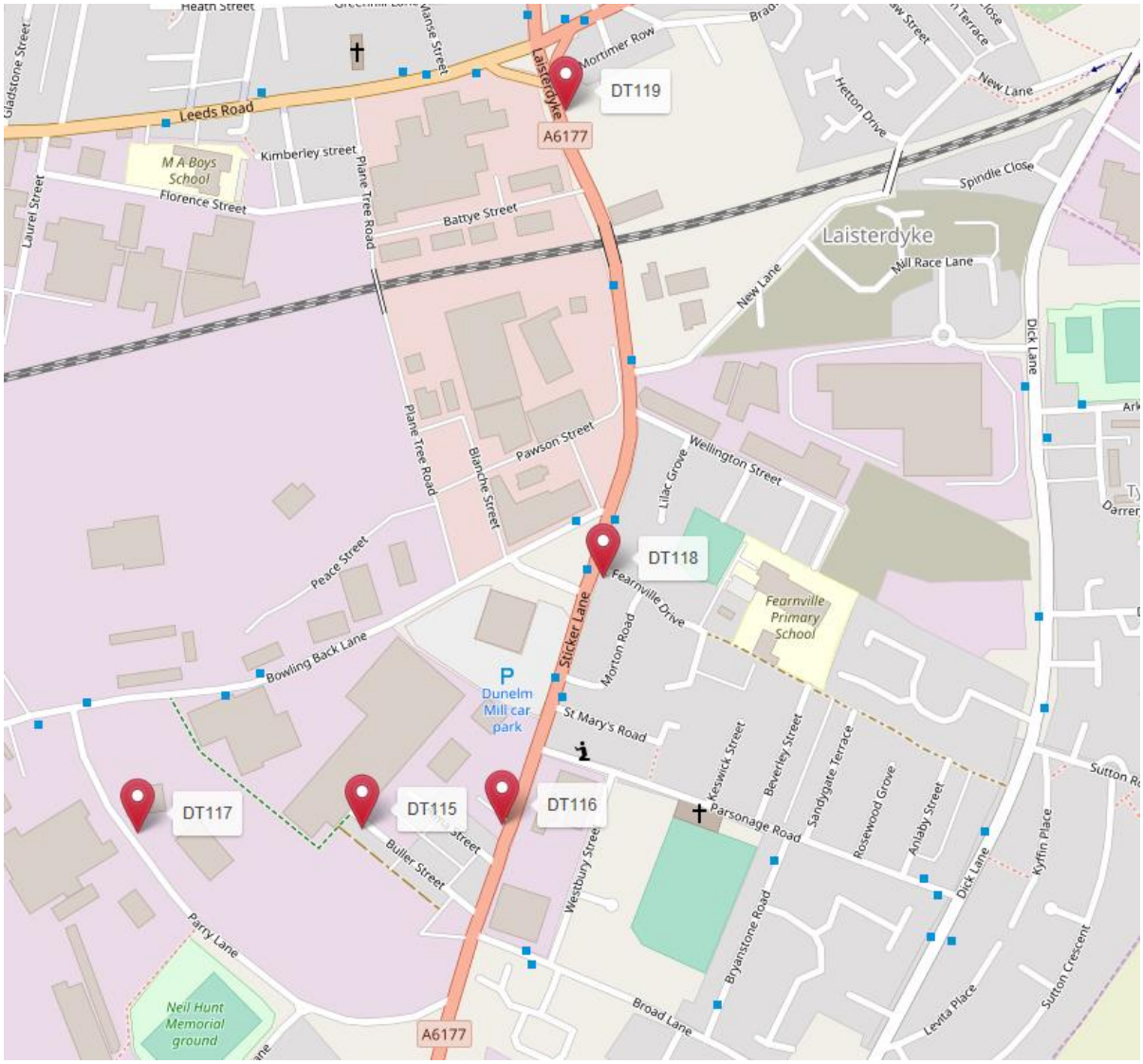


Map 11: Greengates

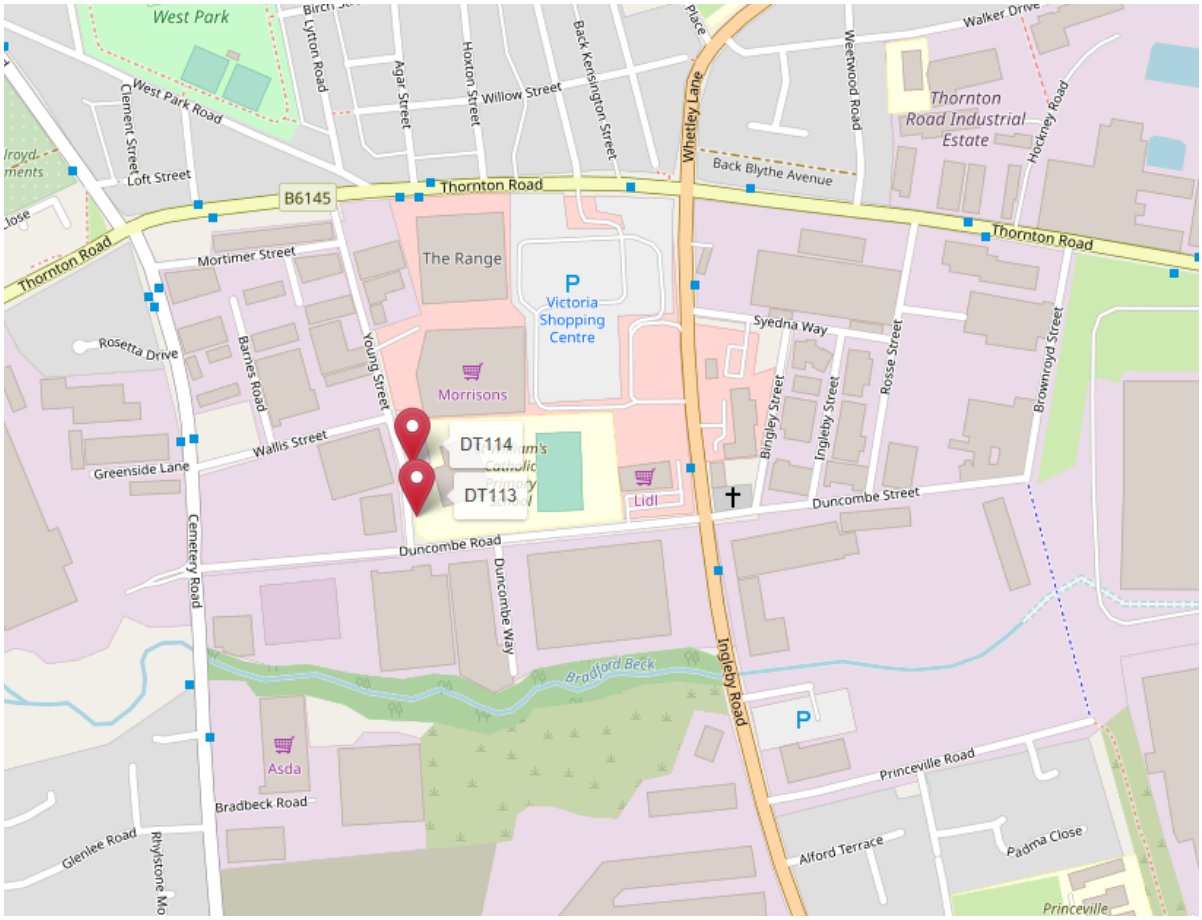
Map 12: City Centre Tubes



Map 13: Parry Lane STOR baseline monitoring



Map 14: Duncombe Road STOR baseline monitoring



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[8]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[8] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority 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
ASR	Air quality Annual Status Report
BiB	Born in Bradford - a Public Health research programme based in Bradford
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
MDC	Metropolitan District Council
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
…	…

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