Crawley Borough Council

2020 Air Quality Annual Status Report (ASR)

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

Local Authority Officer	Gill Narramore
Department	Environmental Health (Community Services)
Address	Crawley Borough Council, Town Hall, The Boulevard, Crawley, West Sussex, RH10 1UZ
Telephone	01293 438 000
E-mail	environmentalservices@crawley.gov.uk
Report Reference number	2020 ASR

Executive Summary: Air Quality in Our Area

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].

Air Quality in Crawley

As part of the Local Air Quality Management process (LAQM) required by the Environment Act 1995, the Council carries out an annual review and assessment of air quality in the borough, which helps identify local air quality hot spots, and relate these to pollution sources. Road traffic is the main source of (nitrogen dioxide) pollution in Crawley, and our network of monitoring sites records concentrations along busy roads as well as at background locations and areas of specific interest (such as residential locations close to the airport), in order to give a broad picture of pollution levels across the borough. If the council finds areas of relevant exposure, where air quality objectives are not being met, it is required to declare an Air Quality Management Area (AQMA) and produce an action plan (AQAP) showing what steps it will take to improve air quality in that area.

Air Quality in Crawley is mainly good, with national targets being met for all pollutants, with the exception of nitrogen dioxide (NO_2) at a small number of locations alongside busy roads and within the AQMA, where the Council is targeting actions to improve air quality. A new site adjacent to the A23 London road also saw a borderline result with concentrations at, but not exceeding the 40 ug/m^3 objective. This latest exceedance was based on incomplete yearly data and will be reviewed when a full year's data is available at next year's ASR to assess if a further amendment to the AQMA boundary is needed.

[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

The latest monitoring data showed NO_2 levels remained more or less constant across Crawley in 2019. There was slight variation, with levels at airport and roadside sites marginally lower than 2018 levels (except in the AQMA), and background sites marginally higher than 2018 levels. This slight year on year fluctuation pattern was also seen regionally, and is likely to be attributable to climatic influences rather than local conditions. It is therefore more informative to look at the long term trends.

The long term monitoring data for Crawley shows that concentrations of nitrogen dioxide have generally fallen throughout the borough since the mid-2000s, despite significant housing and commercial development over the same period. The only exception to this is within the AQMA where the long term trend continues to be upwards. The long term downward trend is driven mainly by cleaner engine technologies. However short-term (5yr) trend data, indicates that levels have remained broadly consistent at roadside, background and airport sites in more recent years as the rate of improvement slows. Increased development and traffic volumes may be a contributing factor in offsetting some of the improvements previously seen, however, it's too early to say if this plateauing is significant, or whether it is a result of the particularly low concentrations seen in 2015 skewing trends. The review and assessment process will continue to monitor year on year variation and report on them annually.

The monitoring results show that the council's monitoring network is essential in identifying local hotspots and that work must continue to manage local air quality through a range of measures in our action plan, including awareness raising and policy measures, as well as working with partners such as West Sussex County Council and the Local Enterprise Partnership (LEP) on traffic management and sustainable infrastructure projects.

Actions to Improve Air Quality

The Council has taken forward a number of measures during the reporting year designed to improve local air quality, including:

- The Crawley Growth Programme continued to deliver sustainable transport infrastructure upgrades across the borough. At Three Bridges station there were improvements to public transport facilities and highway junction traffic light

upgrades to ease congestion, and at Queens Square pedestrian and cycle schemes were completed to improve access to the town centre.

- West Sussex County Council published their new Parking Standards in partnership with the Council, which included for the first time a target for the provision of active and passive electric vehicle charging points.
- The Defra–funded "Clean Burn Sussex" air quality project was launched, in partnership with Sussex-air. The project, aimed at raising awareness of the health and environmental impacts of solid fuel burning, resulted in new webpages on the Sussex-air website to promote cleaner, less polluting and more efficient fuels and appliances and a clean burn survey to gather information on wood burning. We also updated our own webpages to provide links to these information sources to help reduce emissions of particulates (PM_{10} and $PM_{2.5}$).
- The draft local Plan 2020-2035 was published strengthening environmental policy and guidance through the development control process. Major development in and around Crawley will have a cumulative impact on air quality and therefore it is important that new development meets the requirements of planning policies and guidance in relation to air quality.
- Crawley's draft Transport and Access Strategy (New Directions for Crawley) and draft Local Cycling & Walking Infrastructure Plan (LCWIP) were completed. Both these strategies will inform the emerging new Local Plan to guide design and access elements of new developments, ensuring they addressing transport issues and options for shifting from a car-centred to people-centred approach to mobility and access.
- The Council declared a climate emergency with a pledge to reduce carbon emissions from the Council's activities by 45% by 2030 and to zero by 2050.
- The Council undertook a range of awareness raising and educational events to promote understanding of air quality issues and encourage modal shift, including: Junior Citizen Event, promoting our "airAlert" pollution warning service, Clean Air Day Event and Breath Easy Week.

Conclusions and Priorities

In 2019 there were no exceedances of the objectives for PM_{10} pollution, or the hourly objective for nitrogen dioxide. The annual mean objective for NO_2 was met at all sites except within the AQMA where exceedances were measured at sites close to busy roads at the A2011, and the A2220 commuter corridor into Three Bridges station.

The long term trend data shows that air quality has been improving in Crawley over the past 15 years, and pollution levels are still significantly lower than they were a decade ago. The short term (5 yr) trend shows a plateauing in the rate of improvement. However, it is too early to draw any significance from this as the influence of year on year climatic variations may skew trends. The council will therefore continue to review monitoring data annually and any emerging trends will be closely monitored.

Air quality in 2020 will have been greatly affected by the Covid-19 lockdown. It is not yet possible to draw conclusions about the full scale of this impact, however it is likely to show significant reduction in annual pollution levels when compared to 2019. This will be reported on in the next Annual Status Report in 2021.

The council's specific priorities for the coming year include:

- Formally declare the extension to the existing AQMA boundary to incorporate the new area around Three Bridges railway station.
- update air quality modelling and source apportionment for the AQMA to help inform the revision of the current Air Quality Action Plan
- Update the AQAP to reflect the extension of the AQMA boundary and any specific measures relating to the new area.
- Continue to progress the actions in the AQAP, particularly infrastructure upgrades to support sustainable transport that are part of the Crawley Growth Plan, and to assist West Sussex County Council in the development of highway improvement's schemes for the Hazelwick corridor, and walking and cycling schemes across the Town Centre and joining Manor Royal to Three Bridges.
- Work with the Sustainability Team on the emerging Climate Emergency Action Plan. This may include some joint modelling and source apportionment work as well as working on actions that benefit both carbon reduction and air quality.
- Progress the Defra air quality grant bid for 2020 - School Street Closure project

- Awareness raising for schools and businesses, including the annual Clean Air Day, Breath Easy, Junior Citizen, and airAlert service.
- Identifying pollution hotspots and adjusting the monitoring network to respond to local developments and concerns within the borough.

The principal challenges in addressing air quality for the coming year are:

- Balancing the demand for development with the need to improve air quality
- The Covid-19 recovery plans may have an impact on travel habits, vehicle emissions and community engagement.
- Covid-19 has impacted Council revenue streams, which in turn may affect funding to support action plan measures
- Political, public and business attitudes to measures for air quality improvement may be inaccurately perceived as harming or delaying Covid economic recovery. Barriers to some measures to address air quality such as modal shift may therefore become more challenging in the coming year.

Local Engagement and How to get Involved

Crawley is one of the smallest local authorities in Sussex covering an area of 45 km^2. Despite its relative small size, it has the second highest job density in the country outside London and attracts more than 43,000 commuters every day, 80% of which commute by car. In addition to the incoming commuter traffic, many local car journeys are less than 2km, and 58% of car trips are under 5km. These high volumes of traffic on our local roads cause congestion and contribute to worsening air quality. However, since many car journeys are short, there is opportunity to help improve local air quality by switching to sustainable transport options such as walking, cycling, public transport or car sharing.

Many of our action plan measures include schemes that are aimed at infrastructure improvements that will encourage modal shift, and awareness raising work that supports behavioural change. These measure require local engagement to bring about effective change. In developing our air quality action plan it is therefore important that we work closely with interested parties, including community groups, elected members, transport planners, planning policy and development control.

The council is undertaking a range of major infrastructure schemes to reduce congestion and improve sustainable transport options across the borough. Local engagement is integral to this process, firstly in understanding the needs of the community and secondly for informing the public and stakeholders of proposed improvements. Public engagement for these schemes includes presentations at local venues and at accessible times during the day and at weekends to provide maximum opportunity for comments from stakeholders and members of the public. In addition, detailed and focused stakeholder and user group meetings are held. The events are promoted extensively, directly to stakeholders and publicly through posters, flyers and press releases. In addition, West Sussex County Council offers online feedback opportunity on its website.

In our promotional work, we engage with all Crawley's primary schools during our annual Junior Citizen event, we provide information to the public via our Sussex-air website with air quality data, news updates, educational resources, links and other services such as air Alert. We also run public awareness campaigns for annual events such as Clean Air day and Breath Easy week, via the West Sussex news journal "Connections", digital advertising boards and on local radio Spirit FM.

In addition to the initiatives the council is talking to tackle air quality, there are lots of ways we can get involved and take action on a personal level to improve air quality in Crawley:

Walk or cycle: Replacing a car journey by walking or cycling helps reduce traffic and traffic emissions. It has proven health and mental health benefits too.

Take public transport or car-share: For longer journeys consider car share or taking public transport, such as bus, coach or train.

Ultra-Low Emission Vehicle (ULEV): Consider buying an electric/hybrid car

If a car journey is necessary: try to drive in an eco-friendly style

- Drive smoothly and try not to accelerate or brake hard.
- Maintain your car to reduce harmful emissions
- Check tyre pressure is correct to minimise fuel use and emissions.
- Limited use of the air conditioning reduces fuel consumption and emissions
- When your car is stationary turn off your engine. Idling vehicles release lots of exhaust emissions.

Go for local produce: Long distance transport creates more air pollution.

Local authority engagement with decision makers and the public

The council publishes information on its website (www.crawley.gov.uk) and local magazine as well as holding public consultation and focus groups to keep people informed on the measures it is taking to improve local air quality and support public health initiatives. More information on local air quality in Crawley can be found at:

Air Quality Monitoring in Crawley

Sustainable Transport in Crawley

The Crawley Growth Programme

airAlert

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in Crawley Borough Council during 2019. 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 Crawley Borough Council 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 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 AQMAs declared by Crawley 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://crawley.gov.uk/environment/environmental-health/air-pollution/air-quality

https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=xxx

See full list at: https://uk-air.defra.gov.uk/aqma/list

Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

The council is currently consulting on an amendment to the Hazelwick AQMA. A new area of exceedance was identified through the review and assessment process close to Three Bridges station. This area is very close to the boundary of the existing Hazelwick AQMA. The consultation options are therefore to either extend the boundary of the existing AQMA to include the newly identified area of exceedance, or to declare a new AQMA for this area. More detailed is provided in Appendix C.

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
Hazelwick AQMA	09.07.15	NO_2 Annual Mean	Crawley	Area surrounding the Hazelwick Roundabout, including land and properties bordering the roads corridors onto Hazelwick roundabout.	No	41	µg/m^3	44	µg/m^3	Crawley Air Quality Action Plan	2018	AQAP

☒ **Crawley Borough Council confirm the information on UK-Air regarding their AQMA is up to date**

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

Defra's appraisal of last year's ASR:

The report is well structured, detailed, and provides the information specified in the Guidance, following the latest template. The following comments are made:

1. It is encouraging to see that the Council have reviewed their monitoring programme and have introduced new monitoring locations. The Council should continue to review the monitoring programme on a regular basis, to ensure that monitoring takes place at any sites of potential exceedance with relevant exposure.

***Response**: Following the review and assessment last year, four new monitoring sites were added to the network at locations of relevant public exposure adjacent to traffic light junctions on busy roads. These locations were identified as at risk of potential exceedances due to emissions from idling traffic.*

2. The Council have stated that they plan to produce an AQAP in collaboration with West Sussex County Council. However with the extension of the AQMA boundary, the Council must ensure that the new AQAP reflects this change in boundary.

***Response**: The West Sussex County Council Air Quality Action Plan is a partnership approach to improving air quality in West Sussex with input from all the joint authorities. It provides information about air quality across the County, and outlines some of the work taking place to reduce levels of pollution in the districts and boroughs. Although the plan will be regularly reviewed and updated, it does not provide the detail that is included in the local authority's own action plan. The council will ensure that Crawley's AQAP is updated to reflect the extension of the AQMA boundary.*

3. It would be useful if Section 2.3 could make reference to the Public Health Outcomes Framework, and the local indicator for PM2.5 in the district. The Council may wish to consider comparing the '3.01 - Fraction

of mortality attributable to particulate air pollution indicator' value for Crawley to nearby LAs and National indicator values. This can be found in the link below. https://fingertips.phe.org.uk/profile/public-health-outcomesframework/data#page/0/gid/1000043/pat/6/par/E12000005/ati/101/-are/E07000194.

Response: *In the current report, reference to the Public Health Outcomes Framework, and the local indicator for $PM_{2.5}$ have been included, as well as the fraction of mortality attributable to particulate air pollution in Crawley.*

Overall the report is very good, highly detailed and provides the required information. The Council provide an in-depth discussion regarding the status of their AQMA, future plans for their AQMA as well as an in-depth discussion of pollutant trends throughout the borough. This is a sign of good practice and demonstrates that the Council are serious about understanding and managing air quality within their borough. This is encouraging to see and should be continued in future reports.
On the basis of the evidence provided by the local authority the conclusions reached are acceptable for all sources and pollutants. The next step for Crawley Borough Council is to submit their next Annual Status Report in 2020.

Progress summary of Crawley Borough Council's Action plan Measures

Crawley Borough Council has taken forward a number of direct measures during the current reporting year in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the Action Plan.

Key completed measures are:

- Crawley Growth Programme - Three Bridges Station Improvement Scheme completed detailed design stage for new station forecourt, new relocated bus shelters which connect better with the station and greatly improved cycle and pedestrian route connections, a new taxi rank, waiting area and car drop off, highway junction traffic light upgrades and a band new 'eastern 'access to the station comprising a vehicle drop off point and pedestrian access to platform 5.

Key outcomes from measure: Encourage modal shift

- Crawley Growth Programme – Queensway Public Realm Regeneration Scheme**.** This project included the installation of new cycle racks in an effort to encourage people to travel to the town centre by bike. It also improved pedestrian and cycle access to and from the College and Memorial Gardens to the main town centre, by transforming the public realm and reducing dominance of car users.

Key outcomes from measure: Encourage modal shift

- Crawley Growth Programme – Station Gateway Scheme*.* The public realm/highway improvement scheme was agreed by Cabinet 2019. Planning applications for the reserved matters, Overline House and the railway bridge due to be submitted 2020.

Key outcomes from measure: Encourage modal shift, reduce vehicle emissions, reduced energy emissions from housing units.

- WSCC Parking Standards Guidance was approved by Cabinet in 2019. The guidance, which was developed in partnership with district and borough councils, sets out parking standards, including targets for the provision cycle storage as well as electric vehicle charging points in parking spaces, with future percentage increases in allocation for EV's and active transport.
  https://www.westsussex.gov.uk/media/1847/guidance_parking_res_dev.pdf

Key outcomes from measure: Encourage modal shift and reduce vehicle emissions

- WSCC Electric Vehicle Strategy for West Sussex 2019-2030 published December 2019. The strategy aims to encourage and support the adoption of electric vehicles within the county. The objectives are to ensure sufficient charging infrastructure in place to support the vehicles to charge, and to ensure renewable energy sources are used for all charging points on County Council land. Crawley is identified in the strategy as one of the priority areas for EV charging point installation.
  https://www.westsussex.gov.uk/media/13766/electric_vehicle_strategy.pdf

Key outcomes from measure: Encourage uptake of EVs and reduce vehicle emissions

- Crawley Local Cycling & Walking Infrastructure Plan (LCWIP) – LCWIPs are a Department for Transport (DfT) initiative. Crawley Borough Council has worked

with WSCC on its county LCWIP programme to create Crawley's own plan. The LCWIP is a practical plan for a high quality network of safe, convenient and attractive cycling and walking routes though Crawley. The design and early consultation were completed Dec 2019/Jan 2020. Draft and final consultation summer 2020 with aim to publication December 2020.

Key outcomes from measure: Encourage modal shift and reduce emissions

- Delivery of cycling infrastructure along Ifield Avenue was completed in 2019 – this was a result of continuing development and implementation of plans for key routes identified within the West Sussex Walking and Cycling Strategy.

Key outcomes from measure: Encourage modal shift and reduce emissions

- An options appraisal in relation to improving the existing cycle path on Southgate Avenue was commissioned in 2019 as part of the implementation of key routes identified within the West Sussex Walking and Cycling Strategy.

Key outcomes from measure: Encourage modal shift and reduce emissions

- New Directions for Crawley - Draft Transport and Access Strategy – the council's draft transport strategy initiation document addressing issues and options for shifting from a car-centred to a people-centred approach to mobility and access was completed in 2019 for consultation with the final plan aimed for publication in 2020. The action plan emerging from the New Directions for Crawley strategy will be on a 10-year time frame (to 2030) and together with Crawley's LCWIP, will inform the emerging new Local Plan to guide design and access elements of new developments as they arise.

Key outcomes from measure: Encourage modal shift and reduce emissions

- Draft local Plan 2020-2035 – Completed Early Engagement September 2019. Draft new Local Plan final public consultation January - March 2020. Independent examination by Government and adoption due December 2020. The Local Plan provides detailed environmental policy and guidance through the development control process.

Key outcomes from measure: environmental policies and guidance to help improve air quality.

- Defra–funded air quality project - in partnership with Sussex-air delivered Defra funded Clean Burn Sussex project aimed at raising awareness of the health and environmental impacts of solid fuel burning, and the promotion of cleaner, less

polluting and more efficient fuels and appliances to reduce emissions of particulates (PM_{10} and $PM_{2.5}$).

The project included production of new webpages on the Sussex-air website to raise awareness https://sussex-air.net/Cleanburn/clean-burning.aspx, and a clean burn survey to gather information on wood burning, including the type of appliances used, the types of fuel used and whether these were used as primary sources of heating or for recreational use. We also updated our own webpages to provide links to these information sources.

Key outcomes from measure: Reduce emissions of PM10 and PM2.5

- Junior Citizen 2019 - educational programme on environmental issues, safety and citizenship for all Year 6 (KS2) pupils in Crawley. “Air quality in our local area” was delivered through eco-action games and small discussion groups.

Key outcomes from measure: Helping school children understand air quality and encourage modal shift

- Promoting airAlert service - Pollution warning service for people with asthma, COPD, or cardiovascular problems. A voice call, text, or email is sent day before period of high pollution to advise on action to manage health.

Key outcomes from measure: Awareness raising

- Public Awareness Campaigns 2019 - Clean Air Day Event and Breath Easy Week – including the following: promoting sustainable modes of travel to CBC staff, WSCC public awareness campaign through editorials and advertisements in WSCC Connections; anti-idling message on the digital advertising board at Manor Royal; messages broadcast across Sussex on Spirit FM during Breathe Easy Week; targeted education at Crawley schools.

Key outcomes from measure: Awareness raising and encouraging modal shift

1.1 Declaration of climate emergency - a climate emergency was declared at full Council meeting in July 2019 with a pledge to reduce carbon emissions from the Council’s activities by 45% by 2030 and to zero by 2050 as recommended by the Inter-Governmental Panel on Climate Change (IPCC).

Key outcomes from measure: Reduce emissions

Crawley Borough Council expects the following measures to be completed over the course of the next reporting year:

- Crawley Growth Programme - Eastern Gateway Public Realm and Sustainable Transport Improvements Scheme. Highways improvement to improve connectivity in and round the town centre, whilst delivering enhanced pedestrian and cycle access. The scheme is currently at the detailed design. Construction is expected to commence Spring 2021, for completion in 2022.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- Crawley Growth Programme – Station Gateway Scheme. Planning applications for highway improvement scheme due 2020/21.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- Crawley Growth Programme – Three Bridges Station EV Charge Points. Network Rail and GTR identified the need for more electric vehicle points and parking bays at the station (20 in total), in response to a recent increase in demand. A full scheme review is currently being undertaken and we expect to submit a planning application in 2021 and anticipate construction commencing late 2021/22.

Expected impact of measure: encourage modal shift and zero emissions transport

- Crawley Growth Programme – Manor Royal Highways Scheme. In January 2020 the Crawley Growth Programme was awarded an additional £820K funding to improve transport connectivity by extending the proposed bus lane around Manor Royal Business District, reducing bus journey times and improving connectivity. The scheme is currently at the detailed design. Construction is expected to commence Spring 2021, for completion in 2022.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- Crawley Growth Programme – Town Centre Cycling & Walking Schemes connecting Eastern Gateway and Station Gateway with an existing cycle route along the High Street, to create a single, attractive, safe and connected cycle route that runs around the town centre. Currently at preliminary design stage. Construction due to start in 2021/22.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- The Council is currently conducted a staff travel survey which will inform the development for travel policy measures to be designed and included in the emerging Climate Emergency Action Plan in 2021.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- Emission Standards for Licensed Taxis - Changes to the Council's policy on emission standards for licensed hackney carriages and private hire vehicles was agreed at licensing committee in January 2020. The new policy will require all new applications for taxi licences from April 2022 to be vehicles that are zero emission capable (ZEC) and meet (as a minimum) the Euro 6 standards for emissions. And for existing licensed vehicles to be retrofitted to meet Euro 6 standard within by October 2022, with diesel-fuelled vehicles phased out of the Council's taxi and hackney carriage fleet by 2027. The amendment to the existing policy was considered the best means of taking effective action to incentivise uptake of Low emissions vehicles and help improve local air quality. Following public consultation the timescales for adopting the new standards have been delayed as a result of the Covid pandemic. The policy is expected to be adopted early in 2021.

Expected impact of measure: encourage modal shift and reduce vehicle emissions

- Sussex-air (SAQP) successful 2020/21 bid to the Defra Air Quality Grant fund for project work with primary and secondary schools to tackle school travel emissions. The project will involve air quality monitoring and school street closures around schools during school drop-off and pick-up times. The aim of the project is to raise awareness about air quality and evidence the effect of street closures on local air quality at schools and the effectiveness of the interventions on how pupils and staff travel to and from school. This a continuation of the programme that was delivered in 2018-19 to work with primary schools in or near Sussex AQMAs. The project will be delivered over 2020/21.

Expected impact of measure: education/awareness raising, encourage modal shift and reduce vehicle emissions

- Installation of additional anti-idling signs at Crawley's level crossing sites is planned for 2020/21

Expected impact of measure: reduce vehicle emissions

- Pop-up Cycle Lanes - Road space allocation in the form of pop-up cycle lanes have been made at very short notice by West Sussex County Council in order to facilitate active travel resulting from the Covid pandemic restrictions on public transport and to encourage healthier lifestyles. Although there has been some negative feedback, anecdotal evidence suggest cyclists welcome the opportunity to have road space allocation, however this needs to be done in a more carefully considered way so that safety and traffic flow are properly balanced. The future of these measures will be reviewed as the year progresses.

Expected impact of measure: encourage modal shift to active travel and reduce vehicle emissions

Crawley Borough Council's priorities for the coming year are:

- Update air quality modelling and source apportionment for the AQMA to help inform the revision of the current Air Quality Action Plan
- Review and publish our new AQAP in 2021 to reflect the amended AQMA
- To deliver through the Crawley Growth Programme improved sustainable transport infrastructure upgrades and provide alternative sustainable transport options for Manor Royal business district, Three Bridges Station and Crawley Stations and Town Centre Cycling & Walking Schemes.
- Delivery of the Defra air quality grant funded project on school street closures
- Seek further grants/funding streams to support air quality action plan measures.
- Educational/promotional events to raise awareness of air quality issues, including the annual Clean Air day, Breath Easy, and Junior Citizen.
- Review and update the monitoring network to respond to local developments and identify pollution hotspots across the borough.

The principal challenges and barriers to implementation that the council anticipates facing are:

- The scale of local development adjacent to the AQMA which threatens to impact action plan measures and offset improvements in vehicle emissions achieved over recent years. To tackle increasing developmental pressure, the local authority will need opportunity through the planning process to improve infrastructure, especially for walking and cycling, and thus limit the impacts on the existing AQMA and avoid creating new hotspots.
- The Council anticipates facing further funding constraints as a result of the Covid pandemic which has impacted its revenue streams, officer time and potentially the public, business and political drive for measures that may be perceived as harming or delaying economic recovery (even if this is not the case).

Progress on the following measures has been slower than expected due to:

- Crawley Growth Programme - a number of projects have been impacted during 2020 as a result of resources being redeployed to support the emergency response to the Covid-19 pandemic.
- Crawley Station Gateway project – led by Arora Group, progress has been slow due to key personnel within the Arora group being placed on furlough during the Covid-19 pandemic. Planning applications for the reserved matters, Overline House and the railway bridge are due to be considered by the Local Planning Authority in Winter 2020/21. The public realm/highway improvement scheme has been agreed and the delivery programme extended to 2025, to allow the Arora Group to progress their scheme first.
- Emission Standards for Licensed Taxis - The implementation of the policy changes on emission standards for licensed hackney carriages and private hire vehicles has been delayed due to negative feedback from the trade due to downturn in income during the current Covid pandemic during 2020. The implementation will go ahead as agreed by Cabinet, but following public consultation the time scales for adopting the new standards may need to be extended as a result of the Covid pandemic. The policy is expected to be adopted in 2021.

- Formalising the amendment of the AQMA - due to staff redeployment, loses and sickness during the pandemic of the current reporting year. However, the formal consultation and Cabinet briefing has now started and the order is expected to be formalised in January 2021, followed by the revision of the AQAP to reflect the amended boundary.

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Crawley Borough Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of the Hazelwick AQMA.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Date Measure Introduced	Organisations involved	Funding Source	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Crawley Growth Programme Three Bridges railway station Interchange improvement schemes	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2019 Design Stage	Coast to Capital Local Enterprise Partnership WSCC/ CBC	LEP/ WSCC/ CBC £2.94m	Modal Shift/ Improved traffic flow	Reduced vehicle emissions Medium/High	Completion of the detailed design stage, taking into account feedback from extensive stakeholder consultation and pre-planning application advice	Phased delivery programme for scheme extended to 2025. Anticipate construction commencing late 2021/22.	Scheme comprises: New station forecourt, relocated bus shelters, improved cycle and pedestrian route connections, new taxi rank, waiting area and car drop off, highway junction traffic light upgrades, new 'eastern ' access to the station comprising a vehicle drop off point and pedestrian access to platforms
2	Crawley Growth Programme Station Gateway - public realm/ highway improvement scheme including car free residential/ commercial development	Transport Planning and Infrastructure	Public transport improvements-interchanges stations and services	2019 Design/ Approval/ Planning Stage	Coast to Capital Local Enterprise Partnership WSCC/ CBC Private Developer (Aurora Group)	LEP/ WSCC/ CBC Aurora Group £5.4m	Low Emission/car free Housing Modal Shift/ Improved traffic flow	Reduced vehicle and housing energy emissions Medium/High	Scheme agreed by Cabinet 2019. Planning applications for reserved matters due 2020/21	Phased delivery programme for scheme extended to 2025.	Progress slow due to key personnel within Arora group being furloughed during Covid-19 pandemic. The delivery programme extended to 2025, to allow the Arora Group to progress their scheme first.
3	Crawley Growth Programme Three Bridges railways stations EV Parking/ charging points	Promoting Low Emission Transport	Priority parking for LEV's Procuring alternative Refuelling infrastructure to promote EV recharging	2020 Design Stage	Coast to Capital Local Enterprise Partnership WSCC/ CBC	WSCC/ CBC/ Network Rail/ GTR	Modal Shift	Reduced vehicle emissions Medium	A full scheme review is currently being undertaken and we expect to submit a planning application in 2021.	Delivery of scheme extended to 2025 Anticipate construction commencing late 2021/22.	Recent discussions with Network Rail and GTR identified the need for more electric vehicle points and parking bays at the station (20 in total), in response to a recent increase in demand.
4	Crawley Growth Programme Eastern Gateway - highway improvement scheme to deliver better connectivity and enhanced pedestrian and cycle access	Transport Planning and Infrastructure	Other (see comments section)	2020 Design Stage	WSCC		Modal Shift/ Improved traffic flow	Reduced vehicle emissions Medium/High	Currently in detailed design stage. This project, led by WSCC, was delayed during 2020 as a result of resources being redeployed to support the emergency	Construction expected to commence Spring 2021 for completion in 2022.	Deliver improved connectivity and enhanced pedestrian/ cycle access to Town Hall, County Buildings, Telford Place and Crawley College. Scheme covers eastern half of The Boulevard, Exchange

						LEP/ WSCC/ CBC £8.3m			response to Covid-19 pandemic.		Road, the southern end of Northgate Avenue, College Road (including roundabout), Southgate Avenue, up to/ including junction with Station Way. The scheme also complements Station Gateway scheme
5	Crawley Growth Programme Manor Royal - highway improvement scheme to deliver better connectivity and enhanced pedestrian and cycle access across the Business district	Transport Planning and Infrastructure	Other (see comments section)	2020 Design Stage	WSCC	LEP/ WSCC/ CBC £3.31m	Modal Shift/ Improved traffic flow	Reduced vehicle emissions Medium/High	Currently in detailed design stage. Project delayed a result of WSCC resources being redeployed to support the emergency response to 2020 Covid-19 pandemic	Construction due to commence Spring 2021 for completion in 2022.	
6	Crawley Growth Programme Extension to the new Manor Royal bus Route	Promoting Travel Alternatives	Bus route improvements	2020	Coast to Capital Local Enterprise Partnership WSCC/ CBC MetroBus	LEP/ WSCC/ CBC £820k	Improved journey times and timetable accuracy / Modal shift	Reduced vehicle emissions No Target set Medium/low	Funding identified Still in design	2021/22	In January 2020, the Crawley Growth Programme was awarded an additional £820k funding to improve transport connectivity by *extending* the proposed bus lane around Manor Royal Business District, reducing bus journey times
7	Crawley Growth Programme Town Centre Cycling & Walking Schemes connecting Eastern Gateway and Station Gateway with existing cycle route along High Street	Transport Planning and Infrastructure	Cycle network	2020 Design Stage	Coast to Capital Local Enterprise Partnership WSCC/ CBC	LEP/ WSCC/ CBC £1.1m	Modal Shift	Reduced vehicle emissions Medium/low	Currently at preliminary design stage.	Construction due to start i2021/22.	Town Centre Cycling & Walking Scheme creates a single, attractive, safe and connected cycle route that runs around the town centre.
8	Crawley Growth Programme Three Bridges Station Upgrade bus shelter with integrated Real Time Passenger Information	Transport Planning and Infrastructure	Bus route improvements	2019	Coast to Capital Local Enterprise Partnership WSCC/ CBC/ Metrobus	LEP/ WSCC/ CBC/ MetroBus	Modal shift	Reduced vehicle emissions Low	Completed 2019	2019	A new bus shelter with integrated Real Time Passenger Information was installed opposite the station May 2019

9	Crawley Growth Programme Queensway public realm/ regeneration scheme installation of paving, bike racks, signage, lighting and planting.	Promoting Travel Alternatives	Promotion of cycling Promotion of walking	2017	Coast to Capital Local Enterprise Partnership WSCC/ CBC/	LEP/ WSCC/ CBC/ £2.2m	Modal shift	Reduced vehicle emissions Low	completed during 2019/20	2020	This project included installation of new cycle racks to encourage travel to the town centre by bike. Also improved pedestrian and cycle access to and from Crawley College and Memorial Gardens to the main town centre, by transforming the public realm and reducing dominance of car users
10	Crawley's Declaration of Climate Emergency	Policy Guidance and Development Control	Other policy (see comments section)	Declared 2019	CBC	CBC	Emissions balance sheet	Target set for 45% reduction in carbon emissions from the Council's activities by 2030 and net zero by 2050	Declaration July 2019, Draft Climate emergency action plan currently being developed 2020/21	Action Plan due 2021 followed by ongoing implementation	Crawley's declaration of climate emergency pledge to reduce carbon emissions as recommended by the Inter-Governmental Panel on Climate Change (IPCC).
11	Defra funded AQ project Clean Burn Sussex Project to promote cleaner fuels, compliant stoves, efficient burning methods	Promoting Low Emission Plant	Other measure for low emission fuels for stationary and mobile sources	2019	SAQP/CBC	Defra Grant Funded	Public awareness – survey results Reduction in particulate emission	Reduced Particulate emissions No Target set	Production of new webpages on the Sussex-air website to raise awareness https://sussex-air.net/Cleanburn/clean-burning.aspx, and a clean burn survey to gather information on wood burning	2019/20	CBC webpages also updated with Clean Burn information 2020
12	Defra funded AQ project: Schools travel emissions project/ street closure	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2020/21	SAQP/CBC	Defra Grant Funded	Awareness raising/ Modal shift/ reduction in vehicle emission	Reduced vehicle emissions Medium	Successful bid 2020. Sustrans in contact with schools to discuss project work/access	July 2021	The project will involve air quality monitoring and may include school street closures around schools during school drop-off and pick-up times. The aim of the project is to raise awareness about air quality and evidence the effect of street closures on local air quality at schools and the effectiveness of the interventions on how pupils and staff travel to and from school.
13	Air Quality and Emissions Mitigation Guidance for Sussex	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Revised Guidance 2020	CBC with Sussex-air (SAQP)		Conditions on planning applications to require Damage cost calculation	Reduced vehicle emissions No Target set	Air Quality and Mitigation Guidance incorporated in Crawley Local Plan referenced to	ongoing	

							for emissions mitigation		developers in local list		
14	Crawley Local Cycling and Walking Infrastructure Plan (LCWIP)	Transport Planning and Infrastructure	Cycle Network	Draft 2020	CBC	CBC	Modal shift	Reduced vehicle emissions No Target set	Design and early consultation completed 2019/ 2020. Draft/ final consultation summer 2020 Publication due December 2020.	Dec 2020 production of LCWIP Ongoing implementation	The LCWIP is a practical plan for a high quality network of safe, convenient and attractive cycling and walking routes though Crawley.
15	West Sussex Walking and Cycling Strategy - provision of cycling infrastructure along Ifield Avenue	Transport Planning and Infrastructure	Cycle Network	2019	WSCC	WSCC	Modal shift	Reduced vehicle emissions No Target set	Delivery of cycling infrastructure along Ifield Avenue was completed in 2019	2019	
16	West Sussex Walking and Cycling Strategy - Infrastructure upgrade to cycle path Southgate Avenue	Transport Planning and Infrastructure	Cycle Network	2019	WSCC	WSCC	Modal shift	Reduced vehicle emissions No Target set	Options appraisal to improve existing cycle path on Southgate Avenue commissioned in 2019 as part of implementation of West Sussex Walking and Cycling Strategy	2020/21	Progress delayed due to Covid
17	New Directions for Crawley - Draft Transport and Access Strategy	Policy Guidance and Development Control	Other policy (see comments section)	Draft 2019	CBC	WSCC/ CBC	Modal shift	Reduced vehicle emissions No Target set	Draft completed 2019 for consultation with the final plan aimed for end 2020.	Dec 2020 Action Plan 2021 followed by ongoing implementation	The strategy document addresses issues and options for shifting from car-centred to people-centred approach to mobility and access The 10-year time frame action plan emerging from the New Directions strategy together with LCWIP, will inform the emerging Local Plan to guide design and access elements of new developments
18	Draft local Plan 2020-2035 To provide detailed environmental policy and guidance through the development control process.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Draft 2019	CBC	CBC	Energy efficient housing/ commercial development with good public/active transport links to reduce emissions	Reduced air quality impact through development control requiring adherence to air quality policy and emission mitigation	Draft Local Plan 2020-2035 completed and early engagement consultation September 2019. Final public consultation January - March 2020. Independent examination by	Adoption due early 2021	As the Local Plan is currently under review, there is opportunity to strengthen the wording of CBC's air quality policy.

									Government Dec 2020.		
19	Emissions Mitigation Planning Guidance for Sussex - advice to developers on how to address air quality and ensure effective mitigation on planning applications for major development	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Original Guidance 2013	SAQP/ CBC	SAQP/ CBC	Assessment of emissions from development and scheme of mitigation required with application.	Reduction in emissions from transport associated with new development through mitigation	Revised Draft 2019	Publication 2020 Ongoing implementation	Development of the Guidance as Supplementary Planning Document (SPD) being considered – dependent on review of application in other Sussex authorities
20	WSCC Parking Standards Guidance – sets out parking standards, including targets for cycle storage and EV charging/ parking	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Priority parking for LEV's	Approved 2019	WSCC	WSCC	future percentage increases in allocation for EV's and active transport	Reduced vehicle emissions No Target set	2019	ongoing	
21	Electric Vehicle Strategy for West Sussex 2019-2030 to encourage and support the adoption of electric vehicles	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging	2019	WSCC	WSCC	future percentage increases in allocation for EV's and active transport	Reduced vehicle emissions No Target set	2019	ongoing	The strategy objectives are to ensure sufficient charging infrastructure in place to support the vehicles to charge, and to ensure renewable energy sources are used for all charging points on County Council land. Crawley is identified in the strategy as one of the priority areas for EV charging point installation.
22	School Travel plans	Promoting Travel Alternatives	School Travel Plans	2017	West Sussex County Council (WSCC)	WSCC	Modal Shift %children travelling to school by sustainable means	Reduced vehicle emissions No Target set Medium/low	Increase % Uptake	Ongoing	Helps reduce emissions during morning rush hour
23	CBC Travel Plans	Promoting Travel Alternatives	Workplace Travel Planning	2019	CBC	CBC	% staff travelling by sustainable means	Reduced vehicle emissions No Target set Medium/low	Draft Travel plan produced 2019 Staff travel survey 2020 will help inform and shape final plan	Expected 2021	Progress delayed due to other priorities during Covid-19 pandemic.

24	easit Green Travel Network – easit discount (15%) staff rail/ bus commuting available to Crawley staff/ businesses	Promoting Travel Alternatives	Promote use of rail and bus	2018	easit/CBC	easit/CBC or member company	% staff travelling by sustainable means	Reduced vehicle emissions No Target set Medium/low	Currently: 120 easit Organisations = 2% increase from 2019 5274 Crawley registered individuals with easitCARD = 8.8% increase from 2018	Ongoing	Council originally involved in funding the setting up of the scheme. 2018/19 there were 185 CBC staff registered
25	Crawley car club scheme with private sector partner	Promoting Travel Alternatives	Personalised Travel Planning	2019	CBC	CBC/ Private sector partner	Reduction in private vehicle ownership	Reduced vehicle emissions No Target set Medium/low	Procurement due 2020 now delayed	Launch due 2021 Delayed	Progress delayed due to other priorities during Covid-19 pandemic.
26	Crawley Borough Council Staff Travel Survey	Promoting Travel Alternatives	Personalised Travel Planning	2020	CBC	CBC	Modal shift/ staff travelling by sustainable means	Reduced vehicle emissions No Target set	Survey due late 2020	Dec 2020/21	The Council's staff travel survey which will inform the development for travel policy measures to be designed and included in the emerging Climate Emergency Action Plan in 2021.
27	Living Streets campaign - Information, events, and activities to promote walking	Promoting Travel Alternatives	Promotion of Walking	ongoing	WSCC Wellbeing/ Living Streets/ CBC	WSCC/ CBC	Modal shift	Reduced vehicle emissions No Target set	Annual campaign event – Covid restrictions 2020	Ongoing	No event 2020 – planned for 2021 depending on Covid restrictions Information, events, and activities aimed at council staff and local businesses
28	Residential and Business Travel plans	Promoting Travel Alternatives	Residential/ Business travel plans	ongoing	CBC	CBC	% development occupants (residents or staff) using sustainable transport modes	Reduced vehicle emissions No Target set	Developments of certain size required to implement Travel Plan	Ongoing	Implemented through Planning process - each application has its own target plan
29	Staff car loan - Council Vehicle procurement requires vehicle emissions limit eligibility for loan	Promoting Low Emissions Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2000	CBC	CBC	Minimum CO2 level of < 150 g/kg.	Reduced vehicle emissions CO2 level of < 150 g/kg.	100% uptake for vehicle procurement and staff car loan applications	Ongoing	
30	Council Vehicle Fleet LEVs Fleet replacement prioritising uptake of EV/low emission vehicles	Promoting Low Emissions Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	ongoing	CBC	CBC	Modal shift to LEV/ Zero emissions	Reduced vehicle emissions	2019/20 – 3 Nissan e-NV200 to replace diesel vans in CPE team, Neighbourh'd Services and Pest Control 2 Toyota Petrol/electric hybrid cars to replace diesel for for Community Wardens	ongoing	2021/22 proposed replacement programme - Nissan e-NV200 for facilities Team, 2 Electric Sweepers to replace diesel for street cleaning and electric panel van to replace a diesel one for play services

31	CBC Staff Bicycle Loan Scheme	Promoting Low Emissions Transport	Prioritising uptake of low emission vehicles	2015	CBC	CBC	Modal shift from private vehicle to bicycle	low	No new loan awarded 2019/20	ongoing	CBC staff loan to buy Bike
32	CBC Staff Bike to Work Scheme	Promoting Low Emissions Transport	Prioritising uptake of low emission vehicles	2015	Evans Cycles (Cyclescheme)/ CBC	CBC	Modal shift from private vehicle to bicycle	low	3 new applicants 2019/20	ongoing	Bike Hire Scheme CBC/Partnership with Evans Cycle through "Cyclescheme" which allows employees to purchase bike through other shop outlets
33	Junior Citizen Event - educational programme on environmental issues, safety and citizenship, including "Air quality in our local area"	Public Information Promoting Travel Alternatives	Other (interactive games and Awareness raising)	1990	CBC	CBC	Education and Modal Shift	No Target set	Approx. 1200 KS2 (Yr6) pupils per year	Ongoing 2020 Junior Citizen event will not go ahead this year due to Covid restrictions	Educational programme "Air quality in our local area" delivered through eco-action games and small discussion groups. Funding for future events may be cut due to lack of funding resulting from Covid-19 pandemic.
34	Emission Standards for Licensed Taxis	Promoting Low Emissions Transport	Taxi emission incentives	2020	CBC	CBC	All new licensed taxis to be zero emission capable (ZEC) from April 2022 All existing licensed taxis to be retrofitted to meet Euro 6 by October 2022 Diesel-fuelled vehicles to be phased by 2027	Zero emissions by 2030	Changes to policy on emission standards agreed at licensing committee Jan 2020 Consultation and ongoing dialogue with the trade during 2020	Due to be adopted 2021 Implementation from 2022	Following public consultation the time scales for adopting the new standards have been delayed as a result of the Covid pandemic. The policy is expected to be adopted early in 2021.
35	Energy Saving Installation Program	Promoting Low Emission Plant	Shift to installations using low emission fuels	2012	CBC	CBC	45% Reduction in CO2 Emissions by 2030 100% Reduction in CO2 Emissions by 2050	LED replacement: 40% reduction weekly wattage (> 50k watts)	K2 Leisure Centre LED replacement scheme Energy efficient pumps fitted to pool filtration system All areas fitted with PIR detectors Hawth Theatre and Car Park LED replacement scheme	Completed 2019/20 Ongoing LED Replacement scheme when lights fail replaced with LED	
36	airAlert Pollution Warning Service for people with asthma, COPD, or cardio problems.	Public Information	Via other mechanisms SMS/ Mobile phone App/ Email	2006	SAQP	SAQP /CBC	Uptake: Subscription numbers to the alert service	Health based service No Target set – but raises awareness of health impacts of pollution – helps to	Over 800 registered subscribers. Increase in subscribers since service started. Cold and Heat	ongoing	No direct emissions reductions but health benefits from direct application of monitoring data and

	Voice call, text, or email sent to warn of high pollution and advise action to manage health							drive behavioural change.	alerts added to the service.		raises awareness of air quality
37	Anti-idling promotion - Installation of anti-idling signs at Crawley's level crossing sites	Traffic Management	Anti-idling enforcement	Original signage 2003 Additional signage 2019	WSCC/CBC	SAQP funded by Sussex-air Defra funded anti idling around schools (2019)	Local air quality monitoring	No Target set	Installation of additional anti-idling signs approved 2019 by WSCC and for Crawley's level crossing sites	planned for 2020/21	
38	Public Health Information/ Awareness Campaigns promoting sustainable modes of travel to staff and public: Clean Air Day Event and Breath Easy Week	Public Information	Other – see comments	Ongoing	CBC/WSCC	CBC/ WSCC	Engagement/number of pledges for behavioral change/ modal shift Take-up of initiatives Website hits Increase in air alert subscribers	No Target set	Joint working with WSCC Public Health/ CBC EH and Sustainability Teams to support campaigns and promotion of air Alert through publicity and events.	Annual events - ongoing	Public awareness campaign through editorials and advertisements in WSCC Connections; anti-idling message on the digital advertising board at Manor Royal; messages broadcast across Sussex on Spirit FM during Breathe Easy Week; targeted education at Crawley schools

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.

Those most at risk from air pollution are the young and elderly and those with predisposed medical conditions, which may be exacerbated by elevated levels of air pollution. A report by Public Health England (PHE) (Estimating Local Mortality Burdens Associated with Particulate Air Pollution, April 2014) estimates that particulate matter was a contributory factor in 29,000 deaths nationally in 2010. A further report by the Royal College of Physicians in 2016 predicted that air pollution contributed to the equivalent of 40,000 deaths in 2015.

PHE have produced a Public Health Outcomes Framework, which identifies an indicator for the fraction of mortality attributable to particulate air pollution in each authority in the UK. Using this framework it is possible to compare the values for Crawley to regional and national values, as well as other nearby authorities in Sussex.

In Crawley, the estimated fraction of mortality (2018) attributable to long-term exposure to Particulates is 5.8% (Fig. 2.1). This is just above the average for the South East region (5.6%) and England (5.2 %). In West/East Sussex the values range from 5.0% to 5.8% with Crawley and Brighton and Hove both having 5.8%.

Fraction of mortality attributed to particulate air pollution in Crawley

Indicator	Period	England	South East region	Adur	Arun	Ashford	Aylesbury Vale	Basingstoke and Deane	Bracknell Forest	Brighton and Hove	Canterbury	Cherwell	Chichester	Chiltern	Crawley	Dartford
Fraction of mortality attributable to particulate air pollution	2018	5.2	5.6	5.6	5.2	5.4	5.5	5.4	5.7	5.8	5.3	5.5	5.0	5.6	5.8	6.5
Air pollution: fine particulate matter	2017	8.9	9.8	9.9	9.1	9.7	9.7	9.4	9.9	10.2	9.5	9.6	8.9	10.0	10.2	11.3

Crawley borough council is working to address PM2.5 through measures aimed at reducing emissions from a range of sources in the area, including transport, industrial processes and domestic burning.

The council is taking the following measures to address $PM_{2.5}$:

1. Smoke Control Areas (SCA) in Crawley: Almost all of Crawley (with the exception of Gatwick Airport and some newer areas of development of the outskirts of the borough) is designated as a SCA. These areas were declared by Smoke Control Orders during the late 1950s and 1960s (after the public health crisis of the smogs of the 1950s) when Crawley was a rapidly expanding new town. The regulation of smoke emissions by means of controls on the solid fuel appliances and the type of fuel burnt within the SCA, will reduce the impact of PM2.5 emissions in the borough. However, as the popularity of wood burners has increased in recent years, complaints of smoke from wood burners has also risen, due mainly to the burning of waste and unseasoned wood. The need to educate a new generation of solid fuel owners was therefore identified, and a "clean burn" campaign was launched through the Sussex-air partnership.
2. SAQP Defra grant funded project 'Clean Burn Sussex: The Sussex local authorities, in partnership with West Sussex Public Health, launched 'Clean Burn Sussex' in 2019/20. This was a Defra grant funded project through Sussex-air (SAQP) aimed at raising awareness and encouraging choice of cleaner fuels in an attempt to reduce particulate emissions from domestic burning.
3. Website Information Pages: We have updated smoke control area and domestic burning guidance on our website linking to the Clean Burn campaign.
4. Regulation of Industrial Process: Control emissions of $PM_{2.5}$ from mineral processes such as concrete batching, concrete rushing and road-stone coating.
5. Air Quality Action Plan: Many of the measures in our action plan promote low emission travel alternatives (e.g. cycling, walking, electric vehicles, car sharing etc) and infrastructure projects that facilitate modal change, indirectly helping to reduce Particulate emissions.

6. WSCC Electric Strategy: charging network to encourage low/zero emissions vehicles.
7. Policy Measures: These include procurement of low emission vehicles and tightening the emissions standards for licensed taxis
8. Local Plan Policy: Requirement to adhere to the Sussex Air Quality and Emissions Mitigation Guidance document
9. Local Transport Plan: Traffic management measures to reduce congestion, improve traffic flow and reduce road traffic pollutant emissions (including $PM_{2.5}$)
10. Monitoring: There is now a capacity for direct monitoring of PM2.5 in Crawley .The Council installed a FIDAS analyser at our continuous monitoring station at Gatwick Airport in March this year. This replaces the old TEOM monitor that was over 20 years old. The FIDAS is capable of monitoring levels of PM2.5 which will assist us in assessing any PM2.5 issue in the area. The measured annual mean for PM2.5 in Crawley will be reported in the ASR for 2021.

3 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.

Crawley Borough Council undertook automatic (continuous) monitoring at one site on at Gatwick Airport (CA2) during 2019. 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. National monitoring results are available at available at this link.

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

Crawley Borough Council undertook non- automatic (passive) monitoring of NO_2 at 46 sites during 2019. Table A.2 in Appendix A shows the details of 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 “annualisation” and 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[4], “annualisation” (where the data capture falls below 75%), and distance correction[5]. Further details on adjustments are provided in Appendix C.

[4] https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
[5] Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

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. Note that the concentration data presented in Table A.3 represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

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.

The data in Table B.1 shows that air quality in Crawley is mainly good, with national targets being met at most monitoring sites with the exception of some sites close to busy roads. Exceedances of the nitrogen dioxide 40 µg/m^3 annual mean objective were found at eight sites in 2019: CR 55, 62, 63, 69, 93, 101, 105, 106.

Only two of the sites (CR62 and CR69) are located at the façade of the house, the remaining sites are located closer to the road than the houses and therefore are not truly representative of residential exposure because pollution concentrations decrease with distance from the source. In order to account for this falling off in pollution concentration, an adjustment was made. After calculating the effect of fall off with distance from the road, to provide a more representative estimation of exposure, it was found that there were still exceedances at the point of relevant public exposure at four locations: CR55/69 (same receptor), CR62, CR93, CR106.

The nitrogen dioxide concentrations at sites with relevant exposure CR55/69, CR62 and CR93, indicate that levels remain high within the AQMA (and the extension to the AQMA currently in the process of being declared) and continuing work is needed to target emissions within this area.

Site CR106 was a new site which had been identified as part of the last year's review of the monitoring network, as a location with potential for exceedance. However, a full

year's data was not available for this site (data capture 66%). It was therefore necessary to annualise the data as described in LAQM Technical Guidance TG (16). The annual mean was estimated to be 40ug/m^3 which is exactly the limit of the objective level for annual mean NO_2, indicating that further action may be needed outside of the AQMA. This site will be reviewed when a full year's data is available at next year's ASR to assess if there is a need for a further amendment to the AQMA boundary. There is no evidence that the hourly objective for NO_2 is being exceeded at these sites.

The rationale for the choice of bias adjustment factor is discussed fully in Appendix A, however, its effect on the reported results is explained in more detail here: Following Guidance from LAQM Guidance (TG.16) and the laqm helpdesk, the local adjustment factor (1.02) was chosen to take into account the effect of the airport and provide a conservative approach to the monitoring data. However, at busy road locations such as in the AQMA, the influence of road traffic sources is more dominant and the use of the national bias adjustment factor (0.93) may have been more appropriate. If the national factor had been applied to the data, this would have resulted in five exceedances of the objective being reported: CR63, 69, 93, 101, 105 and 106, and after fall off adjustments only two sites (CR69 and CR93) would have shown exceedances of the objective: CR69 40ug/m^3 and CR93 45ug/m^3, withal other sites being below the objective level of 40ug/m^3.

However, it is not appropriate to apply two different adjustments within the same report. Ultimately which ever factor had been chosen, the results at these locations would have been within 10% of the air quality objective of 40ug/m^3 and therefore, with the potential to exceed, would have resulted in the same conclusions being drawn, that is: That the AQMA should remain in place and with an extension of the area to cover the exceedances at Three Bridges.

Trends in Annual Mean NO_2

NO_2 levels across Crawley remained more or less constant in 2019. There was slight variation, with levels at airport and roadside sites marginally lower than 2018 levels (except in the AQMA), and background sites marginally higher than 2018 levels. This slight year on year fluctuation pattern was also seen regionally, and is likely to be attributable to climatic influences rather than local conditions. However, long term

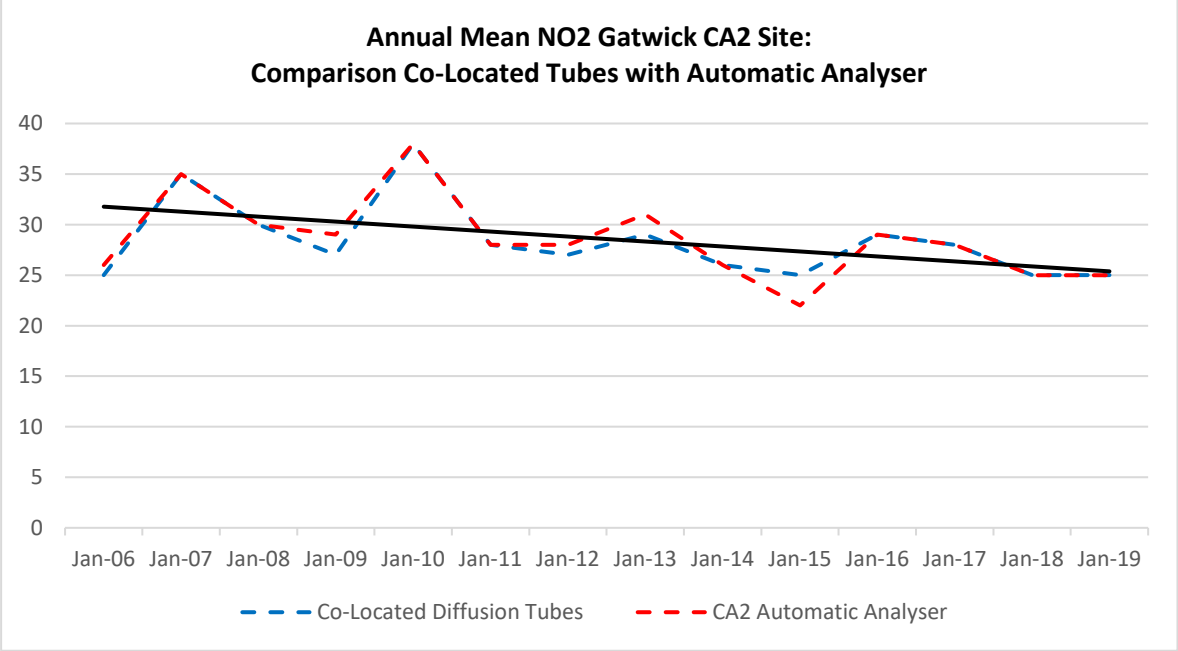
downward trends are indicative that levels of nitrogen dioxide have generally fallen over time, driven mainly by cleaner engine technologies. The only exception to this is within the AQMA where the long term trend continues to be upwards.

The short-term trend data over the last five years also shows downward trends at roadside, background and airport sites, with the exception of an upward trend still present within the AQMA.

Trends in NO_2 at Gatwick

Annual mean NO_2 levels remained constant at the Gatwick East continuous monitoring site in 2019. There were no exceedances of the annual or hourly mean objectives and the long term trend continues to be downwards (Fig 3.1). The co-located diffusion tube data at this site shows very good correlation with the continuous data, recording the same annual mean and the same trend pattern for the long term data.

Fig 3.1



Determining relevant exposure at residential properties within 1000m of the airport is one of the assessment criteria required for authorities with a major airport within their boundary. In 2019 there were no exceedances of annual mean NO_2 at any of these residential receptors (CR 48, 49, 50, 51, 74, 75).

In Fig 3.2 the levels of nitrogen dioxide from the airport's LGW3 site located at the eastern end of the runway (and therefore considered to be worst case) are compared to residential receptors in Crawley within 1000m of the airport. The long-term trend at both these sites shows a decline over the last 15years (Fig 3.2). The short-term (5yr) trend is also downwards at both airport and residential, albeit with a flatter gradient. The trend will continue to be monitored and reviewed annually through the LAQM process.

Fig 3.2

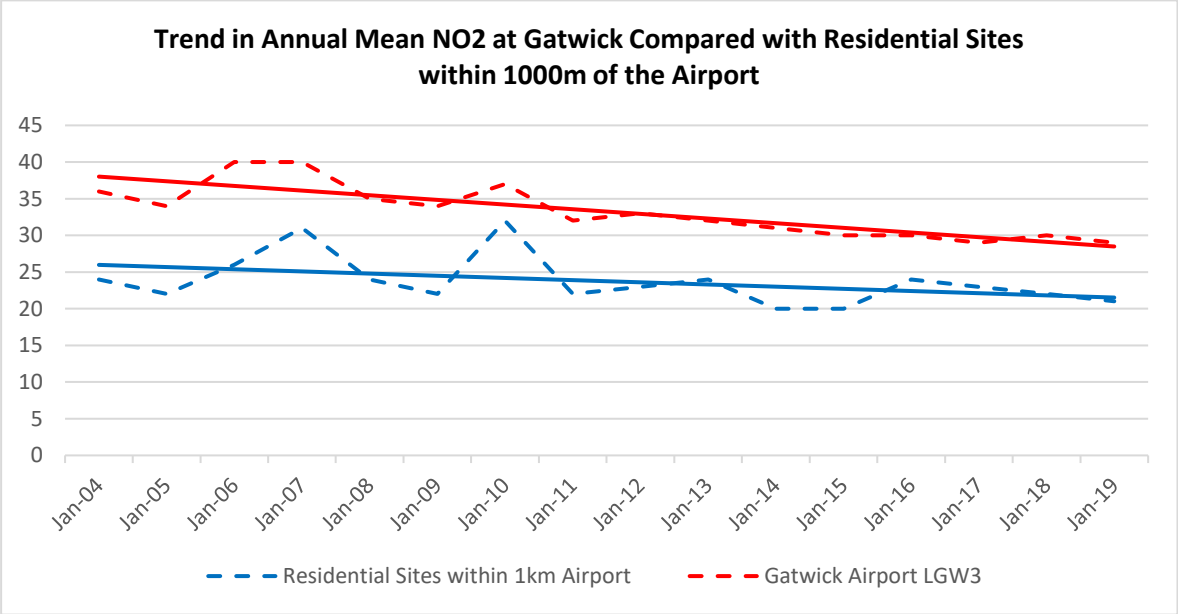
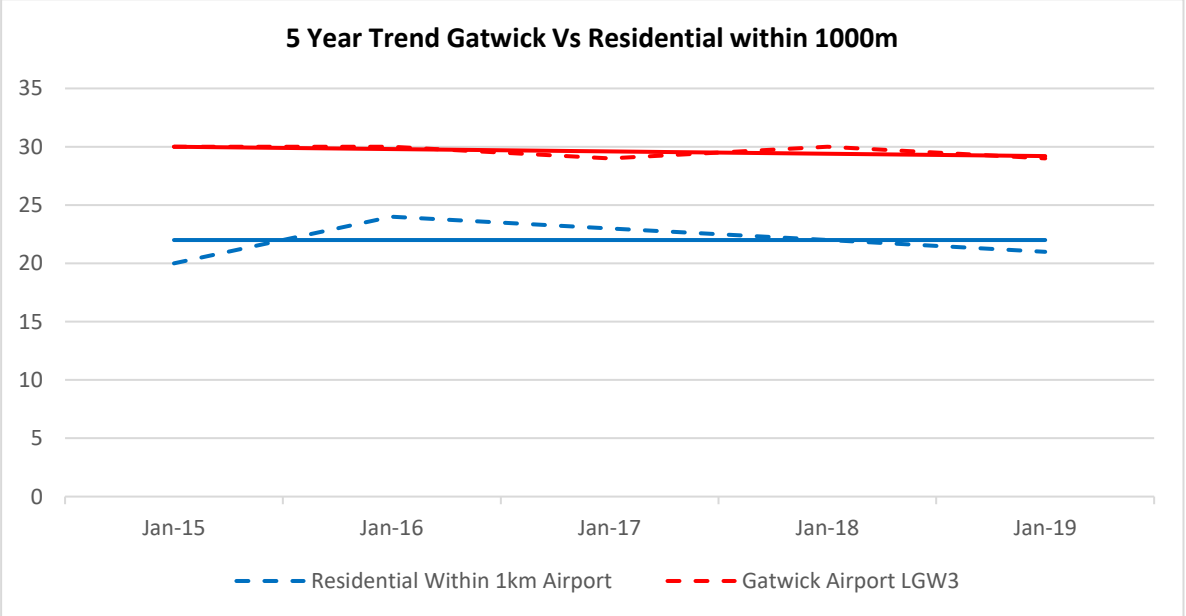


Fig 3.2a



Trends in Roadside NO_2 in Crawley

Fig 3.3 shows the long term (15yr) trend in roadside NO_2 in Crawley continues to be downwards indicating that overall levels have fallen despite an upward trend in traffic volumes over the same period (Fig 3.4). A range of measures at European, national and local level, such as improvements in engine technologies, and gradual shift to more sustainable forms of transport have helped reduce vehicle emissions, which, over time have resulted in reductions in NO_2 both regionally and locally.

The short-term (5yr) trend is only slightly downwards for roadside NO_2, and the trend at the Hazelwick roundabout (within the AQMA) is still upwards. This short-term upward trend may be influenced by a number of factors including increased traffic volumes on local roads, or the effect of low(er) levels in 2014/15 which have skewed the trend upwards in the following years. The trend will continue to be monitored and reviewed annually through the LAQM process.

Fig 3.3

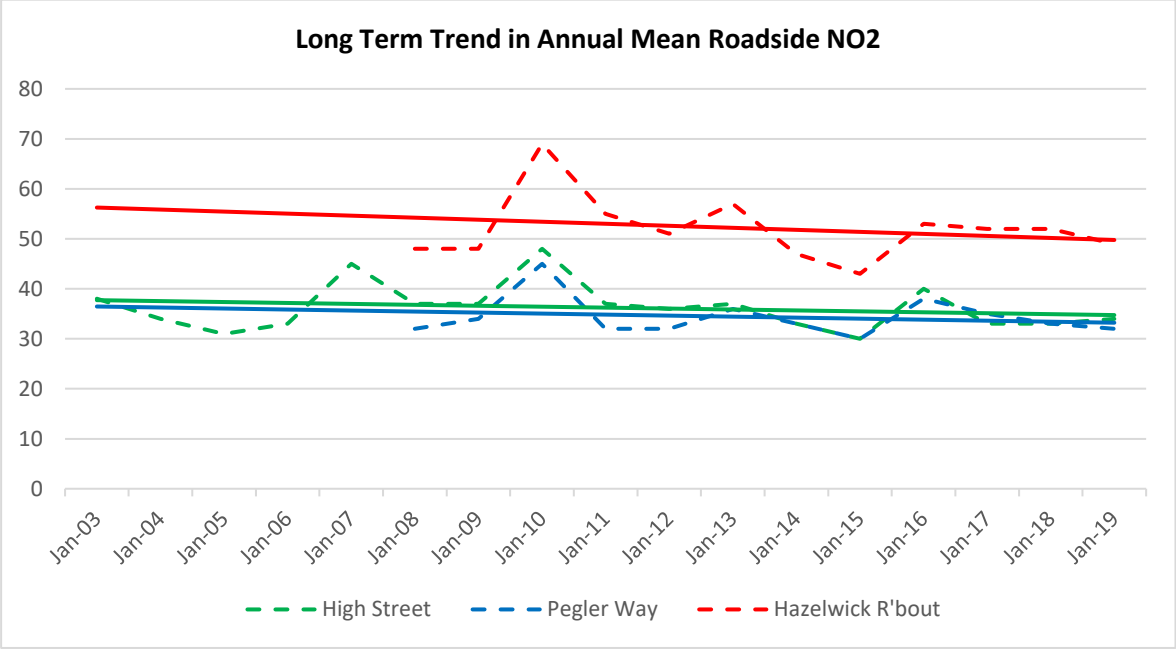


Fig 3.3a

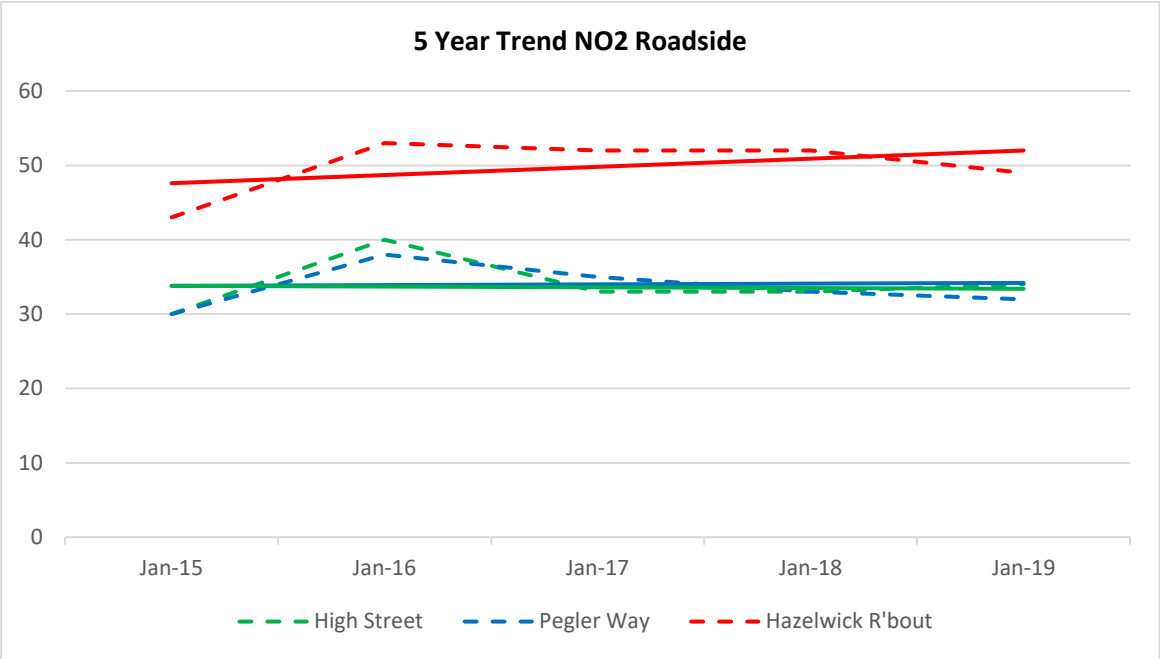
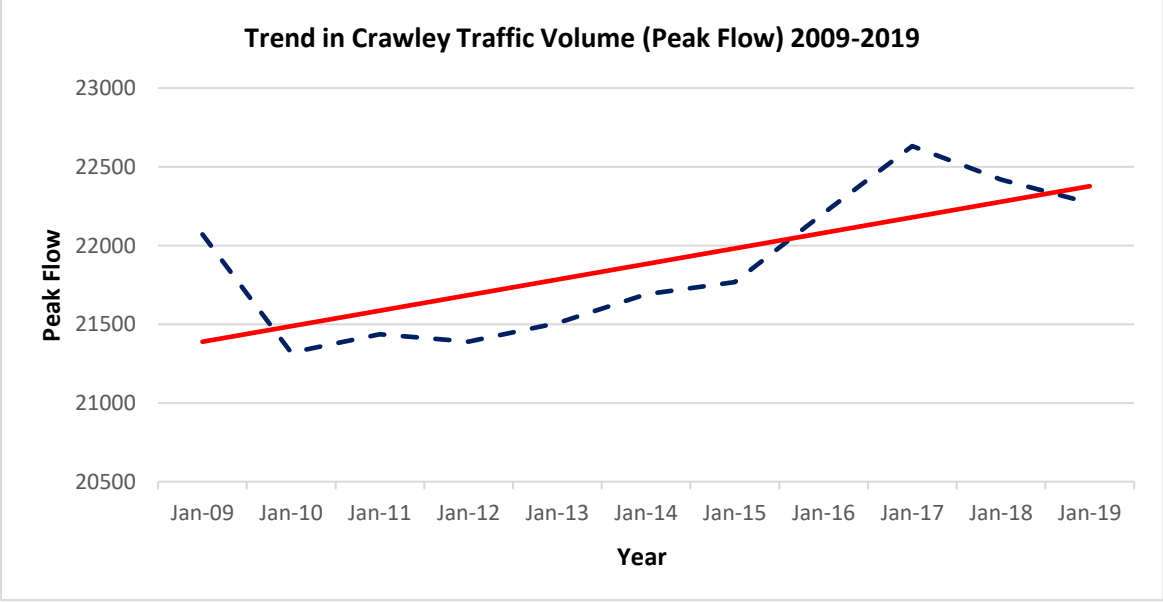


Fig 3.4



Trends in Background NO_2 in Crawley

Fig 3.5 shows the downwards long term trend in NO_2 at background sites is similar to that of other sites (roadside and airport) across Crawley, confirming that background levels of NO_2 have been falling over the last 15years. The steeper downward slope indicates greater improvement in air quality at background sites over the last decade than those close to busy roads around Crawley and the airport. This helps demonstrate the contribution vehicle emissions make to poor air quality at roadside locations and supports the argument for restricting residential development close to busy roads.

Fig 3.5a shows the short term (5 year) trend. The trend is downwards, but, compared to the long-term trend, the rate of improvement is beginning to slow. This may be associated with increased development and traffic volumes in the borough, but climatic factors may be more relevant, with the particularly low concentrations in 2014/15, followed by higher 2016 levels influencing the short term trend. The trend will continue to be monitored and reviewed annually through the LAQM process.

Fig 3.5

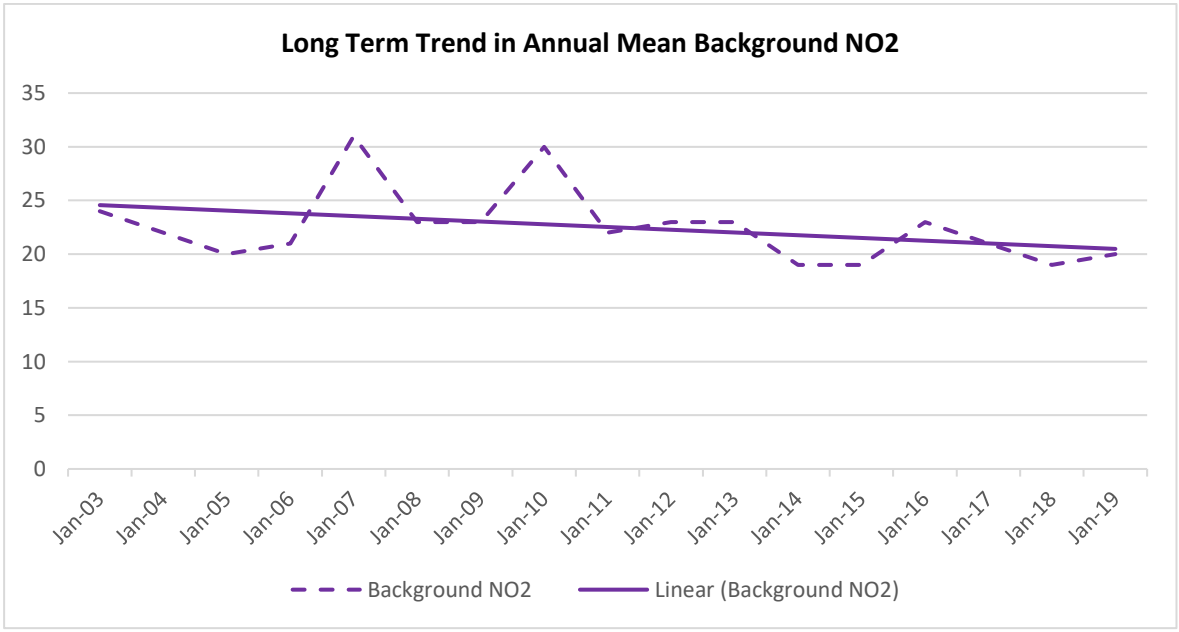
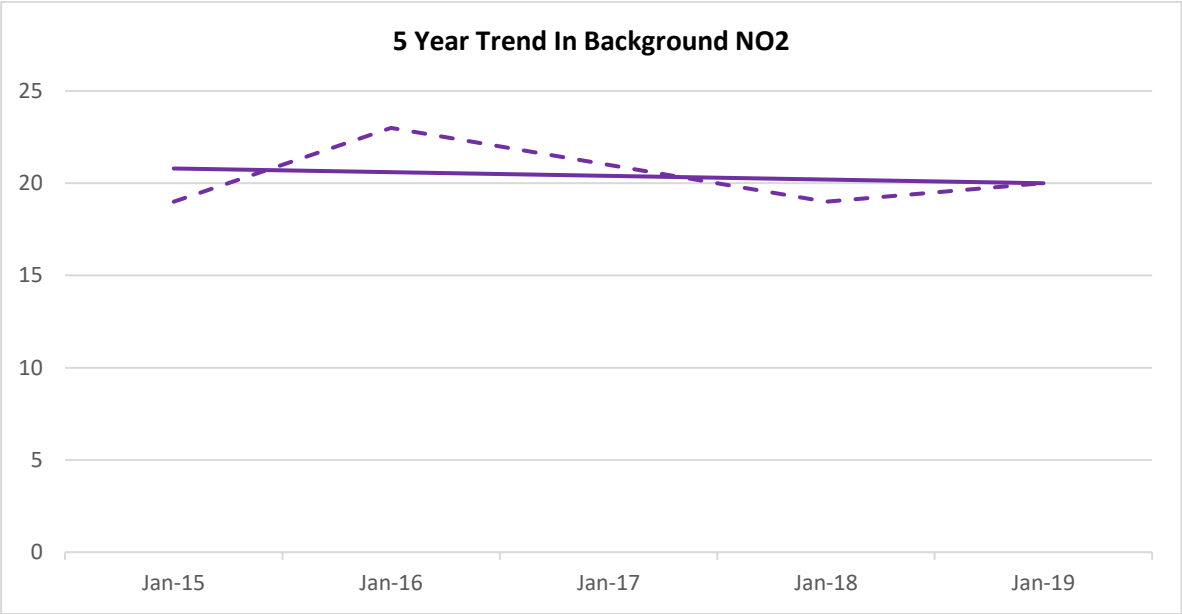


Fig 3.5a



Trends in AQMA NO_2 in Crawley

Although the trend for background and roadside sites in Crawley is down, this is not seen at receptor sites within the AQMA where both the long term and short term data is still showing an upwards trend (Fig 3.6 and Fig 3.6a). The impact of major development (2000 dwellings) adjacent to the AQMA continues to be monitored. The council is not in a position revoke or reduce its AQMA boundary, and is currently going through the process of extending its AQMA to incorporate the Three Bridges area where exceedances were identified last year at two locations with relevant exposure (CR93 and CR97). In 2019 there was a slight improvement in NO_2 levels at site CR97 where measured concentrations were 37ug/m^3, below the annual mean NO_2 objective (40ug/m^3). However, at CR93, there was an increase in NO_2 levels from the previous year confirming the need to target intervention in this location. Further information is provided in Appendix C on the extension of the AQMA at Three Bridges.

Fig 3.6

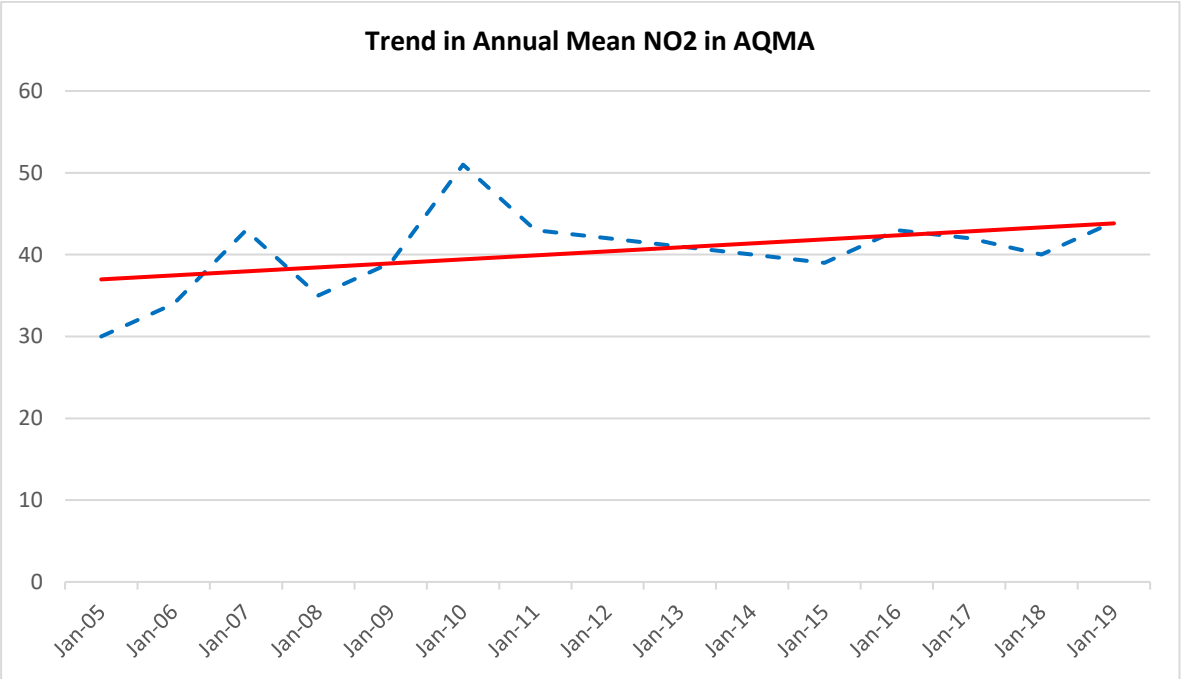
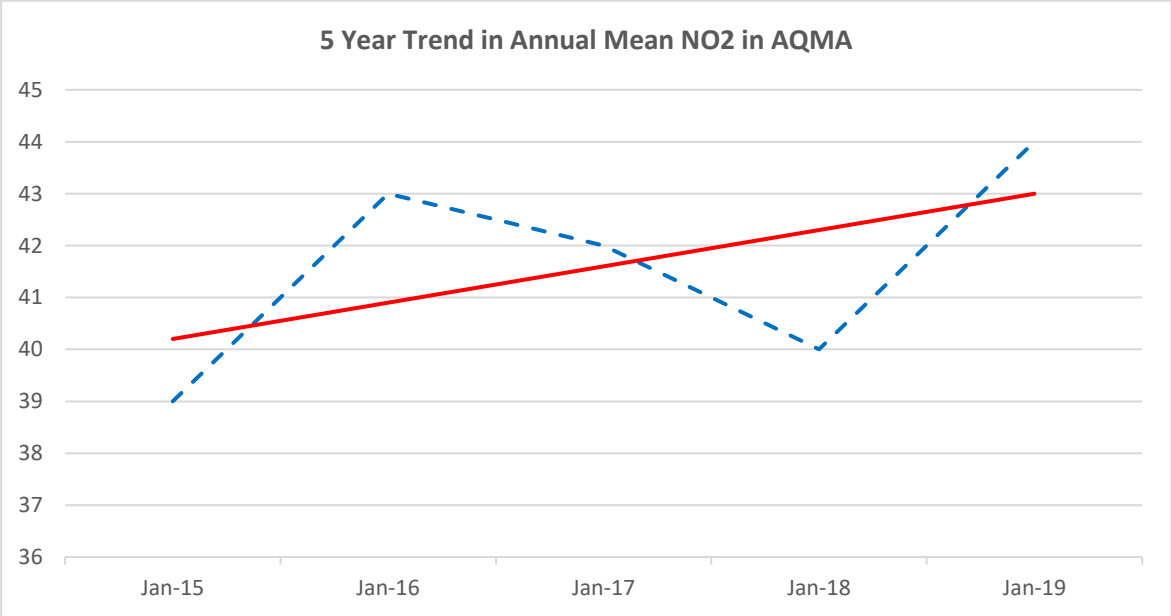


Fig 3.6a



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.

The PM_{10} measured at the automatic monitoring site (CA2) on the eastern boundary of the airport, showed an increase in annual mean PM_{10} concentrations in 2019 (21 µg/m^3 vcm corrected). This pattern was seen across the south east region and was thought to be due to a significant episode of long range transboundary PM_{10} from Eastern Europe. However, the levels are still well within the air quality objectives, and there were no exceedances of the annual mean or daily mean objectives.

The long-term trend for PM_{10} shows a decline over the last 15years (Fig 3.7). However the more recent 5 year trend (Fig 3.7a), is indicating a rising trend in PM_{10}, although concentrations are still significantly below peak 2006 levels. This upward trend will continue to be monitored and reviewed annually through the LAQM process. No recommendation for an AQMA is required for this pollutant.

Fig 3.7

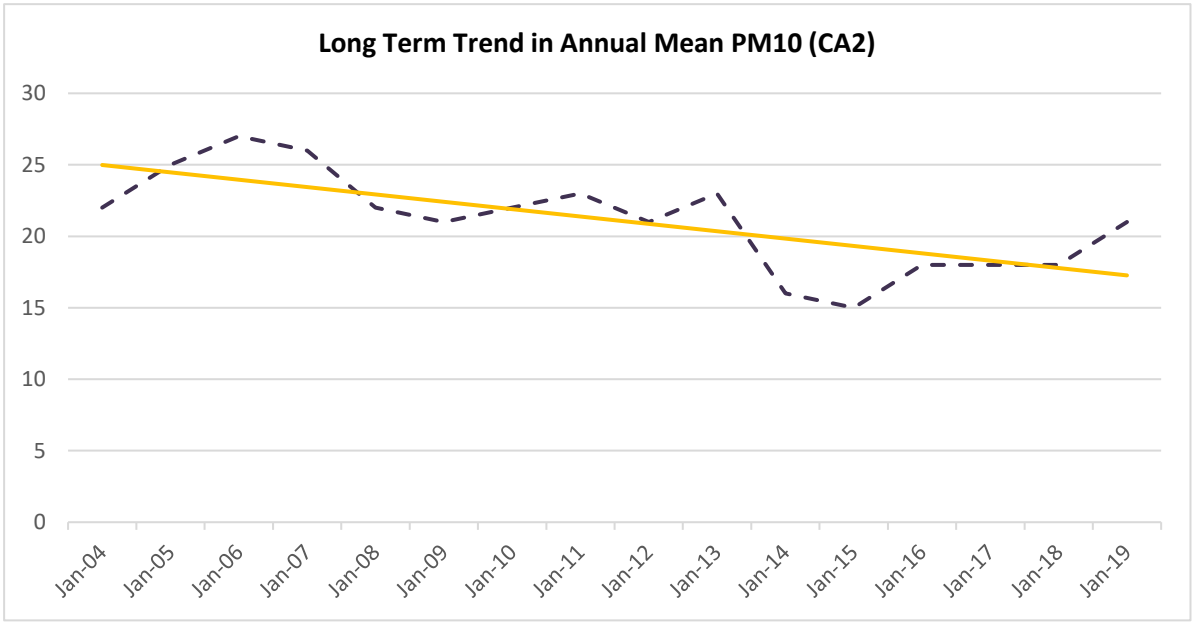
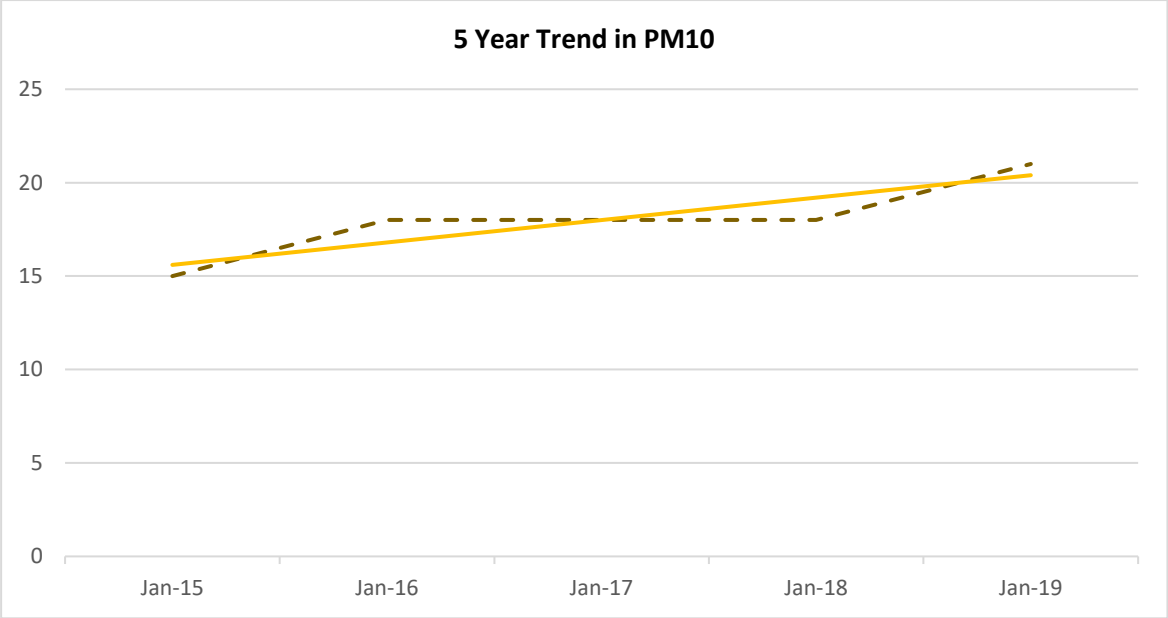


Fig 3.7a



3.2.3 Particulate Matter ($PM_{2.5}$)

Crawley Borough Council did not carry out monitoring for $PM_{2.5}$ in 2019. The Council has since installed a FIDAS analyser at our continuous monitoring station (CA2) at Gatwick Airport in March this year. The new analyser is capable of monitoring $PM_{2.5}$ which will be reported in next year's ASR.

For 2019 an estimate of $PM_{2.5}$ concentrations has been made following the guidance contained in Technical Guidance LAQM TG16. The estimated $PM_{2.5}$ concentrations was calculated as 15µg/m^3 (See Appendix C for methodology).

Appendices

Appendix A: Monitoring Results

Appendix B: Full Monthly Diffusion Tube Results for 2019

Appendix C: Supporting Technical Information:

C.1 Air Quality Monitoring Data QA/QC
C.2 Diffusion Tube Bias Correction
C.3 Annualising NO_2 Diffusion Tube Monitoring Data
C.4 Fall off with Distance Calculations for NO_2 Data
C.5 VCM Adjustment of PM_{10} Monitoring Data
C.6 Annualising PM_{10} Monitoring Data
C.7 Estimating $PM_{2.5}$ Concentrations

Appendix D: Map of Monitoring Locations/ AQMA

Appendix E: Summary of Air Quality Objectives in England

Appendix F: New Pollution Sources/ New Developments

Appendix G: Update on Extending AQMA Boundary

Appendix A: Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CA2	Gatwick East	Other/Suburban Industrial(AQD2008)	529417	141496	NO_2; PM_{10}	NO	Chemiluminescent; TEOM	63m	7m	1.8

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)
CR1	High Street	Roadside	526799	136785	NO_2	N	15.8m	1.75m	N	2.0
CR3	Birch Lea	Urban background	528438	138392	NO_2	N	6.85m	0.5m	N	2.0
CR4	Headley Close	Urban background	529864	138204	NO_2	N	14.80m	0.5m	N	2.0
CR48	Lynhurst Cottage	Urban background	527110	139530	NO_2	N	0m	21m	N	1.5
CR49	Charlwood Nursery	Urban background	526320	139860	NO_2	N	0m	36m	N	1.5
CR50	Rowley Cottage	Urban background	527810	139929	NO_2	N	0m	75m	N	1.5
CR51	Balcombe Road	Urban background	529490	141460	NO_2	N	0m	21m	N	1.5

CR52 - CR54	Gatwick East, (Tri-location)	Other/Suburban Industrial (AQD2008)	529417	141496	NO_2	N	63m	7m	Y	1.8
CR 55	Tinsley Close Fence (11)	Roadside	528446,	138085	NO_2	Y	1.13m	5.7m	N	2.0
CR 60	Peglar Way	Roadside	526740	136934	NO_2	N	6.5m	2.31m	N	2.0
CR62	Tinsley Close (10)	Urban background	528438	138088	NO_2	Y	0m	13.6m	N	2.0
CR63	Woodfield Lodge (Roundabout)	Roadside	528153	137912	NO_2	Y	30m	7.4m	N	2.0
CR64	Woodfield Lodge (NorthgateAve)	Roadside	528150	137825	NO_2	Y	4.57m	1.62m	N	2.0
CR66	Brighton Rd (Rail crossing)	Roadside	526743	136346	NO_2	N	0.5m	1.2m	N	2.0

CR69	Tinsley Close Facade(11)	Urban background	528443	138082	NO_2	Y	0m	9.3m	N	2.0
CR72	Burlands	Urban background	525530	138472	NO_2	N	6.75m	1.3m	N	2.0
CR74	Tinsley Green Radford Road	Urban Background	528978	139599	NO_2	N	31.5m	0.5m	N	1.5
CR75	Steers Lane	Urban Background	529335	139589	NO_2	N	18.6m	2m	N	2.0
CR76	Hazelwick Court	roadside	528303	137800	NO_2	Y	10.3m	2.52m	N	2.0
CR77	Hazelwick Ave (Bays)	Roadside	528362	137812	NO_2	Y	6.34m	2.3m	N	2.0
CR78	Ferndown	Urban background	530037	138553	NO_2	N	0m	40m	N	2.0
CR79	St Hildas Close	Urban background	529312	138534	NO_2	N	0m	12m	N	2.0

CR80	Saxon Road	Urban background	530424	136521	NO_2	N	0m	8.7m	N	2.0
CR81	Bolton Road	Urban background	529047	134474	NO_2	N	0m	12.8m	N	2.0
CR85	Tinsley Lane Flats	Urban background	528286	138019	NO_2	Y	13m	32m	N	2.0
CR86	Crown Buildings The Boulevard	Roadside	526876	136819	NO_2	N	13.8m	0.5m	N	2.0
CR87	Broadway bus shelter	Roadside	526908	136754	NO_2	N	3.5m (planned residential)	0.5m	N	2.0
CR88	Filbert Crescent	Urban background	525489	136573	NO_2	N	0m	5.4m	N	2.0
CR89	Dalewood Garden	Urban background	527715	137893	NO_2	y	0m	13.8m	N	2.0
CR91	Ocean Hse, Hazelwick Ave	Roadside	528681	137177	NO_2	Y	4.7m	0.5m	N	2.0
CR93	St Marys Drive	Roadside	528895	137115	NO_2	N	1.5m	1.8m	N	2.0

CR94	Station Hill	Roadside	528841	137069	NO_2	N	5.45m	3.45	N	2.0
CR95	Daniels Hse, Worth Park Ave	Roadside	528882	137086	NO_2	N	5.44m	2.2m	N	2.50
CR96	Pound Hill Junior School	Roadside	529125	137196	NO_2	N	35m	3.58m	N	2.0
CR97	Daisy Chain Nursery Haslett Ave East	Roadside	528615	136960	NO_2	N	3.52m	1.1m	N	1.5
CR98	Gatwick School Gatwick Road	Roadside	528515	139275	NO_2	N	12.6m	2.13m	N	2.0
CR 99	Furnace Farm Road	Urban background	528410	135628	NO_2	N	12.1m	1.5m	N	2.0
CR100	Horsham Road Level Crossing	Roadside	526326	136487	NO_2	N	2.08m	1.46m	N	2.0
CR101	Horsham Road A2220	Roadside	525679	135556	NO_2	N	8.91m	1.13m	N	2.0

CR102	Pease Pottage Hill A23	Roadside	526449	134139	NO_2	N	5.10m	4.45m	N	2.0
CR103	171 St Marys Drive	Urban backgound	528848	137802	NO_2	N	0m	12.6m	N	1.5
CR104	Southgate Ave	Urban backgound	527333	135 846	NO_2	N	0m	4.7m	N	1.5
CR105	102 London Road	Roadside	526940	137831	NO_2	N	10.1m	3.94m	N	2.0
CR106	147 London Road	Roadside	527000	138357	NO_2	N	5.94m	3.91m	N	2.0

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.3 – Annual Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3) (4)				
							2015	2016	2017	2018	2019
CA2	529417	141496	Other/Suburban Industrial	Automatic	99	99	22	29	28	25	25
CR1	526799	136785	Roadside	Diffusion	100	100	30	**40**	33	33	35
CR3	528438	138392	Urban background	Diffusion	100	100	20	24	22	20	21
CR4	529864	138204	Urban background	Diffusion	100	100	21	25	23	21	23
CR48	527110	139530	Urban background	Diffusion	100	100	24	28	27	25	25
CR49	526320	139860	Urban background	Diffusion	100	100	16	19	18	18	17
CR50	527810	139929	Urban background	Diffusion	100	100	19	25	21	21	21
CR51	529490	141460	Urban background	Diffusion	100	100	21	25	24	22	22
CR52	529417	141496	Other/Suburban Industrial	Diffusion	100	100	25	30	30	24	26
CR53	528446,	138085	Other/Suburban Industrial	Diffusion	100	100	24	29	29	25	25
CR54	526740	136934	Other/Suburban Industrial	Diffusion	100	100	25	29	29	25	25
CR55	528438	138088	Roadside	Diffusion	100	100	39	**42**	**41**	**41**	**42**
CR60	528153	137912	Roadside	Diffusion	100	100	31	38	35	33	32
CR62	528150	137825	Urban background	Diffusion	83	83	31	**40**	**40**	38	**40**
CR63	526743	136346	Roadside	Diffusion	100	100	**44**	**53**	**52**	**52**	**49**
CR64	528443	138082	Roadside	Diffusion	92	92	37	**41**	**41**	**40**	38
CR66	525530	138472	Roadside	Diffusion	92	92	27	35	34	29	30
CR69	528978	139599	Urban background	Diffusion	100	100	36	**43**	**42**	**40**	**44**

CR72	529335	139589	Urban background	Diffusion	100	100	13	16	15	15	13
CR74	528303	137800	Urban Background	Diffusion	100	100	26	37	37	34	33
CR75	528362	137812	Urban Background	Diffusion	83	83	20	25	23	21	23
CR76	530037	138553	roadside	Diffusion	100	100	36	**43**	**40**	35	35
CR77	529312	138534	Roadside	Diffusion	100	100	36	**42**	39	35	35
CR78	530424	136521	Urban background	Diffusion	100	100		29	26	24	22
CR79	529047	134474	Urban background	Diffusion	100	100		30	27	25	25
CR80	528286	138019	Urban background	Diffusion	100	100		32	27	28	27
CR81	526876	136819	Urban background	Diffusion	100	100		28	25	24	22
CR85	526908	136754	Urban background	Diffusion	100	100			27[1]	30	30
CR86	525489	136573	Roadside	Diffusion	100	100			22[1]	26	27
CR87	527715	137893	Roadside	Diffusion	100	100			38[1]	38	39
CR88	526953	138658	Urban background	Diffusion	100	100			18[1]	26	25
CR89	528681	137177	Urban background	Diffusion	100	100			19[1]	22	22
CR91	528841	137069	Roadside	Diffusion	83	83			39[2]	34	32
CR93	528882	137086	Roadside	Diffusion	100	100			**65[2]**	**48**	**53**
CR94	529125	137196	Roadside	Diffusion	92	92				26	27

CR95	528615	136960	Roadside	Diffusion	100	100				31	32
CR96	528515	139275	Roadside	Diffusion	100	100				30	27
CR97	528410	135628	Roadside	Diffusion	100	100				**41**	37
CR98	526326	136487	Roadside	Diffusion	83	83				35	34
CR 99	525679	135556	Urban background	Diffusion	83	83	16	20	20	17	15
CR 100	526449	134139	Roadside	Diffusion	100	100				30(1)	27
CR 101	528848	137802	Roadside	Diffusion	100	100				**54**(1)	**50**
CR 102	527333	135 846	Roadside	Diffusion	100	100				37(1)	34
CR103	528848	137802	Urban background	Diffusion	**66**	**66**					21
CR104	527333	135 846	Urban background	Diffusion	**66**	**66**					27
CR105	526940	137831	Roadside	Diffusion	75	75					**44**
CR106	527000	138357	Roadside	Diffusion	66	66					**46**

☒ **Diffusion tube data has been bias corrected**

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

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance adjustment**

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.

(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

Table A.3.1 Automatic Monitoring for Nitrogen Dioxide at Gatwick Sites: CA2 (Crawley Gatwick East) and LGW3 (Adjacent to Runway Gatwick airport)

Site ID	Location	% Data Capture for mon period 2018	Annual mean concentrations (μg/m³)													
			2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	2014	2015	**2016**	**2017**	**2018**	**2019**
CA2	Gatwick East	99	26	35	30	29	38*	(28)*	28	31	(26)*	22	29	28	25	25
LGW3	Gatwick Airport	91	**40**	**40**	35	34	37	32	33	32	31	30	30	29	30	29

* Analyser failure – adjusted value in brackets taken from tri-located tubes

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
							2015	2016	2017	2018	2019
CA2	529417	141496	Other/Suburban Industrial	Automatic	99	99	0	0	0	0	**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	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
						2015	2016	2017	2018	2019
CA2	529417	141496	Other/Suburban Industrial	73	73	**15**	**18**	**18**	**18**	**21**
LGW3			Industrial	96	96	22	17	19	19	**14**

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

Notes:

Exceedances of the PM_{10} annual mean objective of 40µg/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	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m³ (3)				
						2015	2016	2017	2018	2019
CA2	529417	141496	Other/Suburban Industrial	73	73	1	1	0	2	4
LGW3			Industrial	96	96	7	7	3	1	4

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m³ 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.

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Mean Concentrations (µg/m^3)														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
															Raw Data	Bias Adjusted (1.02) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
CR1	529417	141496	39.21	39.05	34.68	31.44	30.91	30.60	26.66	29.06	27.87	37.75	**39.65**	38.46	33.78	34.45	24.40
CR3	526799	136785	30.25	28.28	21.14	17.52	16.08	15.52	12.17	16.82	16.50	21.30	25.02	20.99	20.13	20.54	19.60
CR4	528438	138392	30.38	28.62	22.02	21.77	16.61	19.03	13.71	18.42	18.52	24.93	36.32	21.75	22.67	23.13	19.70
CR48	529864	138204	33.05	27.11	26.19	25.21	17.44	24.61	17.82	23.98	22.31	26.69	24.71	24.86	24.50	24.99	24.99
CR49	527110	139530	22.51	19.09	17.22	23.58	15.84	20.44	9.24	11.27	11.74	17.14	17.90	13.59	16.63	16.96	16.96
CR50	526320	139860	27.92	25.67	20.96	21.77	16.99	17.46	10.98	16.76	13.44	26.18	25.80	19.32	20.27	20.68	20.68
CR51	527810	139929	29.66	27.69	21.73	18.98	19.27	16.27	16.87	20.82	20.22	20.53	22.25	24.58	21.57	22.00	22.00
CR52	529490	141460	31.86	28.86	26.39	18.28	22.71	22.05	20.75	24.69	23.30	26.44	28.90	26.96	25.10	25.60	25.90
CR53	529417	141496	25.35	29.92	25.83	21.21	22.55	22.23	20.26	26.57	23.09	21.76	28.63	25.17	24.38	24.87	25.10
CR54	528446,	138085	30.11	31.30	25.36	19.28	20.88	21.72	19.93	25.28	24.01	24.10	27.13	24.55	24.47	24.96	25.20
CR55	526740	136934	**41.01**	**51.32**	31.29	35.53	**41.82**	**47.30**	**43.79**	**41.42**	39.38	**41.26**	**40.78**	**40.43**	**41.28**	**42.10**	**40.70**
CR60	528438	138088	25.90	**45.48**	33.71	25.62	30.97	29.26	30.63	24.97	29.68	32.83	33.62	35.04	31.48	32.11	26.70
CR62	528153	137912	39.31			33.22	31.82	**41.12**	**40.44**	**43.51**	36.44	38.58	**47.08**	**43.66**	**39.52**	**40.31**	**40.31**
CR63	528150	137825	**44.81**	**52.40**	**45.39**	**51.72**	**49.60**	**45.14**	**40.31**	**52.03**	**48.65**	**55.18**	**48.14**	**45.88**	**48.27**	**49.24**	35.40
CR64	526743	136346	**41.24**	**44.61**	**42.81**		31.71	37.66	29.66	35.17	33.20	**42.83**	38.36	34.29	37.41	38.16	33.90

CR66	528443	138082	25.97	**43.10**	37.70	27.31	30.49	23.99	17.29	31.49	27.22	28.03		30.04	29.33	29.92	28.90
CR69	525530	138472	34.29	**48.67**	39.03	**41.01**	**44.79**	**50.32**	**46.26**	**41.45**	**40.10**	39.03	**46.21**	**43.08**	**42.85**	**43.71**	**43.71**
CR72	528978	139599	17.30	17.60	13.37	9.52	8.16	11.36	7.78	9.83	11.29	14.54	18.92	14.19	12.82	13.08	12.80
CR74	528978	139599	37.61	31.57	33.01	36.01	31.38	34.44	24.30	31.37	31.67	36.71	31.68	28.39	32.35	32.99	24.50
CR75	528303	137800	31.64	25.44	20.96	19.89	20.23	21.34	15.66		18.22		29.20	21.44	22.40	22.85	18.90
CR76	528362	137812	**39.85**	**41.98**	35.56	30.91	30.46	34.11	27.10	30.96	29.64	35.95	34.75	33.36	33.72	34.39	30.40
CR77	530037	138553	**41.38**	**43.38**	**40.32**	22.06	26.31	32.52	29.15	31.81	33.92	38.45	36.86	34.48	34.22	34.90	31.40
CR78	529312	138534	29.89	23.76	22.76	25.56	19.49	21.17	14.46	19.63	19.08	25.29	22.40	19.86	21.95	22.38	22.38
CR79	530424	136521	32.14	28.75	25.90	23.25	23.88	28.16	16.89	23.03	21.91	26.22	24.71	21.59	24.70	25.20	25.20
CR80	529047	134474	27.96	30.15	27.35	26.44	23.61	33.60	18.12	22.40	22.52	29.85	31.86	20.22	26.17	26.70	26.70
CR81	528286	138019	23.74	29.62	20.84	21.10	21.00	20.59	20.00	17.06	19.83	18.52	24.97	20.34	21.47	21.90	21.90
CR85	526876	136819	37.31	**42.06**	27.02	11.10	26.61	28.51	27.65	33.03	11.07	35.88	36.34	37.46	29.50	30.09	34.01
CR86	526908	136754	31.83	33.70	25.22	23.95	20.28	21.28	20.31	24.24	24.86	28.37	31.70	29.81	26.30	26.82	20.10
CR87	525489	136573	**45.66**	**47.84**	**42.79**	35.58	33.67	**41.19**	34.22	37.60	31.74	36.24	39.30	37.28	38.59	39.36	31.10
CR88	527715	137893	26.03	26.27	22.78	29.05	22.45	29.94	18.39	20.01	22.77	27.71	29.48	22.01	24.74	25.24	25.24
CR89	526953	138658	26.49	24.76	22.11	24.84	19.16	21.30	13.03	16.41	17.39	22.72	24.63	19.75	21.05	21.47	21.47
CR91	528681	137177	24.99			33.65	23.55	29.61	25.89	32.78	32.90	38.09	33.99	37.87	31.33	31.96	28.50
CR93	528841	137069	**57.26**	**60.32**	**52.95**	37.93	**50.93**	**47.19**	**43.59**	**58.42**	**48.98**	**53.29**	**51.56**	**58.46**	**51.74**	**52.78**	**48.40**
CR94	528882	137086	36.74	31.72	28.19	26.96	22.33	25.84	15.81		22.63	27.82	26.94	24.67	26.33	26.86	26.20
CR95	529125	137196	39.20	**41.15**	30.91	29.87	26.94	29.04	25.09	26.85	28.35	33.38	32.36	32.61	31.31	31.94	29.50
CR96	528615	136960	34.72	35.40	25.95	25.26	22.65	22.76	21.48	21.37	26.39	29.22	23.26	28.86	26.44	26.97	20.90
CR97	528515	139275	**45.83**	**55.99**	32.22	33.11	32.50	19.91	30.76	30.19	27.17	**43.51**	**41.81**	39.47	36.04	36.76	35.80
CR98	528410	135628	39.44			25.18	29.69	31.77	29.11	31.06	33.49	34.86	**41.68**	39.04	33.53	34.20	23.90

CR 99	526326	136487	25.41			15.08	13.96	10.56	9.28	10.62	13.25	18.30	16.72	14.00	14.72	15.01	14.00
CR 100	525679	135556	26.49	33.38	26.22	28.04	24.02	25.95	21.63	24.89	26.66	27.48	27.31	25.76	26.49	27.02	24.90
CR 101	526449	134139	**49.89**	**57.20**	**44.48**	**42.25**	35.11	**43.66**	**49.06**	**44.14**	**48.51**	**53.51**	**59.10**	**59.88**	**48.90**	**49.88**	32.60
CR 102	528848	137802	**48.53**	**47.80**	37.31	30.93	30.57	26.33	27.78	30.60	26.74	27.60	30.90	32.43	33.13	33.79	28.70
CR103	528848	137802				20.93		27.05	19.73	15.42	16.00	18.94	19.45	17.18	20.11	20.51	20.51
CR104	527333	135 846				**40.21**	22.03	17.44	17.04	21.11		26.77	31.20	27.92	26.49	27.02	27.02
CR105	526940	137831				**41.10**	33.02	**46.94**	39.34	**42.25**	**40.18**	**50.81**	**44.00**	**50.08**	**43.08**	**43.94**	34.00
CR106	527000	138357				**43.82**	38.06	**40.02**	**39.89**	34.42		**44.97**	**57.42**	**49.86**	**45.30**	**46.21**	**40.00**

☒ **Local bias adjustment factor used**

☐ **National bias adjustment factor used**

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

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column**

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: QA/QC Diffusion Tube Monitoring Data (NO_2)

All diffusion tube monitoring data has been ratified following the methods described in LAQM.TG(16) A quality assurance/quality control (QA/QC) programme including field duplicates and blanks and instrument calibration with standard gases has been followed (AEAT, 2000).

The NO_2 diffusion tube analysis was carried out and analysed by Gradko Environmental (part of Gradko International Ltd) .The QA/QC methodology for Gradko Environmental Ltd is given below:

Tube Preparation: The preparation of the tubes is done using 20% Triethanolamine / 80% Deionised Water. The preparation procedures adhere to the guidance detailed in the document 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users', Issue 1a Feb.2008 (issued by AEA Energy and Environment).

Analysis Methods: Analysis of the NO_2 diffusion tubes is carried out using colorimetric techniques in accordance with Gradko International Ltd UKAS accredited (ISO/IEC 17025) internal laboratory procedures. The details in these procedures adhere to the DEFRA 'Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance for Laboratories and Users, Issue 1a Feb 2008', issued by AEA Energy and Environment.

Quality Control Procedures: All tube components are maintained in a high state of cleanliness. New absorbents are prepared by the Laboratory and checked for levels of contamination.

The diffusion tubes are prepared in a dedicated clean laboratory and stored under refrigerated conditions to maintain stability. A sample of each batch of tubes prepared is checked by the analyst for blank levels. If the tubes are stored for more than one week, a further sample is taken and checked for any increases in blank levels. If the levels reach a pre-determined value, the batch of tubes is discarded.

Method Calibration: A full five to seven (dependant on range of concentrations being measured) point calibration is carried out monthly using NIST certified nitrite standards.

The linear graph acceptance is $r^2 = 0.999$. At the start of every batch of tubes analysed, two nitrite standards are run to check the accuracy of the calibration graph, this is repeated at the end of the analysis run. Statistical graphs are maintained using the plots of the daily standard results and the acceptance criteria achieved before an analysis run is made. An instrument calibration is run every two months using certified optical filters plus an annual preventative maintenance programme carried out by an external engineer is in operation.

Quality Assurance: The laboratory has a fully documented Quality Management System which has been assessed and accredited by UKAS (Accreditation No. 2187). A copy of the Quality Manual Contents Index is available on request.

Quality Control Procedures are supplemented by the use of external proficiency schemes such as W.A.S.P administered by Health and Safety Laboratories at Buxton and the NETCEN U.K. NO2 Field Inter-comparison project administered by National Physical Laboratories (NPL), Teddington.

C.2: NO_2 Diffusion Tube Precision, Accuracy and Bias Correction

Diffusion tube monitoring has inherent errors. In order to minimise these, a bias-adjustment factor is applied to the measurements to improve the accuracy of the results. This factor is obtained by co-locating three diffusion tubes at a continuous monitoring site. The co-location study in Crawley is at the Gatwick East Site (CA2), where triplicate tubes (prepared and analysed by Gradko) are located next to the inlet of the chemiluminescence analyser. Using the results of this study, the average values from the monthly exposed tubes for a given year can be compared directly to the corresponding continuously monitored values; allowing the local authority to calculate the precision of their tubes as well as the bias.

Precision of the Crawley Co-location Site Diffusion Tubes: Precision is the ability of a measurement to be consistently reproduced; and the diffusion tube precision is therefore calculated by determining the coefficient of variation CV. Where the CV is <20% for 8 or more periods in a year, then the Tube Precision is considered to be “Good”. Tube precision was calculated using the calculator tool (version 04) on the laqm review and assessment support website

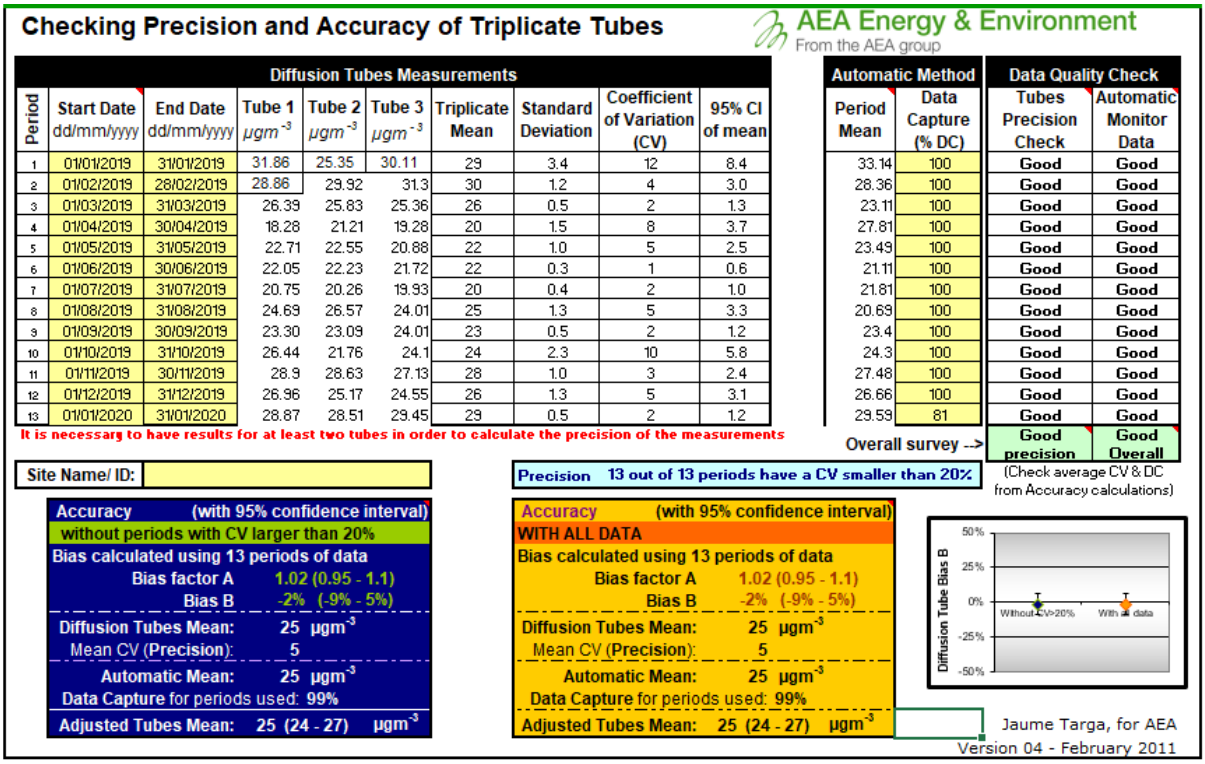
www.airquality.co.uk/archive/laqm/tools.php. The results for the Crawley co-location study are shown in Table C.1 and C.2 below. Overall Precision was "Good"

Table C 2.1: 2019 Precision Assessment of Triplicate Tubes (from calculator tool (version 04) on the LAQM Review and Assessment Support Website)

Site Name/ ID:	GATWICK EAST SITE (CA2)								
2019 Co-Location Diffusion Tubes Measurements									
Period	Start Date	End Date	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2019	31/01/2019	31.86	25.35	30.11	29	3.4	12	8.4
2	01/02/2019	28/02/2019	28.86	29.92	31.3	30	1.2	4	3.0
3	01/03/2019	31/03/2019	26.39	25.83	25.36	26	0.5	2	1.3
4	01/04/2019	30/04/2019	18.28	21.21	19.28	20	1.5	8	3.7
5	01/05/2019	30/05/2019	22.71	22.55	20.88	22	1.0	5	2.5
6	01/06/2019	31/06/2019	22.05	22.23	21.72	22	0.3	1	0.6
7	01/07/2019	31/07/2019	20.75	20.26	19.93	20	0.4	2	1.0
8	01/08/2019	31/08/2019	24.69	26.57	24.01	25	1.3	5	3.3
9	01/09/2019	30/09/2019	23.30	23.09	24.01	23	0.5	2	1.2
10	01/10/2019	31/10/2019	26.44	21.76	24.1	24	2.3	10	5.8
11	01/11/2019	30/11/2019	28.9	28.63	27.13	28	1.0	3	2.4
12	01/12/2019	31/12/2019	26.96	25.17	24.55	26	1.3	5	3.1
13	01/01/2020	31/01/2020	28.87	28.51	29.45	29	0.5	2	1.2
Precision	13 out of 13 periods have a CV smaller than 20%								

Table C 2.2: 2019 Co-location Overall Tube Precision and data Capture (from calculator tool (version 04) on the LAQM Review and Assessment Support Website)

2019 Automatic Monitoring Data (Gatwick East CA2)		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data Capture Check
33.14	100	Good	Good
28.36	100	Good	Good
23.11	100	Good	Good
27.81	100	Good	Good
23.49	100	Good	Good
21.11	100	Good	Good
21.81	100	Good	Good
20.69	100	Good	Good
23.4	100	Good	Good
24.3	100	Good	Good
27.48	100	Good	Good
26.66	100	Good	Good
29.59	81	Good	Good
Overall survey		Good precision	Good Overall Data Capture



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	01/01/2019	31/01/2019	31.86	25.35	30.11	29	3.4	12	8.4
2	01/02/2019	28/02/2019	28.86	29.92	31.3	30	1.2	4	3.0
3	01/03/2019	31/03/2019	26.39	25.83	25.36	26	0.5	2	1.3
4	01/04/2019	30/04/2019	18.28	21.21	19.28	20	1.5	8	3.7
5	01/05/2019	31/05/2019	22.71	22.55	20.88	22	1.0	5	2.5
6	01/06/2019	30/06/2019	22.05	22.23	21.72	22	0.3	1	0.6
7	01/07/2019	31/07/2019	20.75	20.26	19.93	20	0.4	2	1.0
8	01/08/2019	31/08/2019	24.69	26.57	24.01	25	1.3	5	3.3
9	01/09/2019	30/09/2019	23.30	23.09	24.01	23	0.5	2	1.2
10	01/10/2019	31/10/2019	26.44	21.76	24.1	24	2.3	10	5.8
11	01/11/2019	30/11/2019	28.9	28.63	27.13	28	1.0	3	2.4
12	01/12/2019	31/12/2019	26.96	25.17	24.55	26	1.3	5	3.1
13	01/01/2020	31/01/2020	28.87	28.51	29.45	29	0.5	2	1.2

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
33.14	100	Good	Good
28.36	100	Good	Good
23.11	100	Good	Good
27.81	100	Good	Good
23.49	100	Good	Good
21.11	100	Good	Good
21.81	100	Good	Good
20.69	100	Good	Good
23.4	100	Good	Good
24.3	100	Good	Good
27.48	100	Good	Good
26.66	100	Good	Good
29.59	81	Good	Good
Overall survey -->		Good precision	Good Overall

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 13 out of 13 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 13 periods of data
Bias factor A 1.02 (0.95 - 1.1)
Bias B -2% (-9% - 5%)
Diffusion Tubes Mean: 25 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 25 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 25 (24 - 27) µgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 13 periods of data
Bias factor A 1.02 (0.95 - 1.1)
Bias B -2% (-9% - 5%)
Diffusion Tubes Mean: 25 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 25 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 25 (24 - 27) µgm^{-3}

Jaume Targa, for AEA
Version 04 - February 2011

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

Diffusion Tube Bias Adjustment Factors: Bias represents the overall tendency of the diffusion tubes to depart from the true value, ie to under or over-read relative to the reference method (chemiluminescence analyser). The bias can be corrected, using the appropriate bias correction factor, to improve the accuracy of the diffusion tube results. Local bias adjustment factors are obtained by co-locating three diffusion tubes at a continuous monitoring site in the local authority and national factors are derived from the mean value of a number of different local authority studies. The derivation of the National and Local bias adjustment factors are shown below. (Tables C.3 – C.6).

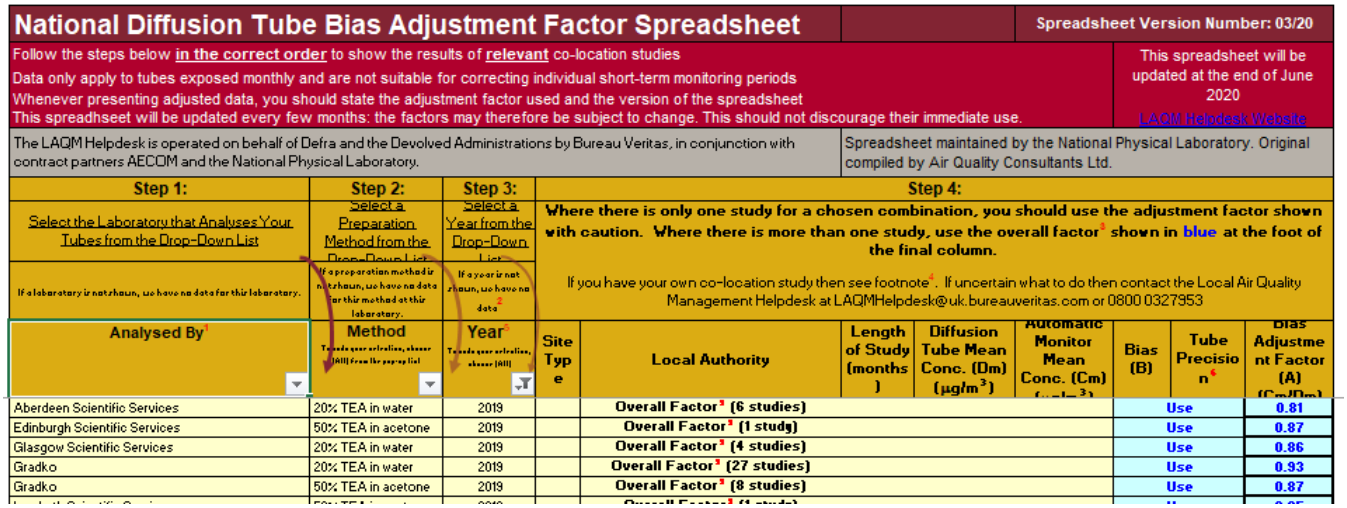
Local Bias Adjustment factor for Crawley: Crawley has a co-location study located at the Gatwick East Site (CA2). A local bias adjustment factor was calculated using data from triplicate tubes (prepared and analysed by Gradko) mounted next to the inlet of the analyser during 4-week periods throughout the year. The 2019 local bias correction for Crawley was calculated using the method described in LAQM.TG(16) (7.191-7.199) and the spread sheet tool provided in www.airquality.co.uk/archive/laqm/tools.php . The bias value (B) derived from the tube data *without* CV > 20% was used to calculate the locally derived bias adjustment factor for Crawley (following the method in foot note 4 on this web-page).

Table C 2.3: Bias and Accuracy - Calculated without periods with CV > 20% (with 95% confidence interval)	
Bias calculated using 13 periods of data Bias factor A Bias B	 1.02 (0.95 – 1.1) -2% (-9% - 5%)
Diffusion Tube Means Mean CV (Precision)	25 µg/m^3 5
Automatic Mean Data capture for periods used	25 µg/m^3 99%
Adjusted Tubes Mean	25(24-27) µg/m^3

Table C 2.4: Bias and Accuracy - Calculated with all data including periods with CV > 20% (with 95% confidence interval)	
Bias calculated using 13 periods of data Bias factor A Bias B	 1.02 (0.95 – 1.1) -2% (-9% - 5%)
Diffusion Tube Means Mean CV (Precision)	25 µg/m^3 5
Automatic Mean Data capture for periods used	25 µg/m^3 99%
Adjusted Tubes Mean	25(24-27) µg/m^3

Table C 2.5 Local Bias Correction Factor for NO_2 diffusion Tube from 2019 Co-location Data Following foot note [4] of the Precision and Accuracy calculator tool LAQM Helpdesk Website (version 03/16)	
Bias (B) value	**= -2%**
Bias value expressed as a factor	**= - 0.02**
Bias value, expressed as a factor + 1	**= - 0.02 + 1 = 0.98**
The inverse of 0.98 = The Bias Adjustment Factor	**= 1/0.98**
Local Bias Correction Factor for Crawley 2019 data	**= 1.02**

National Bias Adjustment Factor: Data from co-location studies are used to calculate the Bias Adjustment Factor. Not all local authorities carry out their own co-location studies, therefore Defra collates the UK co-location study results, and from these calculated the mean value for each laboratory, to provide a national bias adjustment value for the users of each laboratory. The National Bias Adjustment Factor (Gradko) is shown below.



National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/20

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

This spreadsheet will be updated at the end of June 2020
LAQM Helpdesk Website

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

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

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

Step 2: Select a Preparation Method from the Drop-Down List

Step 3: Select a Year from the Drop-Down List

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method	Year[2]	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm)	Bias (B)	Tube Precision[4]	Bias Adjustment Factor (A) (Cm/Dm)
Aberdeen Scientific Services	20% TEA in water	2019		Overall Factor[3] (6 studies)					Use	0.81
Edinburgh Scientific Services	50% TEA in acetone	2019		Overall Factor[3] (1 study)					Use	0.87
Glasgow Scientific Services	20% TEA in water	2019		Overall Factor[3] (4 studies)					Use	0.86
Gradko	20% TEA in water	2019		Overall Factor[3] (27 studies)					Use	0.93
Gradko	50% TEA in acetone	2019		Overall Factor[3] (8 studies)					Use	0.87

Table C 2.6 National Bias Correction Factor for 2019 NO_2 diffusion Tube data from Gradko Co-location Studies (20% TEA in water)

The full spread sheet data for all 27 studies can be view at the LAQM Review and Assessment Support Website http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html)

2019 National Bias Adjustment Factor (Gradko 27 Studies)	**0.93**

Choice of Factor for Bias Adjustment: The annual mean NO_2 for the triplicate co-located tubes was the same value as the annual mean NO_2 measured at the automatic analyser for the CA2 Gatwick site in 2019 (25 µg/m^3). This was reflected in the locally derived bias adjustment figure of 1.02, indicating a very good correlation in the tube data relative to the reference method (chemiluminescence analyser), over the data capture period. The national bias adjustment value for 2019 was 0.93, which also showed very good correlation and was based on a large number of studies (27).

In deciding which bias adjustment value to use, the following factors were taken into account in accordance to the guidance in LAQM-TG16:

Box 7.11 advises that: **"**If the co-location site is unusual in some way: for example, affected by specific large NOx sources other than road traffic, such as local industrial installations, this is a strong indication in favour of using a locally-derived factor"

The co-location site is situated on the eastern boundary of the Gatwick Airport and therefore affected by NOx sources from the Airport. The site is only 60m from the nearest residential property, and there are many other residential properties within 1000m of the airport. Determining relevant exposure within 1km of the airport boundary

is one of the assessment criteria required for authorities with a major airport within their boundary. This would therefore favour using the locally derived factor.

However, in paragraph 7.197 the guidance says that: “care should be taken to avoid applying a bias adjustment factor derived from a local co-location study carried out for concentrations that are very different to those being measured in the wider survey”

Although the effect of the airport as an area source should be considered it may be less of an influence at roadside locations where traffic sources will be the major consideration. At these locations the nationally derived factor may be more relevant.

Consultation with the laqm helpdesk in previous years resulted in the decision to use the more conservative locally derived bias factor of 1.02. The rationale for this decision was that it isn’t appropriate to use two different bias factors within the report, but since both national and local factors were close in value and the precision and accuracy of the local co-location study was very good, the more cautious approach would be to use the local factor. Consequently all conclusions and recommendations made in this report were based on monitoring results adjusted with the 2019 bias adjustment figure of 1.02.

C.3 Annualising NO_2 Diffusion Tube Monitoring Data (where data capture is < 9 months)

Where data capture is below 75%, it is necessary to annualise the data as described in Box 7.9 of the LAQM Technical Guidance TG (16). The reason for annualisation is that the concentration varies throughout the year, and the instrument may have been operational for a period of above or below average concentrations.

For those sites with fewer than 9 months’ worth of data, it is necessary to perform annualisation. This was undertaken for Three sites (CR103, 104 and 106) using the technique discussed in Box 7.9.

Methodology:

- Data was available for 8 full calendar months in 2019.
- The measured mean concentration **M** for this period was calculated.
- Two nearby, long-term, continuous monitoring sites: Gatwick East (CA2) and Poles Lane (RG3), with ≥ 85% data capture were identified.
- Annual means, $\mathbf{A_m}$, for 2019 were calculated for these sites (CA2 and RG3)
- Period means, $\mathbf{P_m}$, were calculated for the period of interest, (between Apr - Dec)

- The ratio, **R**, of the annual mean to the period mean (**A_m/P_m**) for each of the sites was calculated
- The average of these ratios, **R_a** was calculated. This is then the annualisation factor.
- The measured period mean concentration **M** multiplied by this annualisation factor **R_a** to give the estimate of the annual mean for 2019.

Table C 3.1 Annualising Diffusion Tube Monitoring data where data capture <9 months

Background Site	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m)	Ratio (A_m/P_m)
Gatwick East, Crawley (CA2))	25	25	25/25= 1.0
Poles Lane, Crawley (RG3)	15	14	15/14 =1.07
		Average (R_a)	1.04

The estimated annualised mean for the three sites with less than 9 months of data was calculated using the annualized factor R_a. The results are given in Table C.3.2 below

Table C 3.2 Estimated Annualised Mean NO_2 Diffusion Tube Data 2019

Site	Measured Period Mean M	Annualisation Factor (Ra)	Estimated Annual Mean
CR103	19.34	1.04	**20.11**
CR104	25.47	1.04	**26.49**
CR106	43.56	1.04	**45.30**

C.4: Fall off with Distance Calculator for NO_2 Annual Mean

This calculation allows the prediction of annual mean NO_2 concentration for a location "receptor" that is close to a monitoring site, but further from the road than the monitor. Often, for practical reasons, the monitoring site is not located at the façade of the receptor property. Where concentrations are measured closer to the source than the receptor, a fall off with distance calculation is used to check if measured concentrations are representative of exposure.

Where measurements have been carried out at the receptor/façade no fall-off calculation is necessary since the measurement is already representative of relevant public exposure.

Tables C4.1- C4.30 show the results of the adjusted concentrations. These fall-off concentrations are reported in Table B.1

Fall Off Calculations

Table C 4.1: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 1 – High Street (526799, 136785)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.75	17.7	15.41	34.45	24.4

Table C 4.2: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 3 – Birch Lea (528438,138392)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	7.35	18.62	20.54	19.60

Table C 4.3: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 4 – Headley Close (529864, 138204)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	14.8	17.48	23.13	19.70

Table C 4.4: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 52 – Gatwick East Schlumberger Hse (529417,141496)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	28	25	21.85	25.60	25.90

Table C 4.5: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 53 – Gatwick East Schlumberger Hse (529417,141496)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	28	25	21.85	24.87	25.10

Table C 4.6: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 54 – Gatwick East Schlumberger Hse (529417,141496)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	28	25	21.85	24.96	25.2

Table C 4.7: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 55 - 11Tinsley Close (Fence) (528446 138085)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	5.7	6.7	15.00	**42.10**	**40.70**

Table C 4.8: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 60 – Peglar Way (526740, 136934)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2.3	8.8	15.41	32.11	26.70

Table C 4.9: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 63 – Woodfield Lodge, Hazelwick Roundabout (528153, 137912)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	7.4	37.4	24.03	**49.24**	35.4

Table C 4.10: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 64 - Woodfield Lodge, Northgate Avenue (528150, 137825)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.62	6.2	24.03	**38.16**	33.90

Table C 4.11: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 66 – Brighton Road Level Crossing (526743,136346)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.2	1.7	15.41	29.92	28.9

Table C 4.12: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 72 - Burlands (525530, 138472)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.3	8	12.30	13.08	12.80

Table C 4.13: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 74 – Radford Road, Tinsley Green (528978, 139599)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	11.9	17.93	32.99	24.5

Table C 4.14: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 75 – Steers Lane (529335, 139589)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2	20.6	15.53	22.85	18.9

Table C 4.15: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 76 - Hazelwick Ave slip road, (528303, 137800)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2.52	12	24.03	**34.39**	30.40

Table C 4.16: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 77 - Hazelwick Ave The Bays, (528362, 137812)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2.3	8.8	24.03	34.90	31.40

Table C 4.17: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 85 – Tinsley Lane Flats, (528286, 138019)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	27	15	18.62	30.09	34.01

Table C 4.18: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 86 – The Boulevard, Flats, (526876, 136819)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	13.8	15.41	26.82	20.10

Table C 4.19: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 87 – The Broadway (526908, 136754)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	3.5	15.41	39.36	31.10

Table C 4.20: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 91 – Ocean House, Hazelwick Ave, (528681, 137177)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	0.5	5.7	24.03	31.96	28.50

Table C 4.21: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 93 St Mary's Drive, Three Bridges (528895, 137115)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.8	3.5	24.03	**52.78**	**48.4**

Table C 4.22: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 94 Station Hill, Three Bridges (528841, 137069)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	3.5	8.5	24.03	26.86	26.20

Table C 4.23: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 95 – Daniels House, Worth Park Ave, (528882, 137086)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2.2	8.0	24.03	31.94	29.50

Table C 4.24: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 96 – Pound Hill Junior School Worth Park Ave (529125, 137196)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	3.5	33.6	17.01	26.97	20.90

Table C 4.25: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 97 – Daisy Chain Nursery, Haslett Avenue East (528615, 136960)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.1	1.4	16.70	36.76	**35.8**

Table C 4.26: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 98 – Gatwick School, Gatwick Road, (528515, 139275)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	2.1	30.5	17.93	34.2	23.90

Table C 4.27: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 99 - Furnace Farm Rd , (528397, 135579)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.5	13.6	12.87	15.01	14.00

Table C 4.28: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 100 – A2220 Horsham Road Level Crossing, (526326, 136487)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.6	3.7	15.41	27.02	24.90

Table C 4.29: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 101 – A2220 Horsham Road Gossops Green, (525679, 135556)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	1.3	12.1	13.57	**49.88**	32.60

Table C 4.30: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 102 – Pease Pottage Hill A23 (526449, 134139)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2018	3.7	9.2	13.38	33.79	28.70

Table C 4.31: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 105 – A23 London Road, Northgate (526940, 137831)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	3.94	14.04	15.93	**43.94**	34.00

Table C 4.32: Fall off with Distance Adjustment for NO_2 Annual Mean					
Site with potential for Exceedance	**CR 106 – A23 London Road, Northgate (527000, 138357)**				
Year	**Distance of Monitoring Site from Receptor**		**Local Annual Mean Background Concentration ($\mu g/m^3$)**	**Measured Annual Mean NO_2 at Mon Site (bias adjusted) C_Y ($\mu g/m^3$)**	**Estimated Annual Mean NO_2 at Receptor (adjusted for fall off with distance)**
	Dist (m) Mon Site to Kerb D_Y	**Dist (m) Receptor to Kerb D_Z**			
2019	3.91	9.85	22.19	**46.21***	**40**

* Estimated concentration from annualised value

C.5 Adjustment of PM_{10} Monitoring Data Using Volatile Correction Model (VCM)

For the TEOM data the Volatile Correction Model (VCM) was used to adjust the data for the gravimetric equivalent concentration. VCM corrected data for the Gatwick East data is shown in Table C5.1 below.

Table C 5.1: Gatwick East PM_{10} Monitoring Adjustment using Volatile Correction Model (VCM) (from Kings College London ERG vcm web portal)

Local Measurement Data for VCM correction		**2019 Measured Data**	
Site	Gatwick East, Crawley	TEOM Annual Mean PM_{10} (uncorrected) µg/m^3	17.40
Year	2019 (1/01/19-31/12/19)		
Timescale	Daily Mean		
Monitor	TEOM		
EPA Constant A	3		
EPA Constant B	1.03		
Instrument Temp ^oC	25		
Instrument Pressure mbar	1013		
Reports to local ambient readings	No	No of exceedances of the 50µg/m^{3}in Daily Mean in 2019	4
Pressure Site	Reigate and Banstead 1	VCM Corrected Annual Mean PM_{10} µg/m^3	20.30
Temperature Site	Reigate and Banstead 1		
FDMS Sites	1. Reigate and Banstead (RG5) 2. Greenwich – (GN4) 3. Average of remaining sites*. * Correction includes unratified data		

C.6 Annualising PM_{10} Continuous Monitoring Data

Where data capture is below 75%, it is necessary to annualise the data as described in Box 7.9 of the LAQM Technical Guidance TG (16). This was undertaken for TEOM monitoring data at the Gatwick East site (CA2) where 73% data capture was achieved in 2019. The technique outlined in Box 7.9 was used to annualise the data following the same methodology described in C.3 above.

Table C 6.1 Annualising PM_{10} Monitoring data where data capture <9 months

Background Site	**Annual Mean 2019 (A_m)**	**Period Mean 2019(P_m)**	**Ratio (A_m/P_m)**
GatwickAirport (LGW3)	14	13	14/13 = 1.08
Poles Lane, Crawley (RG3)	15	14	15/14 =1.07
		Average (R_a)	1.07

The estimated annualised mean for the Gatwick East (CA2) TEOM PM_{10} was calculated using the annualised factor R_a. The results are given in Table C6.2 below

Table C 6.2 Estimated Annualised Mean PM_{10} Monitoring Data 2019			
Site	**Measured Period Mean M**	**Annualisation Factor (Ra)**	**Estimated Annual Mean**
CA 2	20	1.07	**21.40**

C.7 Estimating $PM_{2.5}$ Concentrations from Nationally Derived Correction Ratio - TG (16) Method

Where no appropriate local sites measuring both PM10 and PM2.5 are available, then it may not be possible to use a locally derived ratio. In this situation, a nationally derived correction ratio of 0.7 can be used.

This factor was calculated as the average of all ratios of PM2.5/PM10 found for years 2010 to 2014 for forty sites within the AURN where both PM10 and PM2.5 are measured on an hourly basis.

Crawley 2019 Annual Average PM_{10} (CA2 site Gatwick East) = 21.40 µg/m^3 (VCM)

$PM_{2.5}$ = 21.40 x 0.7µg/m^3

$PM_{2.5}$ = 14.98µg/m^3.

Appendix D: Maps of Monitoring Locations and AQMAs

Fig D.1 Hazelwick AQMA

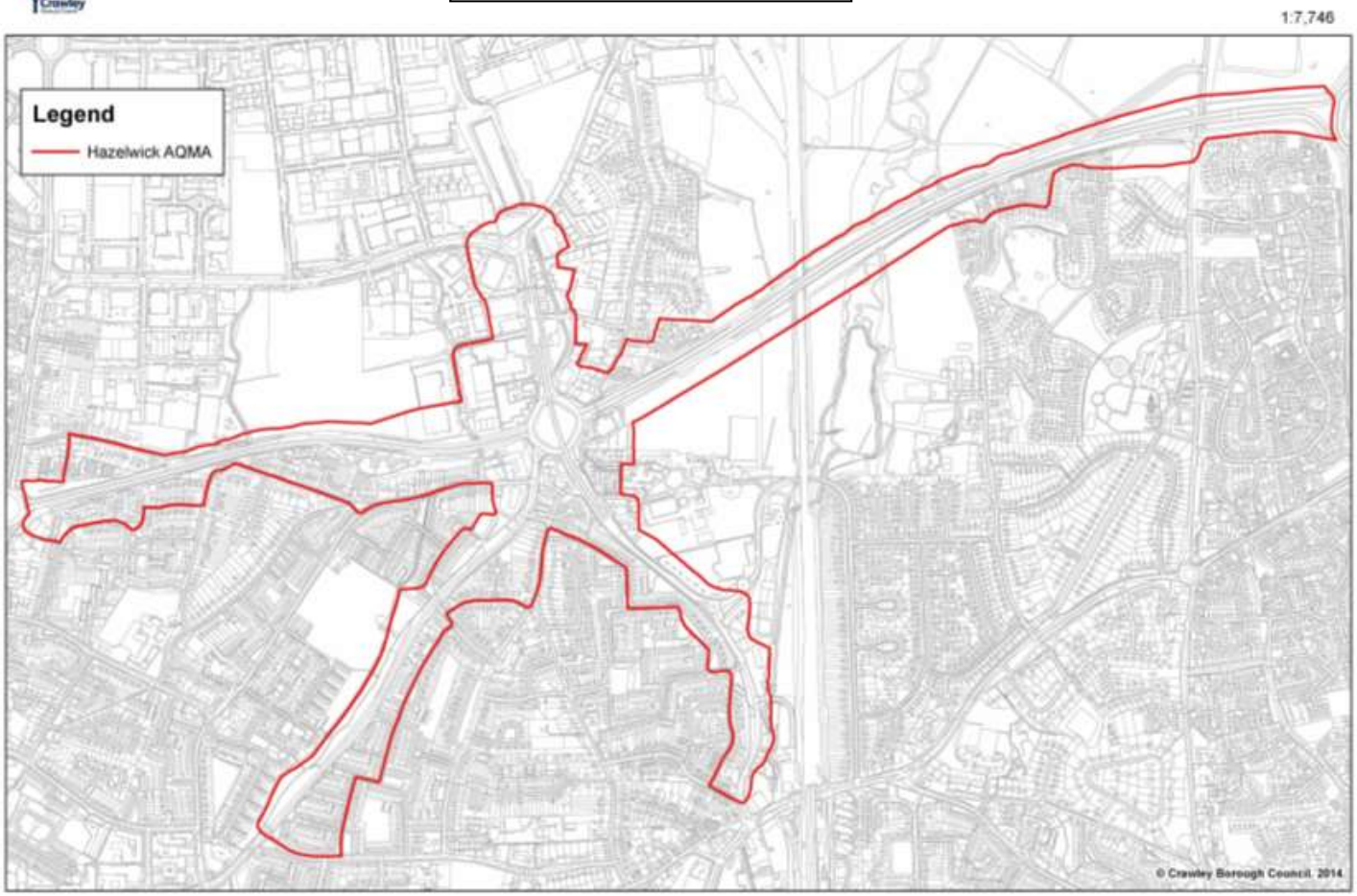


Fig D.2 2019 Diffusion Tube Monitoring Site Crawley Borough Council

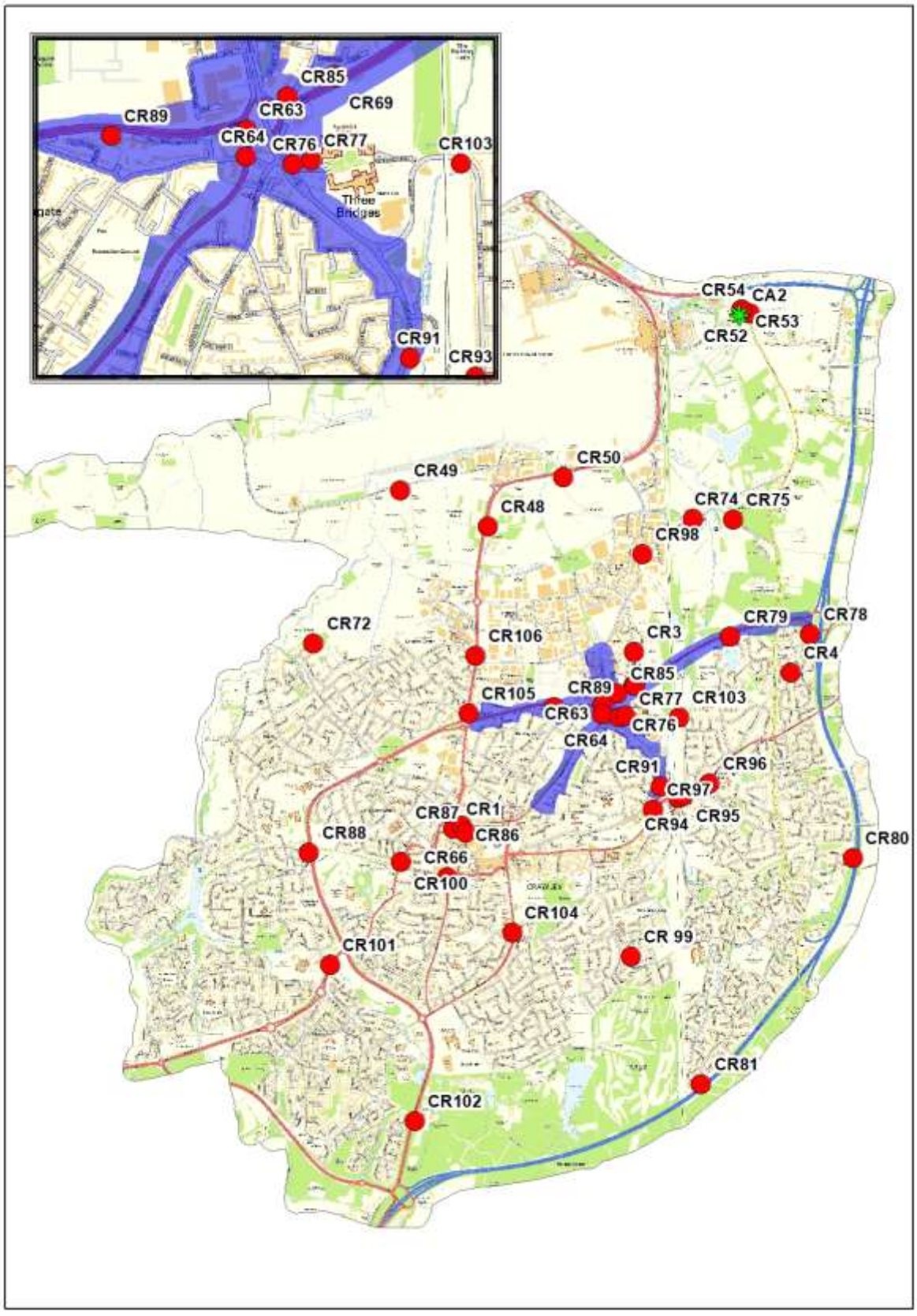


Fig D.3 Monitoring Sites in Hazelwick AQMA

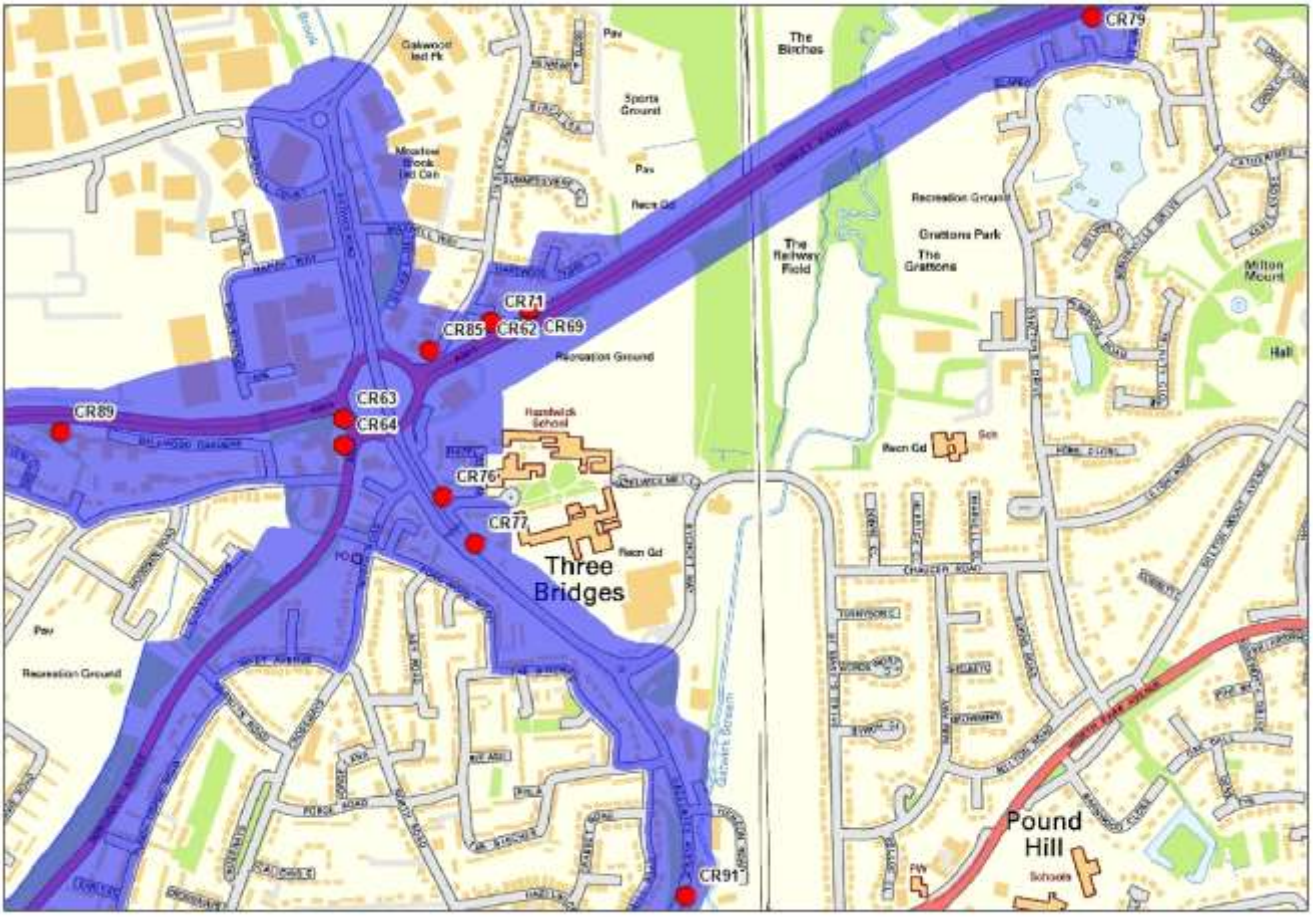


Fig D.4 Automatic Monitoring Sites - Gatwick Airport

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	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

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

Appendix F: New Pollution Sources and New Developments

There are a number of significant new or ongoing developments within the borough which may cumulatively contribute to pollution sources in the area. These include:

Commercial/Industrial Development:

1. **Manor Royal Business District** (adjacent to the Hazelwick AQMA) major redevelopment works, including:

    - Astral Towers/The White House (marketed as Nova), Betts Way - B8 warehouse – construction started 2020
    - Former GSK Site – Data storage/Cloud servers – completed 2020
    - Space Gatwick, Faraday Road – Flight Training Centre completed 2019
    - Land at Jersey Farm – B8 industrial development on greenfield land – planning permission given but construction not started
    - Forgewood employment land - 5000m^2 business (B1/2/8) land construction started 2020
    - Manor Royal District Heating Network – two energy centres :one with ground source heat pump and one with low NOx gas boiler - feasibility study stage

2. **Crawley Growth Programme:** £60m investment programme (public and private) to deliver infrastructure improvements and growth/regeneration to sites in the town centre and Manor Royal business district, including: delivery of 11,300m^2 office/industrial space at the Nova site London Road, 1,000 new homes in Crawley town centre by 2030, new Crawley railway station and sustainable transport infrastructure (bus, cycle routes and pedestrian walkways)

    Projects coming forward 2020/21:

    - Station Gateway (Mokka Site) - planning permission residential units
    - Station Gateway(Begrave Hse) -planning permission residential units
    - Station Gateway (Overline House) - awaiting planning permission Commercial/residential units
    - Town Centre (New Town Hall) - construction started

- Town Centre (District Heating Network (low NOx gas boiler) – construction started
- Town Centre (Car Park Land next to Town Hall, The Boulevard) - 91 dwellings – Geraint Thomas House.
- Crawley College – STEM building for WSCC education

Residential Development:

1. **Forgewood Residential neighbourhood**: Ongoing development of new neighbourhood, including 2000 new residential units, local shops, amenities, community centre, school and realignment of surrounding roads. The Forgewood development is adjacent to the Hazelwick AQMA. The development is still in the building phase, but the full impact of the development won't be known until fully operational – expected to be in 2022/3

2. **Key Housing Sites:** The following sites were identified as key housing sites in the Local Plan Map and are currently under construction:
    - Longley House (120 dwellings) – Planning permission but construction not started
    - Bridgefield House, Northgate Avenue (99 dwellings) –construction expected to complete 2020
    - Zurich House, East Park, Southgate (59 dwellings) –construction not started
    - Stoner House, Northgate Avenue (130 dwellings) –construction expected to complete 2021
    - Ocean House Hazelwick Avenue (38 dwellings) construction expected to complete 2020

All new developments are examined through the planning system and where necessary air quality assessments and mitigation are required in order to offset the impacts of existing and new sources of pollution on future residents.

In addition, diffusion tube monitoring within the AQMA and surrounding areas will measure the effects of new developments and new pollution sources, allowing the council to identify pollution hotspots and assess long term trends. These results are reported annually through the LAQM process.

Appendix G: Update on Extending Existing AQMA Boundary

Progress on declaring the new or extended boundary AQMA has been slow due to key personnel within council leaving, being on sick leave, or being redeployed during the Covid-19 pandemic.

The council is currently undertaking statutory consultation on the declaration of an extension to an existing AQMA (option1), or a new AQMA (option 2) prior to its formal declaration by legal order. This will be followed by a review of the air quality action plan to reflect amended area.

A copy of the consultation document is provided below:

Consultation on Proposed Changes to Crawley's Air Quality Management Area (AQMA)

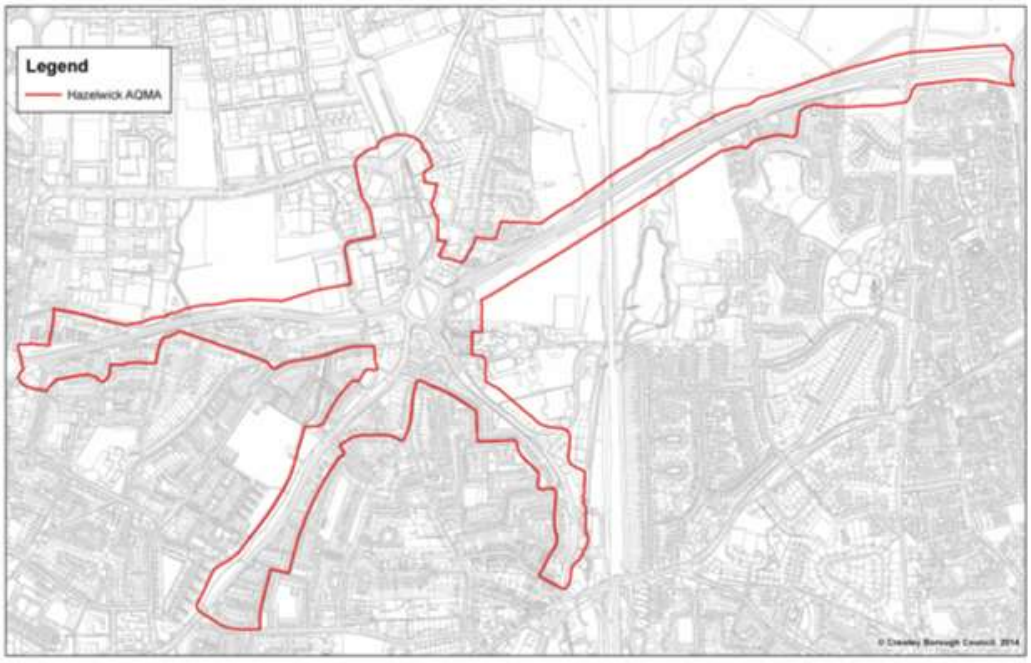
1. Legal Duty

Crawley Borough Council is required under Part IV of the *Environment Act 1995* to periodically review and assess the air quality in their area in line with guidance issued by the Department for Environment, Food and Rural Affairs (DEFRA). Present and likely future quality of the air is compared to the National Air Quality Objectives and where the objectives are found to be exceeded in areas of relevant exposure, an Air Quality Management Area (AQMA) must be declared and an action plan drawn up with measures aimed at reducing emissions to improve air quality.

2. Current Situation

The Council maintains an extensive monitoring network that records average ambient concentrations of nitrogen dioxide. Based on the results of monitoring, an AQMA was declared in 2015 for levels of nitrogen dioxide exceeding legal limits in the area around the Hazelwick roundabout. The Map below shows the location and boundaries of the current Hazelwick AQMA. The geographical boundary of the AQMA is set to identify the general area in which the Council wants to target actions to reduce ambient concentrations of road traffic related nitrogen dioxide. It is not meant to indicate all properties within its boundary have exceedances.

Existing AQMA



The current action plan measures are aimed at reducing traffic emissions in this area through a range of methods including: improving sustainable transport infrastructure; traffic management; awareness raising; and planning and policy measures to encourage modal shift. Progress on these measure are updated annually. The most recent 2020 update can be found here

Since this AQMA was declared, ongoing monitoring has indicated that annual average nitrogen dioxide levels are being exceeded outside the current AQMA, in the area around Three Bridges station on the A2220 Worth Park Avenue and Haslett Avenue East.

3. Proposed Actions

The council regularly reviews the boundaries of its existing AQMA to ensure it remains relevant. As a result, we are proposing two options to address the changes in nitrogen dioxide levels. The report outlining the assessment of air quality which lead to the recommendation of these options is available online via the following link

The options are:

Option 1 - Extend the existing AQMA boundary

This option wound link the new area of exceedance to the existing AQMA to form a single extended AQMA as shown in the Option 1 Map below.

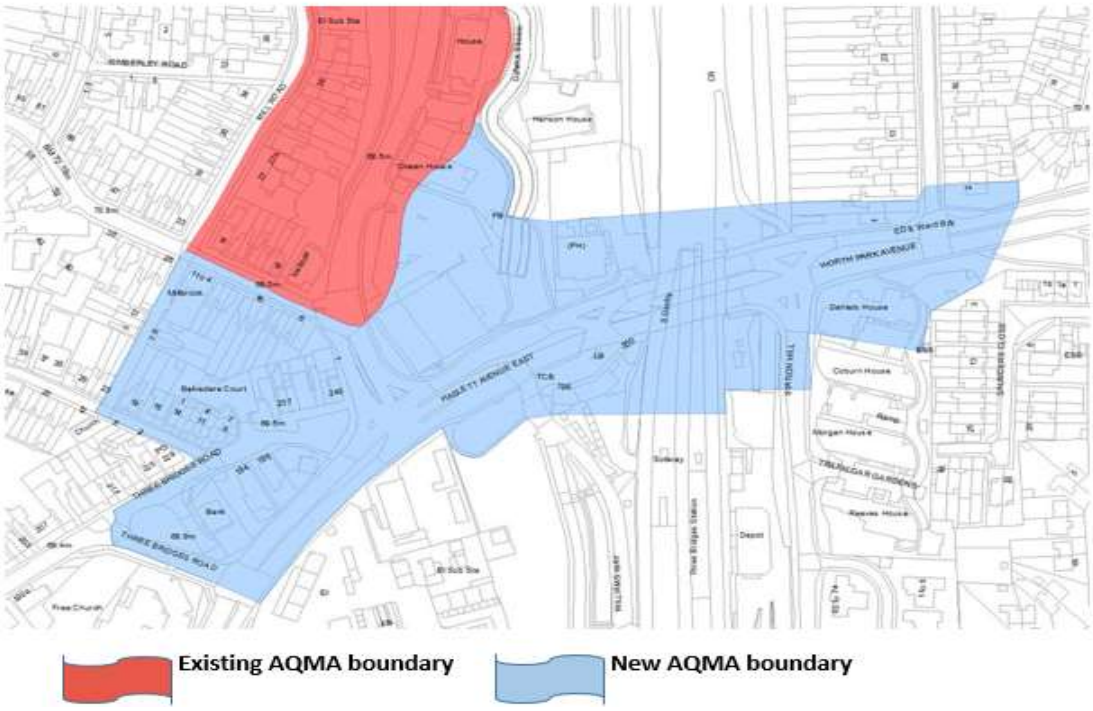
The new area would include the roads and properties fronting *parts* of:

- Worth Park Avenue from the junction of St Mary's Drive,
- Haslett Avenue East to the junction of Three Bridges Road,
- Three Bridges Road to New Street
- New Street to Mill Road
- Mill Road to Hazelwick Road

- Hazelwick Avenue.

Having a single AQMA allows a coordinated approach to addressing air quality issues across all locations in a holistic manner. It give focus to the traffic corridors that are contributing to the problem at specific locations within the area, and helps prevents the risk of solving air quality issues at one location and creating another elsewhere.

Option1 - Proposed Extension to Existing AQMA Boundary



Option 2 – Declare a new Three Bridges AQMA:

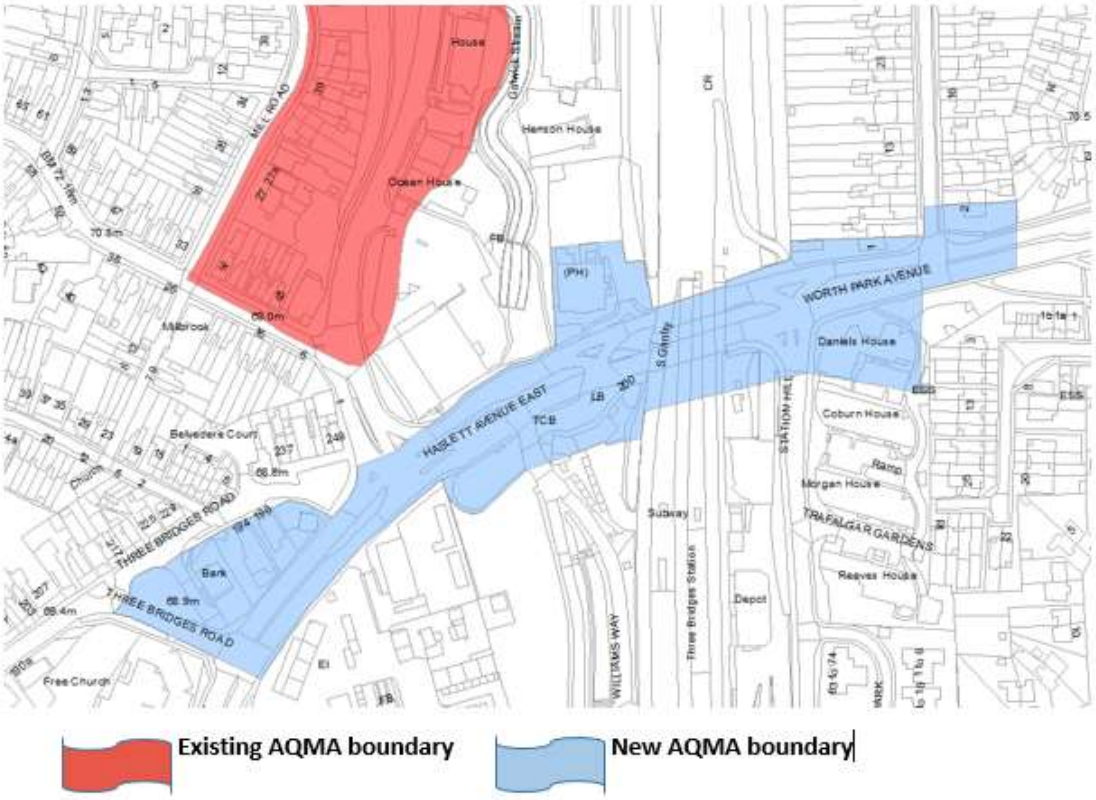
This option proposes the declaration of a new separate AQMA covering only those roads and the properties fronting them, where exceedances of the objectives have been recorded, as shown in the Option 2 Map below.

The new AQMA would include the roads and properties fronting ***parts*** of:

- Worth Park Avenue from the junction of St Mary's Drive,
- Haslett Avenue East to the junction of Three Bridges Road,

This option satisfies the Council's legal obligation to act on individual exceedances and has the advantage of defining the problem area very precisely. However, where the problem is a result of transport issues, as it is in this case, it may limit the council's ability to implement measures in a joined up way.

Option 2 - Proposed New AQMA Boundary



4. Consultation (How to Take Part?)

The Council is legally obliged to declare an AQMA in areas where the air quality objectives are exceeded. We would like to hear your views on the proposed options above.

When responding to these proposals, please consider the following points:

- Although required by law, the declaration of an AQMA is intended to be a positive and proactive step towards improving air quality.
- An AQMA is not meant to indicate all properties within its boundary have exceedances, but rather the geographical boundary of the AQMA is set to identify the general area in which the Council wants to target actions to reduce ambient concentrations of road traffic related nitrogen dioxide.
- Bringing an area within an AQMA means greater attention is paid to the air quality impacts of new developments within the planning process.
- Following the declaration of an AQMA, an Air Quality Action Plan will be drawn up or the current plan will be amended to identify actions to reduce air pollution levels. This action plan would also be subject to consultation.
- Creating further individual AQMA's ensures each problem area is dealt with in isolation and not in a collaborative, joined up way. It also presents the risk of creating new areas of exceedance due to displacement of local traffic
- In their appraisal of Crawley's Annual Status Report, DEFRA have endorsed the principle of consolidating the existing Hazelwick AQMA into one, to cover the new area of exceedance.

Glossary of Terms

Abbreviation	Description
AADT	Annual Average Daily Traffic
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
AQS	Air Quality Strategy
ASR	Air quality Annual Status Report
CBC	Crawley Borough Council
CGP	Crawley Growth Programme
CAZ	Clean Air Zones
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
DFT	Department for Transport
EA	Environment Agency
EFT	Emissions Factor Toolkit
EPAQS	Expert Panel on Air Quality Standards
EU	European Union
FDMS	Filter Dynamics Measurement System
GAL	Gatwick Airport Ltd
GP	General Practitioner
GPS	Global Positioning Systems
HGV	HGV Heavy Goods Vehicle

KS2	Key Stage 2
LAQM	Local Air Quality Management
LEP	Local Enterprise Partnership
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
LPTS	Local Plan Transport Strategy
MR BID	Manor Royal Business/Industrial District
MOVA	Microprocessor Optimised Vehicle Actuation (traffic light control system)
NAQS	National Air Quality Strategy
NPPF	National Planning Policy Framework
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OLEV	Office for Low Emission Vehicles
PHE	Public Health England
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
RTPI	Real Time Passenger Information
SAQP	Sussex Air Quality Partnership
TBC	To be Confirmed
WHO	World Health Organisation
WSCC	West Sussex County Council
ZEC	Zero Emission Capable

References

Local Air Quality Management Technical Guidance 2016 - LAQM.TG(16)

Local Air Quality Management Policy Guidance (PG09)

Sussex Air Quality Emissions Mitigation Guidance 2020

Draft Crawley Borough Council Local Plan 2020-2035

Crawley Borough Council Air Quality Action Plan (2018)

Crawley Growth Programme

Crawley Town Centre Regeneration Programme 2016

National bias adjustment factor spreadsheet:
http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Tube precision spreadsheet:
www.airquality.co.uk/archive/laqm/tools/AEA_DifTPAB_v03.xls

Volatile Correction Model website:

http://www.volatile-correction-model.info/

Air Quality Consultants: Nitrogen Dioxide Distance from Road Calculator (Issue 4)