Tunbridge Wells Borough Council

2020 Air Quality Annual Status Report (ASR)

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

June 2020

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Executive Summary: Air Quality in Our Area

Air Quality in Tunbridge Wells Borough Council

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].

Tunbridge Wells is a borough in Kent and consists of the main town of Royal Tunbridge Wells and a number of small towns and villages including Paddock Wood, Cranbrook and Hawkhurst. The borough is largely rural in character.

The mid-year population of the borough in 2018 was 118,100 based on figures from the Kent County Council[1]. This is expected to rise to 122,700 by 2026. The main roads which serve the borough include the A26, A264, A267 and the A21.

Royal Tunbridge Wells suffers from congestion, particularly on the approach roads to the town centre. Other pollution sources, including commercial, industrial and domestic sources, also contribute to the background pollution concentrations.

There is one Air Quality Management Area (AQMA) declared in the Borough due to exceedances of the annual mean Air Quality Strategy (AQS) objective for nitrogen dioxide (NO_2). This AQMA was originally declared in 2005 and extended in 2011 due to exceedances outside of the original AQMA boundaries. The Action Plan adopted by the Council in 2010 was largely completed by 2017, therefore a new action plan was produced during 2018 to cover the period 2018 to 2023. The new plan was adopted by the council in early 2019 and actions are being implemented in line with the action plan.

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1 www.kent.gov.uk/research
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, April 2013 updated Feb 2019

At the end of 2016, Tunbridge Wells BC commissioned Air Quality Consultants Ltd to review the boundaries of its AQMA. The review concluded that the northern and southern ends of the AQMA could be extended, but that the width of the AQMA could be reduced. This process was formally completed in 2018, with the new AQMA taking effect from 1st September 2018.

The 2019 annual mean NO_2 level, measured at the A26 St John's Roadside automatic monitoring location was again slightly lower than previous years, and was below the annual mean objective for NO_2 at 34µg/m^3, thus continuing the downward trend we have seen in recent years. The 1-hour objective for NO_2 was met at this location, with no instances of the hourly mean exceeding 200µg/m^3.

We have seen a steady decline in NO_2 levels over the past 5 years during which annual mean NO_2 levels have dropped from 48ugm^3 in 2014 to 34 ugm^3 in 2019. Due to COVID 19, 2020 will not be an accurate representation of a typical year as traffic levels and the movement of people has reduced due to lockdown and it may not be until the end of 2021 that we get a true representation of data. We propose to continue monitoring throughout 2020 and 2021 and if the downward trend remains (even after traffic increases post COVID 19 lockdown) we aim to revoke the AQMA in Tunbridge Wells from March 2022.

For the 2019 non-automatic monitoring data set there were only two sites within the existing AQMA where the annual mean AQS objective was exceeded. The two sites are:

- TW41 - 38 The Pantiles/London Road
- TW58 – Union House, London Road

These sites are not located at the façade of relevant receptors. Therefore, the NO_2 fall-off with distance calculator was used to estimate the NO_2 concentration at the nearest locations relevant for exposure.

Following the fall-off calculations, the annual mean NO_2 concentrations at the closest locations of relevant exposure for TW58 and TW 41 were found to be below the 40µg/m^3 objective.

Hawkhurst

The new site in Hawkhurst (TW63, Smugglers Rest), established towards the end of 2018, continued to measure monthly levels over the annual mean objective for NO_2 in

2019. A further five diffusion tubes were deployed in Hawkhurst from August 2019 to gain a further understanding of the situation and to gather further monitoring information for a detailed assessment to be commissioned in early 2020. The draft report by Air Quality Consultants Limited (AQC) was completed in May 2020 and is included in this report (see Appendix F). TWBC are satisfied with the modelling, analysis and conclusion. In addition to the work already carried out by the consultants, we have asked AQC to model source apportionment (SA) as part of the final report. The report advises that an Air Quality Management Area (AQMA) will need to be declared on the uphill section of Cranbrook Road in Hawkhurst. Work will continue throughout 2020 to finalise the detail of the AQMA and to inform and consult residents and other parties. It is hoped that we can declare the AQMA towards the end of 2020.

Actions to Improve Air Quality

The new Air Quality Action Plan (AQAP) for Tunbridge Wells Borough Council was adopted by the council in early 2019.The aim of the action plan are as follows:

1. To ensure that TWBC is complying with relevant air quality legislation.
2. To achieve a higher standard of air quality across the Tunbridge Wells borough.
3. To engage with partners and colleagues including those representing Highways and Transportation, Public Health, Economic Development, local bus companies and other relevant stakeholders, to improve air quality across the borough.
4. To build on previous work in this area in order to drive further improvements in air quality with the ultimate aim of being able to revoke the Air Quality Management Area.

The proposed general borough-wide measures to improve air quality include:-

- Support for measures to increase the use of sustainable transport modes such as walking and cycling.
- Investigation of a Low Emission Standard for buses.
- Incorporation of an SPD into the emerging Local Plan

- Improve the vehicle emissions for taxis.
- Reduce the idling of engines whilst stationary.
- Engaging with schools to reduce the impact of school traffic.
- Incorporate initiatives into planning policy and the local plan

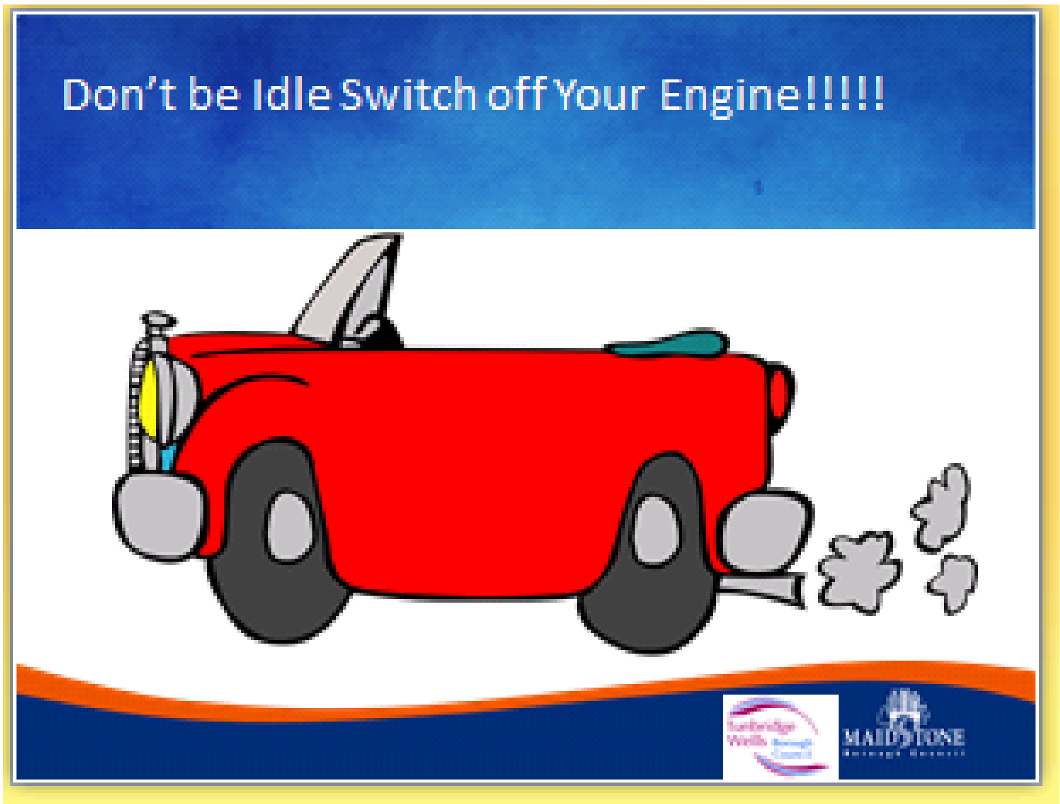
In addition, a few of the existing policies and strategies also in place to help improve air quality within the borough include:

- Kent and Medway Air Quality Partnership Air Quality and Planning Technical Guidance (Updated 2016)
- Kent County Council Local Transport Plan (2016-2031)
- Tunbridge Wells Borough Local Plan (2006) (currently being updated). The draft Local Plan went out for public consultation in Autumn 2019.
- Tunbridge Wells Borough Development Plan – Transport strategy (2015 – 2026)

Our Clean Air For Schools (CAFS) project continues to run across the boroughs of Tunbridge Wells Borough Council (TWBC), Maidstone Borough Council (MBC) and Swale Borough Council (SBC). It has been extremely successful in introducing air quality to pupils and teachers, promoting our anti idling campaign and encouraging the school to consider how their individual behaviour can help to improve the air quality in their local community. We have engaged with over 80 primary schools since 2018 across the three boroughs by delivering interactive assemblies, creating a CAFS information section on each local authority website and creating additional teaching material. We ran a competition throughout 2019 for each school to create and enter a banner for our anti idling campaign. The winning school in each borough had their banner made into large printed banners. These were handed out to schools to display along the roadside near their school to encourage drivers to switch off their engines. Our assemblies, competition and achievements were promoted through the Councils social media accounts and schools were encouraged to promote the message to parents, guardians and their community through internal news letters and competitions and banners.

Figure 1: Logo of Clean Air for Schools Project (from School Assembly material)

Figure 2: Anti Idling Slide (from School Assembly Material)



Schools were also able to borrow a ‘Plume Flow’ indicative pollution monitoring device, in order to conduct their own experiments, for example comparing pollution levels of different routes to the school or pollution encountered whilst using different modes of transport to school, e.g. walking, cycling, car, bus etc.

Figure 3: School Assembly Slide Relating to Plume Flow Device

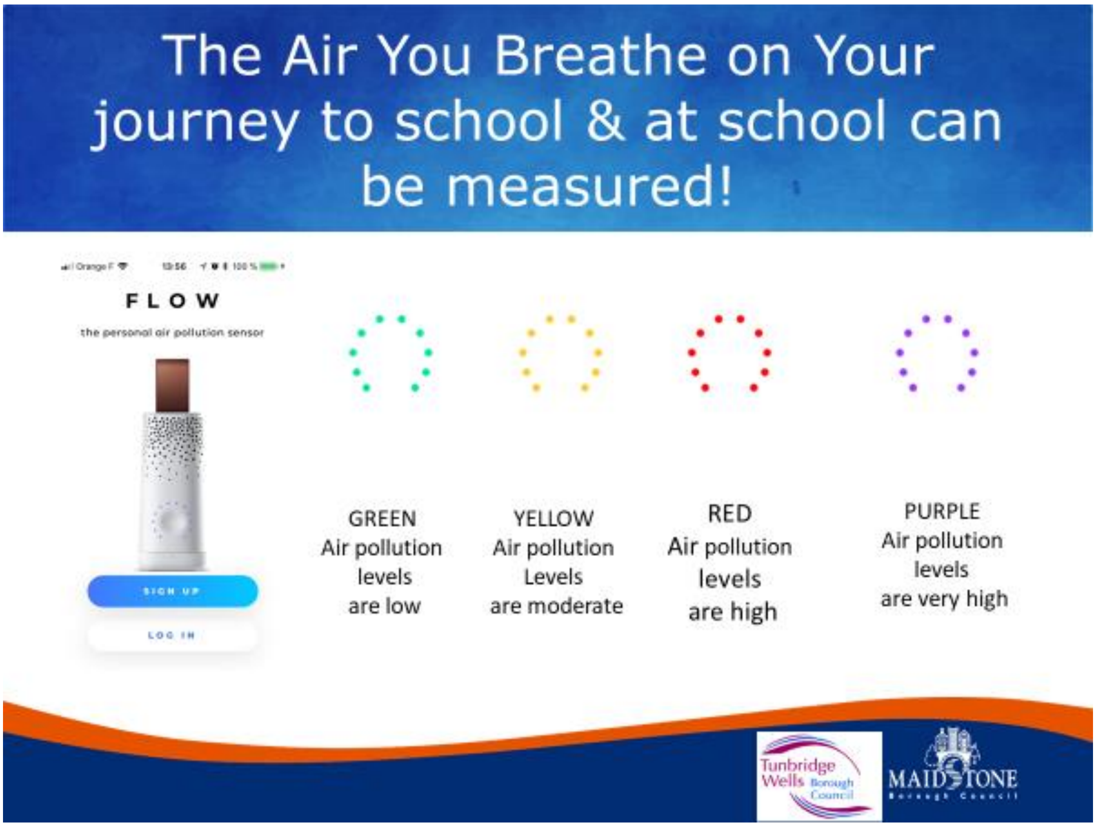
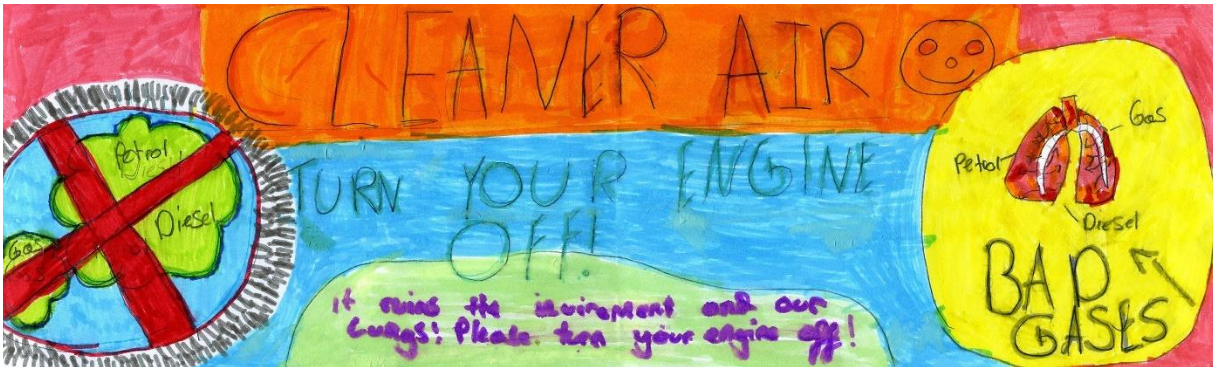


Figure 4 Winning entry in the CAFS anti Idling Banner competition for TWBC. Winning banner from St Marks School.



To further promote our CAFS message and reach a wider audience we applied for funding through the DEFRA Air Quality Grant Scheme 2019/20. TWBC lead on an application for a joint project with MBC and SBC. The application was for professional theatre group to attend schools across the partnership to present information about air quality to children. The application submitted outlined the request for funding the professional theatre group to complete this project.

The main objective of this project was to build on the assemblies and teaching material created for CAFS and to visit and educate and increasing number of primary school pupils about the causes and concerns of poor air quality and promote safe, sustainable travel to primary schools in a more engaging and interactive manner. By using a professional theatre company to perform to primary schools we proposed to further our CAFS project and put local authority resources into creating a class based presentation and teaching resource to secondary schools. Extending our CAFS message to secondary schools will further promote behavioural change to a wider audience.

Whilst we understand that that the funding available from DEFRA is limited and applications numerous and wide ranging, we were disappointed to receive notification that the application was unsuccessful on this occasion.

Conclusions and Priorities

The 2019 monitoring results show that the annual mean of NO_2 measured at the air quality station (located on St Johns Road, Tunbridge Wells) and from the diffusion tubes (located in Tunbridge Wells, Southborough, Pembury and Paddock Wood) are below the annual mean objective of 40ug/m^3. Measurements of particulate matter of less than 10 micrometres in diameter (PM_{10}) (measured at the air quality station have continued to reduce and remain below the objective. The level recorded for 2019 was 21µgm^{-3}, again showing a decrease in PM_{10} levels. PM_{10} levels in Tunbridge Wells are consistently below the objective level of 40µg/m^3 (annual mean of 21ug/m3 in 2019) and will need further monitoring to establish the likely trend.

We have and will continue working with schools to promote our Clean Air for Schools campaign and anti-idling message and work with other groups, departments and authorities to promote sustainable transport including cycling and walking.

We feel that our priority for 2020 will be to investigate and establish an AQMA in Hawkhurst. We propose to work and engage with a number of departments within the Local Authority including Development Control (Planning) along with residents, interested parties and the local parish council. We propose to commence the public engagement from July 2020 with the aim to declare an AQMA towards the end of 2020.

Local Engagement and How to get Involved

As transport is the main source of air pollution within the borough of Tunbridge Wells, the easiest way for the public to get involved with helping to improve air quality within the area would be to look at alternatives to the way they usually travel.

The following are suggested alternatives to private travel that would contribute to improving the air quality within the Borough:

- Use public transport where available – This reduces the number of private vehicles in operation reducing pollutant concentration and helping to reduce congestion;

- Walk or cycle if your journey allows – From choosing to walk or cycle for your journey the number of vehicles is reduced and also there is the added benefit of keeping fit and healthy;

- Car/lift sharing – Where a number of individuals are making similar journeys, such as travelling to work or to school car sharing reduces the number of vehicles on the road and therefore the amount of emissions being released. This can be promoted via travel plans through the workplace and within schools; and there is further information on https://kent.liftshare.com

- Alternative fuel / more efficient vehicles – Choosing a vehicle that meets the specific needs of the owner. Fully electric, hybrid fuel and more fuel efficient cars are available and all have different benefits by reducing the amount of emissions being released. The installation of Electric Vehicle charging points is being promoted through the use of conditions attached to relevant planning permissions.

We plan to continue with our CAFS project and engage with more primary schools within the three boroughs. We also propose to spread our message and project to secondary schools, possibly through presentations to class groups and curriculum related teaching material and projects.

For Hawkhurst we will commence the public engagement exercise from July 2020. The work will involve writing to properties that will be affected along with all interested parties and groups, producing guidance in the form of leaflets and webpages and inviting comments and questions.

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1 Local Air Quality Management

This report provides an overview of air quality in Tunbridge Wells Borough Council (TWBC) 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 TWBC 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 (AQMA) 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 TWBC 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://uk-air.defra.gov.uk/aqma/local-authorities?la_id=287..

The AQMA in Tunbridge Wells has seen a steady decline in NO_2 levels over the past 5 years during which annual mean NO_2 levels have dropped from 48ugm3 in 2014 to 34 ugm3 in 2019. Due to COVID 19, 2020 will not be an accurate representation of a typical year as traffic levels and the movement of people has reduced due to lockdown. It may not be until the end of 2021 that we get a true representation of data. We propose to continue monitoring throughout 2020 and 2021 and if the downward trend remains (even after traffic increases once COVID 19 restrictions have been eased) we aim to revoke the AQMA in Tunbridge Wells from March 2022.

Hawkhurst

The Parish Council for Hawkhurst raised concerns in 2018 relating to the current and potential future air quality in Hawkhurst, especially where two major roads (A268 and A229) meet at traffic lights in the centre of the village. Hawkhurst has seen many planning applications submitted to the planning portal for the development of schemes ranging from small developments averaging ten houses to sites of many hundred properties. In addition, the proposed local plan has also identified several additional sites around this village that may be allocated for residential development.

We previously monitored the air quality in Hawkhurst at the lamppost located outside 8 The Colonnade, Rye Road, Hawkhurst from 2009 until 2017. The diffusion tube site number was TW 42. The annual results for this site average around 25 ug/m^3 NO_2 when bias adjusted. Following a review of diffusion tube locations across the borough in 2018, the diffusion tube was discontinued in 2018 due to the consistent readings from this location which were well below the objective of 40 NO_2 ug/m^3.

Diffusion monitoring location TW63 HH (Smugglers Rest) was chosen in 2018 due to its proximity to a residential property and location. The diffusion tube is located on a narrow uphill section of road near to the traffic lights. This section of road is regularly congested and the narrow road with the high sided properties can create a canyon effect inhibiting dispersion of pollutants. The location was therefore thought to be a worst case scenario in Hawkhurst.

Following the results from the TW63 diffusion tube in 2019, a further 5 diffusion tubes were deployed in Hawkhurst from August 2019 to gain a further understanding of the situation and to gather further monitoring information for a detailed assessment to be commissioned in early 2020.

In February 2020, TWBC commissioned Air Quality Consultants Ltd (AQC) to analyse the data collected from the diffusion tubes located in Hawkhurst, to undertake a detailed assessment, provide a professional opinion regarding declaring an Air Quality Management Area (AQMA) in Hawkhurst and to define locations where the objective would be exceeded. As part of the investigation we asked AQC to carry out a further assessment to model source apportionment (SA). The report by Air Quality Consultants Limited (AQC) was completed in May 2020.

TWBC are satisfied with the modelling, analysis and conclusion. The report by AQC can be found in Appendix F. It is advised to refer to this report for further detail and information.

The report details the assessment methodology using ADMS-Roads dispersion model and DEFRA's Emission Factor Toolkit (EFT). The traffic data was sourced from Department of Transport annual traffic count for 2018. Where assumptions are made, a realistic worse case approach was adopted. The data collected from five diffusion tubes deployed from August 2019 required annualisation due to an incomplete year of results. Modelling uses algorithms to modify the data based on the levels and typography of the location. The model is then further verified and adjusted to ensure confidence in the predictions.

The data collected from the diffusion tubes were corrected by AQC for the purpose of investigating the requirement of an AQMA in Hawkhurst. To allow for greater accuracy in the annualisation, the diffusion tubes deployed in August 2019 (TW66, TW67, TW68, TW69 and TW70) have been annualised to 2019 annual mean concentrations and included the data from tubes deployed in January and February 2020.

Figure 2.1 Measured Annual Mean Nitrogen Dioxide Concentrations (µg/m3). Table taken from AQC, Air Quality Monitoring report: Hawkhurst, Tunbridge Wells.

Site name	Site Type	Location	2018	2019
TW63	Roadside	Cranbrook Road, Hawkhurst	**52.4 (a)**	**52.7**
TW66	Roadside	Rye Road, Hawkhurst		26.2 (a)
TW67	Roadside	Highgate Hill, Hawkhurst		35.9 (a)
TW68	Roadside	Cranbrook Road, Hawkhurst		38.1 (a)
TW69	Roadside	Cranbrook Road, Hawkhurst		**45.3 (a)**
TW70	Roadside	Cranbrook Road, Hawkhurst		37.7 (a)
Objective			40	

Exceedances of the objectives are shown in bold. (a) Indicates results have been annualised

The results identified TW63 and TW69 to be above the objective. These diffusion tubes are located along Cranbrook Road close to the junction with Rye Road. Site TW70, which is located further down Cranbrook Road, is below but close to the objective. Monitoring locations in Highgate Hill and Rye Road measured lower levels of NO_2 and suggest that any AQMA declared in Hawkhurst should focus along Cranbrook Road.

AQC looked at possible residential properties in Hawkhurst that would exceed the annual objective (40 $\mu g/m^3$). The model identified a number of properties located along Cranbrook Road. The model did not show any properties with NO_2 levels greater than 60 ug/m^3 in Hawkhurst and therefore the hourly mean objective for NO_2 was unlikely to be exceeded.

The report details the residential properties that have been identified as receptors with modelled concentrations of over 40 $\mu g/m^3$ (identified in red in Figure 2.2 below). The properties identified in blue on Figure 2.2 below are those which are judged to have a reasonable likelihood of an exceedance when the model uncertainties (due to factors such as height, canyon effect etc.) have also been considered. They have been included due to the relative likelihood of exceedances at these residential properties.

The report looked the source apportionment (percentage and type of vehicles that would travel through Hawkhurst) contributing to the objective exceedances in Hawkhurst. The following categories were considered and included in the assessment:

- Regional background;
- Local background;
- Cars;
- Lights Good Vehicles (LGV);
- Buses and Coaches;
- Rigid Heavy Goods Vehicles (HGVs);
- Artic HGVs; and
- Motorcycles.

The modelling showed the contribution from each of the different categories at receptors located at the top of Cranbrook Road and on the steeper section of

Cranbrook Road. At all receptors where exceedances are predicted, the largest proportion of the overall concentration is caused by cars (34-35%), followed by LGVs (24%), and Rigid HGVs (13-17%). Background concentrations were predominately from regional sources which only contributed to small proportion of NO_2 concentrations (15%-21%)

The report does note *'that progressive improvements in vehicle emissions, and a transition away from diesel vehicles and towards zero tailpipe emission vehicles is expected to lead to reduced nitrogen dioxide concentrations in future years (DfT, 2018). It is, therefore, reasonable to expect concentrations to reduce from those measured and modelled in 2019 in the coming years, more rapidly than they have in previous years. This should perhaps also be taken into account when deciding whether the properties within the blue areas on Figure 4 need be included in the AQMA, as they are unlikely to experience objective exceedances much beyond 2019*. '. Due to COVID 19 it is unlikely that we will gain any meaningful data in 2020 and it highly likely that accurate data cannot be fully analysed until the end of 2021 and therefore reason to include the properties identified in blue.

Emissions from domestic and commercial vehicles are predicted to decrease over a number of years due to the natural progression to newer and cleaner vehicles. However the number of vehicles on the road has been predicted to increase. It is possible that the predicted general increase in the number of vehicles on the road will result in an increase of domestic and LGV movements in the area. We will take this into account when drawing up the AQAP for Hawkhurst and consider measures such as:

- Steps for mitigation methods in new developments (such as EV charging points for all new properties)
- Private, Local Authority or County Council car club or car sharing schemes.
- Improvements to public transport.
- Introducing tighter controls and restrictions to parking and deliveries on all roads located near to the crossroads.

Engagement will take place shortly (from early July 2020) in the form of a letter to stakeholders, identified residential properties and further information and links available on the TWBC website. The webpage will also include a section where individual questions can be asked, the answers to these questions will be placed on the webpage. The engagement will raise awareness of the situation and will explain the process and expected outcome. It is hoped that we can declare the AQMA towards the end of 2020.

Figure 2.2 - Recommendation for the Hawkhurst AQMA (image taken from the AQC document)

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
A26 AQMA	Declared <2005>, Amended <2011> Amended 2018	NO_2 Annual Mean	Tunbridge Wells	The A26 between Park Road and Neville Terrace also including Grosvenor Road, at 0-30m from the road (centre line)	NO	41.8	µg/m3	34	µg/m3	TWBC AQAP 2018	2019	https://laqm.defra.gov.uk/1rsw2/submit/progress.php?z&revId=7360

☒ Tunbridge Wells Borough Council confirm the information on UK-Air regarding their AQMA(s) is up to date

2.2 Progress and Impact of Measures to address Air Quality in Tunbridge Wells Borough Council

Defra's appraisal of last year's ASR was that the report was well structured, detailed, and provided the information specified in the Guidance. The following comments were made to inform future reports:

1. **Progress of AQAP measures (Table 2.1) has not been reviewed or incorporated into the ASR. While this is a key requirement, the Council note the development of the new AQAP during 2018 and its formal adoption in January 2019. Whilst it has been deemed acceptable that this not be included on the basis of the Council's reasoning, the Council are expected to include a detailed and comprehensive review of progress of the new AQAP measures during 2019 in the 2020 ASR, following the prescribed template.**

Comments: The update to the AQAP are contained in Table 2.1 and Section 2.2 of the ASR and show the progress that has been made to the AQAP measures.

2. **The new AQAP was formally adopted in January 2019. New AQAP measures have been appended to the report, however the Council should seek to identify KPIs for each measure for inclusion in next year's ASR.**

Comment: KPI's have been considered and included where possible, they are detailed in Table 2.1. However, we have seen five or six years of steady decline in pollution levels in Tunbridge Wells, during which annual mean NO_2 levels measured at the Tunbridge Wells air quality station have declined from 48µgm^{-3} (2014) to 34µgm^{-3} (2019).

Although 2020 will be an exceptionally low year due to the COVID 19, it is expected that 2021, will continue the downward trend in NO_2 levels. If levels continue to decline in 2021, the Council intends to revoke the AQMA in Tunbridge Wells by March 2022 (extended time frame due to COVID 19). Therefore, although we will continue to progress the existing AQAP as far as possible, we do not propose any further reviews or updates to this AQAP. However, consideration will need made to ensure the air quality improvements we have achieved can be protected and for the completion of the current AQAP. The air quality priorities for the Council now are the declaration of the AQMA in Hawkhurst and developing the associated action plan, which will include KPI's. We therefore do not feel that it would a good use of time and resources to develop KPIs for the existing AQAP.

We are working towards influencing change and by working to improve and support the cycling and walking infrastructure to increase the use of sustainable modes of transport such as walking and cycling through more prominent signage, safer routes and providing and promoting alternatives to vehicle use. Equally, the concerns are that with recent COVID 19 government advice to avoid public transport, there is a significant risk traffic levels will increase due to the increase in private car use and it will be critical to monitor for this and work towards promoting active travel as part of air quality protection.

Our assemblies and work through the Clean Air for Schools (CAFS) project focuses on showing pupils and teachers that there are alternatives to travelling to school rather than being driven, schools are being encouraged to build on this by raising awareness through school activities and submitting designs for our CAFS banner competition.

3. **The Council state that the LAQM.TG16 Table A.1 Action Toolbox will be reviewed for incorporation in the new AQAP however this was stated in last year's ASR and the AQAP has now been released. It is unclear whether any of these measures have been included in the AQAP. The Council may wish to consider clarifying this prior to final submission and indicate whether there are future plans to incorporate such measures if not already.**

Comment: TWBC does not currently undertake any monitoring of $PM_{2.5}$ and consequently there are no specific measures in place to address $PM_{2.5}$ concentrations within the Tunbridge Wells Borough. In the absence of $PM_{2.5}$ monitoring it can be estimated using the model detailed in Chapter 7 Section 1 of TG16 (Section 7.107 – 7.111). The model calculates that $PM_{2.5}$ levels are estimated to be 14.7ugm^3 (PM_{10} annual mean measured at 21ugm^3 for 2019). $PM_{2.5}$ monitoring in the neighbouring district of Maidstone suggests the exceedances of the $PM_{2.5}$ objective in Tunbridge Wells are highly unlikely. Measured PM_{10} levels are gradually reducing and therefore it can be estimated that $PM_{2.5}$ levels following a similar pattern.

LAQM.TG16 Table A1 Action Toolbox provides a list of measures that can be implemented to tackle $PM_{2.5}$, and some of these measures are included in our

AQAP including anti idling campaigns, encouraging behavioural change (CAFS) and promotion of cycling and walking. However it is also recognised that any measures employed to reduce NO_2 and PM_{10} will also have a beneficial effect on $PM_{2.5.}$ At this current time TWBC does not have any additional funding to install equipment that will measure $PM_{2.5,}$ but it would be a consideration for the future, possibly if an air quality station was proposed in Hawkhurst or if the Tunbridge Wells Air quality Station was upgraded but this would be subject to a number of factors, including funding.

4. **The QA/QC of monitoring data is thorough and includes supporting evidence. This is good practice and encouraged for all future reports.**

Comment: Noted

5. **Bias adjustment has been correctly carried out, and supporting evidence provided. This is good practice and encouraged for all future reports.**

Comment: Noted

6. **Annualisation has been carried out where appropriate. Evidence of this has been provided and is encouraged for all future reports.**

Comment: Noted

7. **Monitoring results have been distance-corrected where appropriate (e.g. where there are exceedances of the air quality objective at locations not representative of relevant exposure). Following distance correction, there are no exceedances within the AQMA.**

Comment: Noted

8. **Five additional monitoring sites were introduced for/during 2018. The NO_2 annual mean objective is exceeded at one of these locations, TW63, and is representative of relevant exposure. This site does not lie within the AQMA boundary. Results for this site have been annualised from 4 months of data and must therefore be viewed with caution. Upon receipt of 2019 monitoring data, the Councils should re-address any exceedances.**

Comment: Further monitoring locations have been established in Hawkhurst in 2019. The results of TW63 have continued to show raised levels of NO_2 (above $40ug/m^3$) throughout the year, with unusually high levels in the summer months (due at least in part to road works taking place throughout June and July 2019). In 2020 we engaged an air quality consultant to undertake a detailed assessment of the location, and we have included the report in appendix F.

9. Trends in concentrations are not discussed in for all pollutants. It would be useful to see 5-year trend graphs and corresponding discussion of concentrations for each monitored pollutant.

Comment: Trends over 5 years have now been included for the monitored pollutants in TWBC, namely PM_{10} and NO_2.

10. Maps of monitoring locations do not show the AQMA boundary, and therefore interpretation is difficult. The Council are encouraged to ensure that all future maps show the AQMA boundary in addition to labelled monitoring locations.

Comment: Maps have been updated for 2020 ASR and now include the current AQMA in Tunbridge Wells on the appropriate maps.

TWBC has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

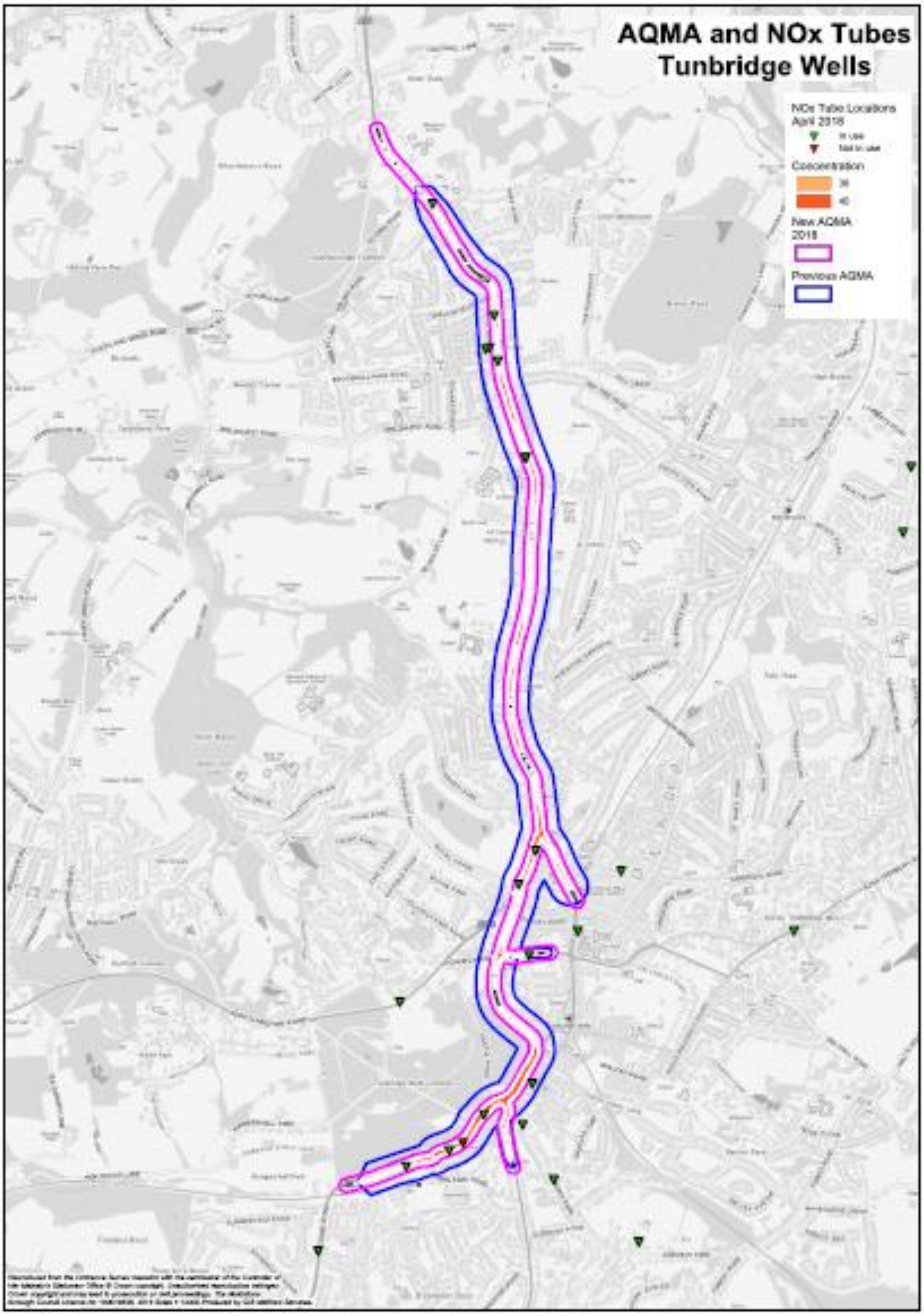
More detail on these measures can be found in their respective Action Plans including the Tunbridge Wells Borough Council Air Quality Action Plan (2018-2023), Tunbridge Wells Borough Development Plan Transport Strategy 2015 – 2026 (July 2015), Kent County Council Local Transport Plan (2016-2031), Tunbridge Wells Borough Council Draft Local Plan relating to the Council's proposed strategy for the future development in the borough (public consultation carried out in September to November 2019) with the aim for adoption in early 2022.

A revised AQAP for Tunbridge Wells was produced and published on1 September 2018. Modelling work commissioned from Air Quality Consultants Ltd suggested that the AQMA should be extended slightly to the north and south, but that the buffer, which currently stands at 80m, either side of the centreline of the A26 carriageway, could be reduced to 30m. Public consultation on this took place at the same time as the consultation on the new Air Quality Action Plan. A Map of the new AQMA is shown in Figure 2.3, with the old AQMA for comparison.

Actions from the new AQAP are included in this report at Appendix 2.2. The actions fall into three themes, namely Transport, Planning and Public Health. Examples of actions included in the Action Plan are:-

- Support for measures to increase the use of sustainable transport modes such as walking and cycling.
- Consider the establishment of an Air Quality Protection zone to replace the AQMA, when we are confident that the AQMA can be revoked.
- Expansion of the Car Club scheme.
- Investigation of a Low Emission Standard for buses.
- Incorporation of an air quality SPD into the emerging Local Plan
- Use S106 funding to introduce a bike share scheme.
- Engaging with schools to reduce the impact of school traffic.

Figure 2.3 - Comparison of new and old AQMA



AQAP progress summary

Cycling, walking and alternative transport schemes

- **TR 1 - Support the development of cycling and walking infrastructure to increase the use of sustainable transport modes such as walking and cycling** - The Local cycling and walking infrastructure plan that focuses on Tunbridge Wells Town Centre has been prepared in draft and due to go out to consultation in early 2020. **Ongoing throughout 2020.**
- **TR 4 - Review opportunities to facilitate the implementation of a Bike Share Scheme. With possible options to provide initial support funding using S106 or grant funding, including. private investor funding. Including as appropriate docking stations and electric bicycle facilities** - Funding has been identified by Kent County Council to investigate the potential of implementing an electric bike share scheme in Tunbridge Wells and are currently at the very early stages of a scoping report. **Ongoing throughout 2020.**
- **PH1 - Infrastructure developments in parks to support cycling and walking links to and through parks to enable sustainable access and support commuting routes**. Improvements to the 21st Century Way cycle route have been delivered which links to Grosvenor & Hilbert Park and Colebrook Recreation Ground. The draft LCWIP analyses several walking and cycling routes through parks and across the Commons in Tunbridge Wells and Rusthall. **Partially completed and further work ongoing through 2020.**

Buses, public transport and taxis

- **TR 2 - Securing Grant funding for buses –** In recent years we have made DEFRA bid for funding to retrofit and improve bus fleets in Maidstone Borough Council and Swale Borough Council, the most recent in 2019 to request funding for electric buses in Maidstone and Swale (as part of the Mid Kent Environmental Health Partnership with Tunbridge Wells Borough Council, Maidstone Borough Council and Swale Borough Council). Unfortunately we were unsuccessful in these bids and current DEFRA bid guidance currently dissuades applications for retrofitting of buses. The bid submitted by Tunbridge Wells BC in 2019 bid for funds to improve and support supported our active and engaging Clean Air for Schools project across the three boroughs. Unfortunately, without funding from other sources it is currently unlikely that full implementation will be successful. **Unlikely to make progress in 2020 unless specific funding becomes available.**

- **TR 3 - Investigate Low Emission Standard for Buses and/or HGV's. Either a graduated scheme of improvement "Low Emissions Zone" or a Euro VI "Clean Air Zone" -** Quarterly Quality Bus Partnership meetings are held with Arriva (the largest operator) and KCC. Arriva currently reports on progress towards improving emission standards at these meetings. Work to review the Borough Transport Strategy is underway and will consider this issue further. Support freight routing as set out in the KCC Freight Action Plan. **Ongoing throughout 2020.**
- **TR8 - Reduce idling of engines whilst stationary with focus on Taxi's, coaches/ buses and HGV's. -** Wider anti idling campaign started in TWBC targeting schools and other key locations for banners and signage. Social media and TWBC residents magazine used to publicise the campaign and raise awareness. Signage to be finalised in early 2020 and locations to be investigated for signage and banners to be installed throughout 2020. We are waiting for parking to update us on possible enforcement options. Dependant on resources there is an option to extend to anti-idling campaigns outside schools located near the AQMA through our CAFS project. **Main drive for this project throughout 2020 with the aim for completion in 2020.**
- **TR9 - Emissions Standard for Taxis (Euro 6 standard) –** Ongoing through vehicle checks and licensing of taxi vehicles to encourage drivers to replace vehicles to meet current licensing standards. **Ongoing throughout 2020.**
- **TR 10 - The Council will support KCC in their delivery of a 'Demand Response Transport service as part of Kent Connected and Kent Connected** – currently under consideration as part of the review of the

Borough Transport Strategy. **Await outcome and progress of strategy throughout 2020.**

Electrical vehicle charging improvements

- **PI4 - An effective Electric Vehicle charging network is available for use within the Borough** - Discussions with KCC Highways to further the network to include on street charging and other schemes, currently dependent on local funding and other KCC schemes. **Await further update in 2020.**
- **TR7 - Explore ways in which the Parking Strategy can contribute to improving air quality, by the review of parking restrictions/enforcement** - encourage EV use through parking promotion, currently awaiting the outcome of the borough transport strategy. **Await outcome and progress of strategy throughout 2020.**

Emissions from delivery vehicles

- **TR 5 - Review opportunities to reduce emissions from delivery vehicles -** Guidance prepared for developers of this type of scheme to be provided at the planning stage. Issue will be included in review of the Borough Transport Strategy (currently in draft). **Await outcome and progress of strategy throughout 2020.**

Reduction in vehicle ownership

- **TR 6 - Direct the ongoing expansion of the Tunbridge Wells Car club – Await outcome and progress of strategy throughout 2020 before progress can be made.**

Action through planning and future development

- **PI2 - Incorporate a requirement for sustainable travel choices and car club schemes into the emerging Local Plan to support ongoing air quality improvements and maintaining good air quality. The Local Plan**

to introduce as appropriate a requirement for air quality impacts to be considered as part of Transport Assessments and Transport Statements, and for air quality impacts arising from transport to be a consideration in determining the appropriateness of transport mitigation and the overall transport impacts arising from the development. The Local Plan to introduce a requirement for ongoing monitoring of the impacts of development on air quality as appropriate in those locations within the Borough most at risk of poor air quality, transport mitigation and the overall transport impacts arising from the development. The Local Plan to introduce a requirement for ongoing monitoring of the impacts of development on air quality as appropriate in those locations within the Borough most at risk of poor air quality. – The borough wide local plan consultation took place during September to November 2019. **The comments are being collated and finalised in 2020,**

- **PI3 - Incorporate the development of a future 'Air Quality Protection Area' into the emerging Local Plan to support ongoing air quality improvements and maintaining good air quality** - The borough wide local plan consultation took place during September to November 2019. The comments are being collated and finalised in 2020.
- **PI5 - Support the protection of existing and development of new Green Infrastructure (GI) as part of the Green Infrastructure Policy** - The borough wide local plan consultation took place during September to November 2019. **The comments are being collated and finalised in 2020 with the aim to adopt in early 2022.**

<u>**Promotion of air quality**</u>

- **PH2 - Engage with schools to reduce impact of school traffic. Work with KM Charity Team to increase the number of schools using green travel** - Very positive engagement through the Clean Air for Schools Project is growing. Successfully working with and engaging with schools through assemblies, competitions, activities and teaching material. Promoted through social media and publications from TWBC and schools.

One of our main focuses for 2019 and will continue to be a main focus throughout 2020.

- **PH4** - **Improved Air Quality/sustainability web pages –** project for 2020 as part of the TWBC review and update of their website. **Ongoing throughout 2020 with the aim for completion in 2020.**

<u>Review of air quality monitoring in TWBC</u>

- **PH 5 - Annual progress report to Cabinet timed with annual reporting (of the Annual Status Report, ASR), to DEFRA -** Annual report (ASR) submitted to DEFRA and presented to cabinet and general public. **Ongoing annual requirement.**
- **PH 6 - Review of air quality monitoring provision in TW Area -** More intensive monitoring of Hawkhurst Village and to declare an AQMA in Hawkhurst. Further investigation throughout 2020. Review of diffusion tubes to be carried out in 2020. **Work to declare the new AQMA to take place in 2020, with the target date of December 2020. Work on the Action plan to take place throughout 2021.**

The principal challenges and barriers to implementation that TWBC anticipates facing during 2020 are: COVID 19 and the requirement for the team to focus on COVID 19 priorities during lockdown. To date COVID 19 has limited the progress with our CAFS and anti-idling project due to lockdown. A number of projects await the full consultation and publication of reports and strategies such as the Local Plan, Transport Strategy, Green Infrastructure Policy and Local cycling and walking infrastructure plan. Additional challenges are from the limited budgets and funding opportunities available from central and local government.

Progress on the measures has been slower than expected due to the length of time the process of consultations and final adoption of plans and policies take. We have concentrated on contributions towards the Local Plan and other policy documents, CAFS and anti-idling project and the review of the air quality in Hawkhurst. This work is expected to dominate our workload in 2020.

Tunbridge Wells Borough Council made one bid to DEFRA under the 2019 Air Quality Grant Scheme. It was a joint bid between Tunbridge Wells Borough Council, Maidstone Borough Council and Swale Borough Council (the Midkent Environmental Health Partnership) for £25,000 for a professional theatre group to attend primary schools across the three boroughs to hold assemblies with a tailored script focusing on air quality, the theatre company will also run workshops and provide engaging, curriculum related teaching plans and follow up information and feedback. We felt that we submitted a strong and detailed bid, but unfortunately, our bid was unsuccessful, but we aim to continue our Clean Air for Schools programme throughout 2020.

Two additional bids were also made through our Midkent EH partnership, one from Maidstone BC and another from Swale BC. Both were for funding towards an electric bus for each borough. Unfortunately, we were again unsuccessful to secure funding for these bids. It is frustrating that we were unsuccessful again this year and have been unsuccessful in previous years despite engagement with businesses and communities and committing officer time to compile and submit the information required for the bids. We understand that funding is limited, and the application process is competitive, however unfortunately a number of our action plans are unable to move forward without similar funding opportunities.

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
Tr1	Support the development of cycling and walking infrastructure to increase the use of sustainable transport modes such as walking and cycling.	Promoting Travel Alternatives	Promotion of cycling	2018	TWBC Economic Development Team and KCC Transport	Local Authority	10%	Unquantifiable	Phase 1 LCWIP (Local Cycling and Walking Infrastructure Plan) prepared in Draft that focuses on RTW town centre. Consultation on the draft will start early 2020. Phase 2 LCWIP to be commissioned and will cover low traffic neighbourhoods and inter-urban routes.	Ongoing	Lengthy Timescale
Tr2	Securing Grant funding for buses	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	2011	Local Authority Environmental Health	Local Authority, Funding: Defra Air Quality Grant	Unquantifiable	Reduced vehicle emissions	Implementation on-going	ongoing	Funding
Tr3	Investigate Low Emission Standard for Buses and/or HGV's. Either a graduated scheme of improvement "Low Emissions Zone" or a Euro VI "Clean Air Zone" Support freight routing as set out in the KCC Freight Action Plan	Vehicle Fleet Efficiency	Other	2018	Environmental Protection Team in conjunction with QPB and Economic Development Team	Local Authority, Funding: Defra Air Quality Grant	Unquantifiable	Reduced vehicle emissions	Not progressed at this time. Currently not budget allocation. However experience of completed project in neighbouring authority with much higher levels of pollution demonstrated very little gain for cost.	2024	Unlikely to be project worth implementing. Money (approx £50,000 better spent on other projects). Quarterly Quality Bus Partnership meetings are held with Arriva (the largest operator) and KCC. Arriva currently reports on progress towards improving emission standards at these meetings. Work to review the Borough Transport Strategy is underway and will consider this issue further.
Tr1	Support the development of cycling and walking infrastructure to increase the use of sustainable transport modes such as walking and cycling.	Promoting Travel Alternatives	Promotion of cycling	2018	TWBC Economic Development Team and KCC Transport	Local Authority	10%	Unquantifiable	Phase 1 LCWIP (Local Cycling and Walking Infrastructure Plan) prepared in Draft	Ongoing	Lengthy Timescale

									that focuses on RTW town centre. Consultation on the draft will start early 2020. Phase 2 LCWIP to be commissioned and will cover low traffic neighbourhoods and inter-urban routes.		
Tr2	Securing Grant funding for buses	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	2011	Local Authority Environmental Health	Local Authority, Funding: Defra Air Quality Grant	Unquantifiable	Reduced vehicle emissions	Implementation on-going	ongoing	Funding
Tr3	Investigate Low Emission Standard for Buses and/or HGV's. Either a graduated scheme of improvement "Low Emissions Zone" or a Euro VI "Clean Air Zone" Support freight routing as set out in the KCC Freight Action Plan	Vehicle Fleet Efficiency	Other	2018	Environmental Protection Team in conjunction with QPB and Economic Development Team	Local Authority, Funding: Defra Air Quality Grant	Unquantifiable	Reduced vehicle emissions	Not progressed at this time. Currently not budget allocation. However experience of completed project in neighbouring authority with much higher levels of pollution demonstrated very little gain for cost.	2024	Unlikely to be project worth implementing. Money (approx £50,000 better spent on other projects). Quarterly Quality Bus Partnership meetings are held with Arriva (the largest operator) and KCC. Arriva currently reports on progress towards improving emission standards at these meetings. Work to review the Borough Transport Strategy is underway and will consider this issue further.
Tr4	Review opportunities to facilitate the implementation of a Bike Share Scheme. With possible options to provide initial support funding using S106 or grant funding, inc. private investor funding. Including as appropriate docking stations and electric bicycle facilities	Promoting Travel Alternatives	Promotion of cycling	2018	Sustainability, Economic Development, and Healthy Lifestyles Team, with support from Parking Services and Environmental Health.	Funding to implement project awarded by KCC. Very early stages of scoping in progress	Unquantifiable	Reduced vehicle emissions	Funding has been identified by Kent County Council to investigate the potential of implementing an electric bike share scheme in Tunbridge Wells.	2024	Outcome of the scoping exercise
Tr5	Review opportunities to reduce emissions from delivery vehicles	Freight and Delivery Management	Other	2018	Environmental Protection and Economic Development With Planning Policy, Parking and KCC	Local Authority	Unquantifiable	Reduced vehicle emissions	Guidance prepared for developers of this type of scheme to be provided at the planning stage. Issue will be included in review of the Borough Transport Strategy.	2023	Guidance prepared for developers of this type of scheme to be provided at the planning stage

Tr6	Direct the ongoing expansion of the Tunbridge Wells Car club.	Alternatives to private vehicle use	Car Clubs		Sustainability and Parking Services	Local Authority	0%	Reduce vehicle ownership and provide alternative	Issue to be covered in emerging Borough Transport Strategy.	2022	Await outcome of Borough Transport Strategy
Tr7	Explore ways in which the Parking Strategy can contribute to improving air quality, by the review of parking restrictions/enforcement	Promoting Low Emission Transport	Priority parking for LEV's		Parking Services	Local Authority	Unquantifiable	Encourage EV ownership and use	Issue to be covered in emerging Borough Transport Strategy.	2022	Await outcome of Borough Transport Strategy
Tr8	Reduce idling of engines whilst stationary with focus on Taxi's, coaches/ buses and HGV's. With an option to extend to anti-idling campaigns outside schools located near the AQMA.	Traffic Management	Anti-idling enforcement	2018	Environmental Protection Team and Parking Services	Local Authority	Unquantifiable	Encourage drivers to switch off engines	Wider anti idling campaign started in TWBC targeting schools and other key locations for banners and signage. Social media and TWBC residents magazine used to publicise the campaign and raise awareness. Parking to add update on enforcement options	2022	Signage to be finalised and locations to be investigated for signage and banners.
Tr9	Emissions Standard for Taxis (Euro 6 standard)	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport		Licensing	Local Authority	Unquantifiable	Encourage drivers to replace vehicles to meet standards through licensing criteria	Ongoing through vehicle checks and licsing of taxi vehicles	2024	ongoing
Tr10	The Council will support KCC in their delivery of a 'Demand Response Transport service as part of Kent Connected and Kent Connected +	Promoting Travel Alternatives	Other		KCC Public Transport Team	County Council	Unquantifiable	Encourage alternative transport and reduce car use	Ongoing	2024	Issue covered in emerging Borough Transport Strategy.
Tr11	To revise and update the Councils own 2011 Travel Plan.	Promoting Travel Alternatives	Workplace Travel Planning		Sustainability Parking Services	Local Authority	Unquantifiable	Encourage use of alternative transport and home working		2022	May be incorporated as part of Climate Change project
Tr12	To deliver an adaptive traffic management control system	Traffic Management	UTC, Congestion management, traffic reduction	KCC Highways	County Council	Unquantifiable			2024	Issue to be covered in emerging Borough Transport Strategy.	
Pl1	Good air quality is appropriately recognised in the Local Plan - Development Plan Document/SPD in emerging local plan.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance		KCC Highways	Planning Policy Sustainability Environmental Protection	Unquantifiable	Local Plan	SPD has been prepared and provided to planning policy for adoption. In line with the local plan	In line with Local Plan Development 2024	Local Plan consulation due to take place

PI2	Incorporate a requirement for sustainable travel choices and car club schemes into the emerging Local Plan to support ongoing air quality improvements and maintaining good air quality. The Local Plan to introduce as appropriate a requirement for air quality impacts to be considered as part of Transport Assessments and Transport Statements, and for air quality impacts arising from transport to be a consideration in determining the appropriateness of transport mitigation and the overall transport impacts arising from the development. The Local Plan to introduce a requirement for ongoing monitoring of the impacts of development on air quality as appropriate in those locations within the Borough most at risk of poor air quality.transport mitigation and the overall transport impacts arising from the development. The Local Plan to introduce a requirement for ongoing monitoring of the impacts of development on air quality as appropriate in those locations within the Borough most at risk of poor air quality.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance		TWBC Development Control and Planning Policy	Local Authority	Unquantifiable	Local Plan	SPD had been written and provided to planning policy for adoption in line with the local plan.	In line with Local Plan Development 2024	Local Plan consulation took place during Septemebr to November 2019. The comments are being collated.
PI3	Incorporate the development of a future 'Air Quality Protection Area' into the emerging Local Plan to support ongoing air quality improvements and maintaining good air quality.	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance		Planning Policy Sustainability Environmental Protection	Local Authority	Unquantifiable	Local Plan	SPD has been written and provided to planning policy for adoption.	In line with Local Plan Development 2024	Local Plan consulation due to take place
PI4	An effective Electric Vehicle charging network is available for use within the Borough	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel rechargi		Sustainability, Development Control, Parking Services. KCC Highways	Local Authority and County Council	Unquantifiable	Reduced vehicle emissions	Discussions with Kcc Highways regarding on street charging and other schemes	2021	Dependent on Local funding and KCC schemes

			ng								
PI5	Support the protection of existing and development of new Green Infrastructure(GI) as part of the Green Infrastructure Policy	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance		TWBC landscape and biodiversity	Local Authority	Unquantifiable			2024	Local Plan
PH1	Infrastructure developments in parks to support cycling and walking links to and through parks to enable sustainable access and support commuting routes.	Promoting Travel Alternatives	Other		TWBC Parks and Economic Development	Local Authority	30%	Reduce vehicle usage and promote safe and accesable alternative routes	Improvements to the 21st Century Way cycle route have been delivered which links to Grosvenor & Hilbert Park and Colebrook Recreation Ground. The draft LCWIP analyses several walking and cycling routes through parks and across the Commons in Tunbridge Wells and Rusthall.	2022	
PH2	Engage with schools to reduce impact of school traffic Work with KM Charity Team to increase the number of schools using green travel	Promoting Travel Alternatives	School Travel Plans		Environmental Protection	Local Authority	Unquantifiable	Reduce vehicle usage and promote safe and accesable alternative routes	Project was successfully rolled out and is now in second year. Officers are delivering assemblies to schools taking part in the scheme and providing anti idling banners to put outside. Schools are being asked to design and implement an anti idling campaign and tell TWBC what they have done with a prize to the winner. Schools also provided with a Plumeflow portable monitoring device to look map levels or polluting around he school and on different routes to school to raise awareness and promote walking, cycling etc as well	2022	Engagement through the Clean Air for Schools Project is growing. Succesfully working with and engaging with schools through assemblies, compatitions, activities and teaching material. One of our main focuses for 2019. Promoted through social media and publications from TWBC and schools

									using less trafficked routes to walk to school.		
PH3	Raising Awareness of Air Quality and health issues	Public Information	Other		KCC Public Health TWBC Environmental Protection	Local Authority and County Council	Unquantifiable		Working on articles for residents magazines etc and promoting our Clean Air For Schools promotion.. AQ remains a lower priority for overall public comms attention.		Engagement through the Clean Air for Schools Project is growing. Successfully working with and engaging with schools through assemblies, compatitions, activities and teaching material. One of our main focuses for 2019. Promoted through social media and publications from TWBC and schools
PH4	Improved Air Quality/sustainability web pages.	Public Information	Via the Internet		TWBC Environmental Protection	Local Authority	Unquantifiable		Website are in the process of being updated and Clean Air for Schools promotion with additional material	ongoing	
PH5	Annual progress report to Cabinet timed with annual reporting (of the Annual Status Report, ASR), to DEFRA.	Public Information	Other		Environmental Protection	Local Authority	Unquantifiable		This report will be included on our Intranet a submitted for noting.	Ongoing	Annual report (ASR) submitted to DEFRA and presented to cabinet and general public.
PH6	Review of air quality monitoring provision in TW Area	Public Information	Other		Environmental Protection	Local Authority	Unquantifiable		The continuous monitoring station has upgraded following equipment failure.. Results indicate that Nox is not in excess of the annual objective is not being exceeded for particulates. Diffusion tube network has been reviewed and the updated round will be starting January 2020. More extensive monitoring of a potential hotspot has been implemented to address anomalous results and gain a more detailed data set.	Ongoing	More intensive monitoring of Hawkhurst Village and to declare an AQMA in Hawkhurst. Further investigation throughout 2020. Review of diffusion tubes to be carried out in 2020.

PH7	Review the opportunity to identify the 'cost of illness' by using the newly developed Public Health England tool in the: 'Estimations of costs to the NHS and social care due to the health impacts of air quality.'	Public Information	Other		Sustainability	Local Authority	Unquantifiable			2022	

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

As detailed in Policy Guidance LAQM.TG16 (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.

The Public Outcomes Framework indicates that for the fraction of deaths, attributable to $PM_{2.5}$, in Tunbridge Wells is 5%. This is below the national average of 5.3%.

TWBC does not currently undertake any monitoring of $PM_{2.5}$ and consequently there are no specific measures in place to address $PM_{2.5}$ concentrations within the Tunbridge Wells Borough. In the absence of $PM_{2.5}$ monitoring it can be estimated using the model detailed in Chapter 7 Section 1 of TG16 (Section 7.107 – 7.111). The model calculates that $PM_{2.5}$ levels are estimated to be 14.7ugm^3 (PM_{10} annual mean measured at 21ugm^3 for 2019). $PM_{2.5}$ monitoring in the neighbouring district of Maidstone suggests the exceedances of the $PM_{2.5}$ objective in Tunbridge Wells are highly unlikely. Measured PM_{10} levels are gradually reducing and therefore it can be estimated that $PM_{2.5}$ levels following a similar pattern.

LAQM.TG16 Table A1 Action Toolbox provides a list of measures that can be implemented to tackle $PM_{2.5}$, and some of these measures are included in our AQAP including anti idling campaigns, encouraging behavioural change (CAFS) and promotion of cycling and walking. However it is recognised that any measures employed to reduce NO_2 and PM_{10} will also have a beneficial effect on $PM_{2.5.}$ At this current time TWBC does not have any additional funding to install equipment that will measure $PM_{2.5,}$ but it would be a consideration for the future subject to funding.

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.

TWBC undertook automatic (continuous) monitoring at one location during 2019 Table A.1 in Appendix A shows the details of the site. National monitoring results are available at http://www.kentair.org.uk/.

The automatic monitoring station is co-located with triplicate tubes TW34, which are shown in Figure D.6 in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

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

TWBC undertook non- automatic (passive) monitoring of NO_2 at 34 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 and any other adjustments applied (e.g. “annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias[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).

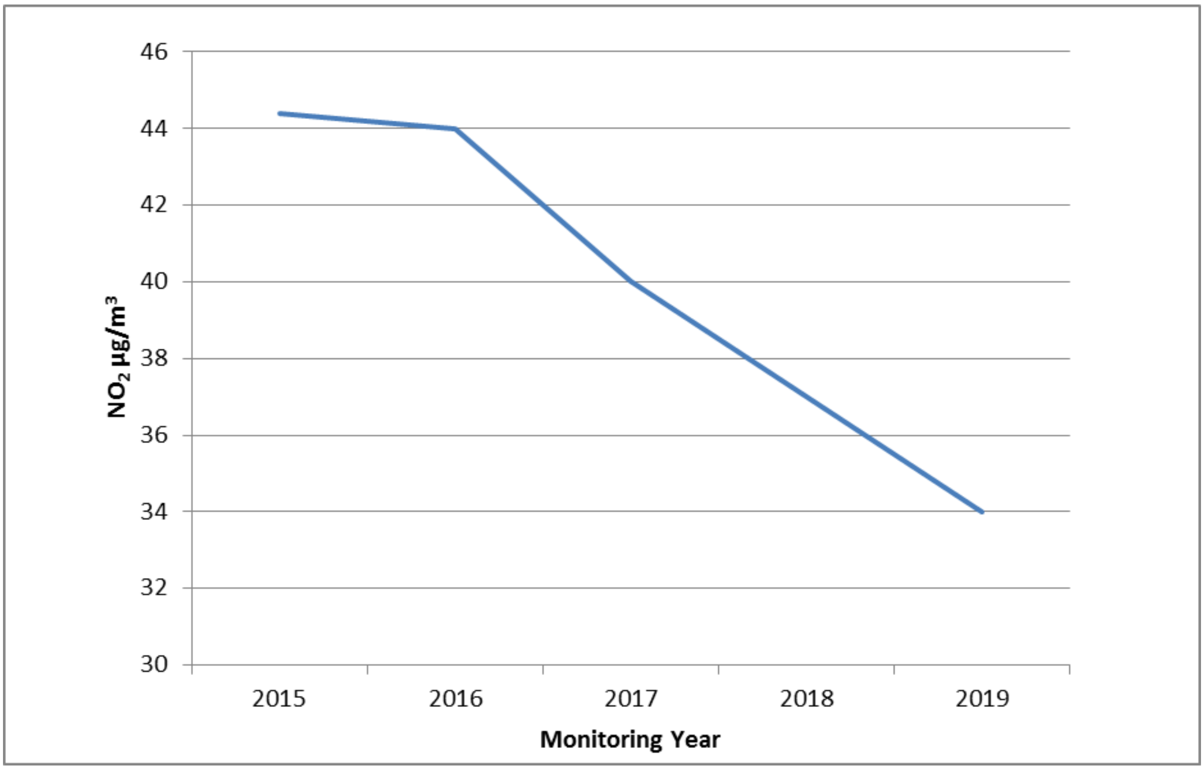
For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

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.

Results for 2019 indicate that the annual mean NO_2 level at the A26 St John's Roadside automatic monitoring location was below the annual mean objective for NO_2 at 34µgm^{-3}. The 1-hour objective for NO_2 was met at the St John's Roadside monitoring location, with no instances of the hourly mean exceeding 200µg/m^3 (see **Error! Reference source not found.**).

Figure 3.3 shows the trend in NO_2 concentration from 2015 through to 2019 at the A26 St John's Roadside location. This shows the fluctuation in annual mean concentrations. The highest concentrations were recorded in 2015 with the annual mean concentration of 44.4µg/m^3, however the annual mean concentration measured in 2019, at 34 µg/m^3 was the lowest recorded.

Figure 3.3 – Trends in Annual Mean NO_2 Concentrations Measured at the Automatic Monitoring Site



Error! Reference source not found. shows the trend in NO_2 concentration at iffusion tube monitoring sites within the AQMA from 2015 through to 2019. The figure shows that all the sites except TW41 showed a peak in annual mean concentration in 2016, however site TW41 recorded the highest NO_2 concentrations within the existing AQMA in all the monitoring years. There were two sites within the existing AQMA where the annual mean objective was exceeded in 2019. Both sites had recorded exceedances in previous years. The two sites were:

- TW41 - 38 The Pantiles/London Road.
- TW58 – Union House, London Road

Figure 3.2 – Annual mean trend at locations within the AQMA

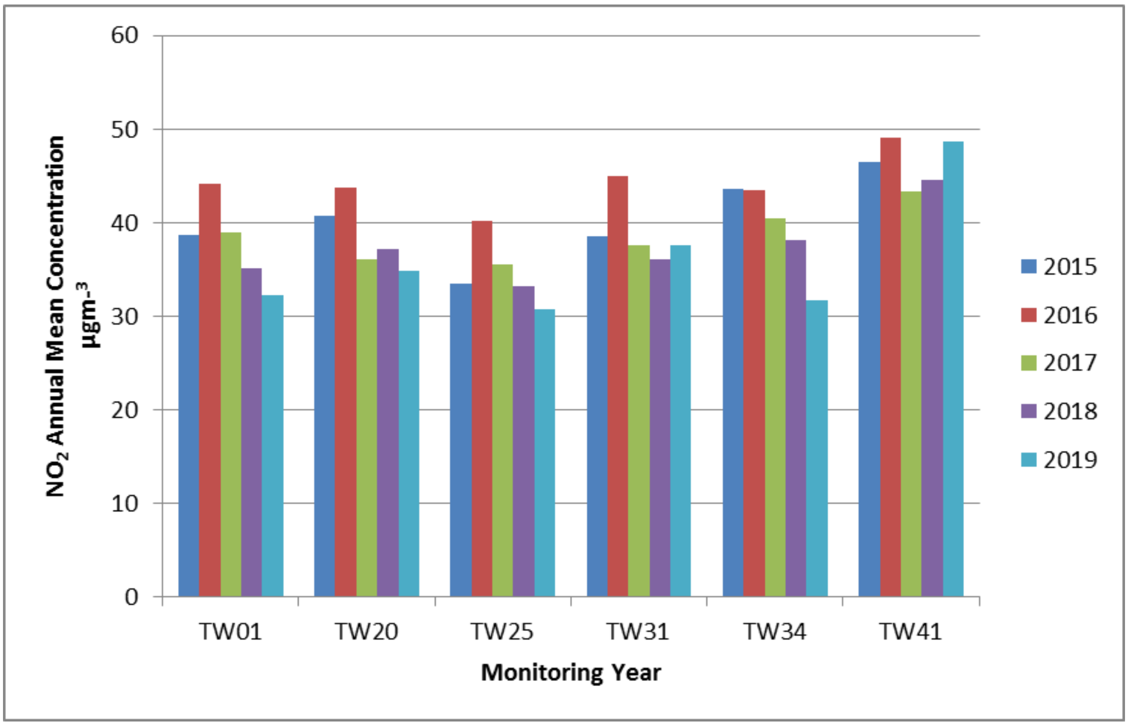


Figure 3.4 shows the trend in annual mean NO_2 concentration at the diffusion tube locations outside of the existing AQMA over the past five years. It can be seen that the annual mean NO_2 objective has been met in all the sites in 2019. The majority of sites showed peak concentrations in 2016. The annual mean NO_2 concentration in 2019 is broadly similar to 2018 levels, having decreased slightly at some sites and increased slightly at others.

Figure 3.4 – Annual mean trend at locations outside the AQMA

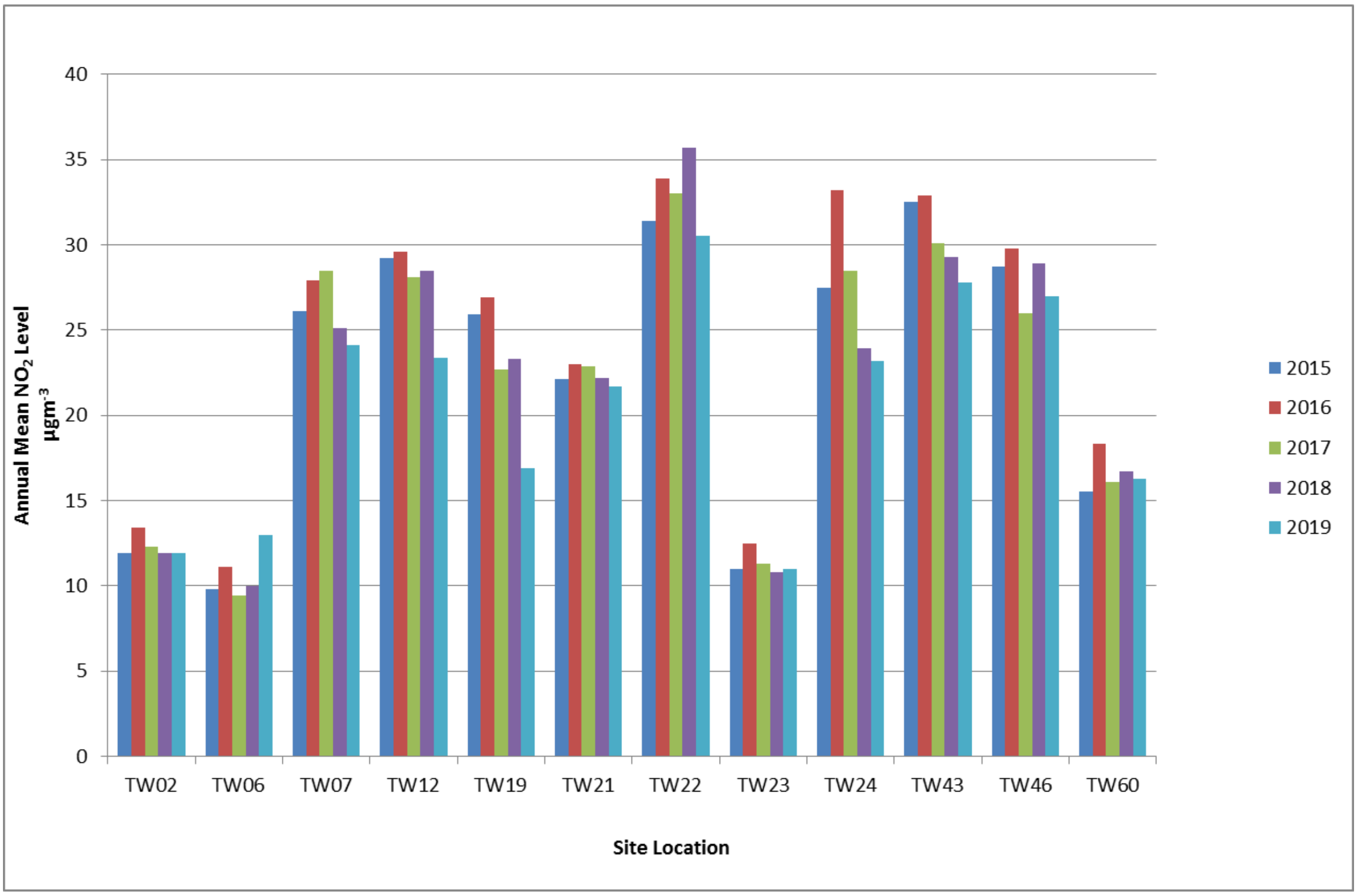


Table 3.2 provides the information for the NO_2 fall-off distance correction within the AQMA. The details of the NO_2 fall-off distance correction calculation for these sites are presented in Appendix C.

Table 3.2 – Fall-off Distance Correction of Sites inTtunbridge Wells exceeding the NO_2 Annual Mean Objective within the AQMA (2019)

Site ID	In AQMA?	Distance Kerb-Receptor (m)	Distance Kerb-Monitor (m)	Background Concentration(µg/m^3)	Bias Adjusted and annualised Annual Mean (µg/m^3)	Distance Corrected Annual Mean (µg/m^3)
TW41	Y	4.8	1.8	11.0	48.7	37.5
TW58	Y	7	1.3	11.0	42.9	30.3

Hawkhurst

A new site in Hawkhurst, (TW63, Smugglers Rest) established towards the end of 2018, also exceeded the annual mean objective for NO_2 in 2019. Distance correction to the nearest receptor was not straightforward because of changes in street topography between the tube and the receptor, and the fact that the receptor was at first floor level. Therefore we have relied on the results of modelling by our Air Quality Consultant AQC, to determine NO_2 levels at nearby receptors.

Concern has been raised from mid 2019 regarding the apparent anomalies in the data at TW63 during 2019 with higher levels in the summer than the winter. Consultation with the Parish Council and KCC noted that there were two occasions of roadworks taking place near the cross roads of Hawkhurst throughout the months of June and July These works resulted in an increase in stationary traffic in this area due to additional traffic lights and diversions. The results from TW63 in a mid year review in 2019 continued to raise concern and from August 2019, further tubes were deployed near to the cross road junction of Hawkhurst to gather additional evidence for a detailed assessment of air quality in Hawkhurst. In March 2020 It was clear that the Covid 19 situation would have a serious impact on further air quality monitoring in 2020. We therefore decided to we commission a consultant to explore the situation further and to use the data already at hand for a detailed assessment, in order to determine whether we should consider declaring an Air Quality Management Area (AQMA) in Hawkhurst.

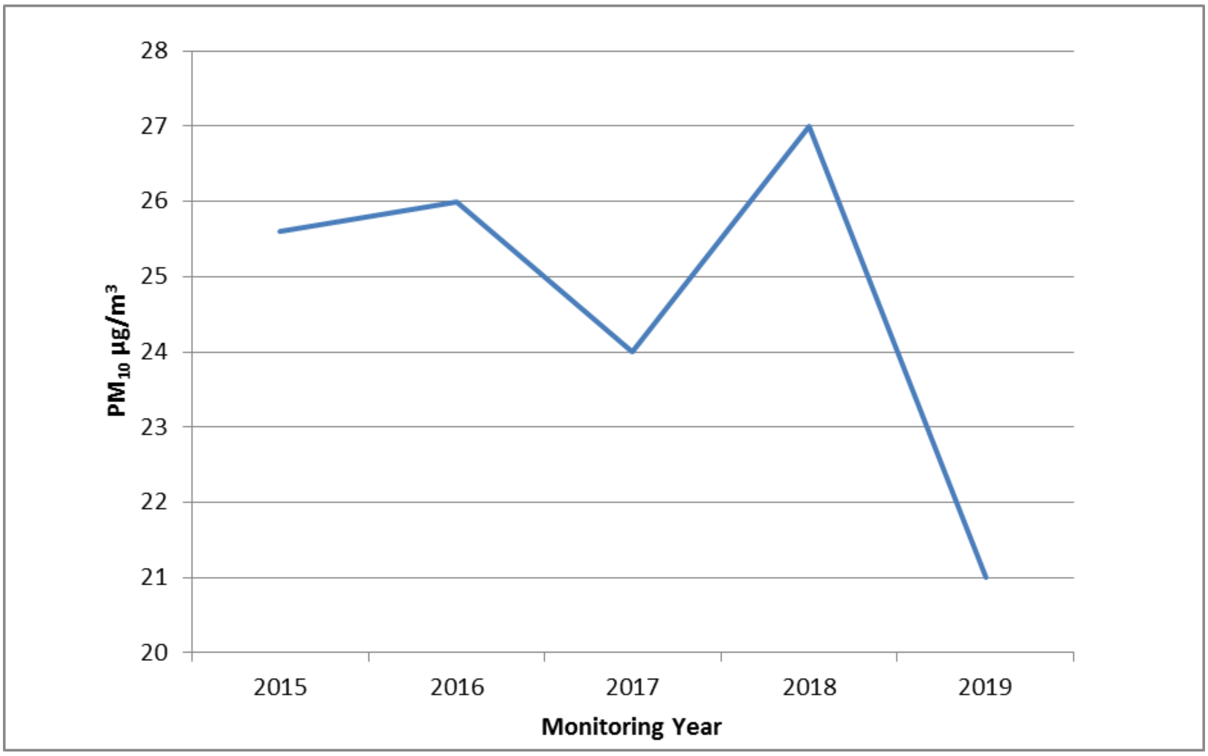
Particulate Matter (PM_{10})

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.

Figure 3.5 shows the trend in annual mean PM_{10} concentrations at the A26 Roadside monitoring location in the past five years. In 2015 and 2016 the annual mean PM_{10} concentration remained steady and reflected previous results in 2013 and 2014. The levels decreased in 2017 only to increase to an unusually high level in 2018. The levels recorded for 2019 were 21µgm^{-3}, again showing a decrease in PM_{10} levels. PM_{10} levels in Tunbridge Wells are consistently below the objective level and will need further monitoring to establish the likely trend.

Figure 3.5 – Trends in Annual Mean PM_{10} Concentrations Measured at the Automatic Monitoring Site



3.2.2 Particulate Matter ($PM_{2.5}$)

TWBC does not currently undertake any monitoring of $PM_{2.5}$ and consequently there are no specific measures in place to address $PM_{2.5}$ concentrations within the Tunbridge Wells Borough. In the absence of $PM_{2.5}$ monitoring it can be estimated using the model detailed in Chapter 7 Section 1 of TG16 (Section 7.107 – 7.111). The model calculates that $PM_{2.5}$ levels are estimated to be 14.7ugm^{3} (PM_{10} annual mean measured at 21ugm^{3} for 2019). $PM_{2.5}$ monitoring in the neighbouring district of Maidstone suggests the exceedances of the $PM_{2.5}$ objective in Tunbridge Wells are highly unlikely. Measured PM_{10} levels are gradually reducing and therefore it can be estimated that $PM_{2.5}$ levels following a similar pattern.

LAQM.TG16 Table A1 Action Toolbox provides a list of measures that can be implemented to tackle $PM_{2.5}$, and some of these measures are included in our AQAP including anti idling campaigns, encouraging behavioural change (CAFS) and promotion of cycling and walking. However it is recognised that any measures employed to reduce NO_2 and PM_{10} will also have a beneficial effect on $PM_{2.5.}$ At this current time TWBC does not have any additional funding to install equipment that will measure $PM_{2.5,}$ but it would be a consideration for the future subject to funding.

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)
CM1	A26 St Johns Road, Southborough	Roadside	558260	141599	NO_2; PM_{10}	YES (St Johns Tunbridge Wells)	Chemiluminescent; TEOM	18	4	3

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 (Easting)	Y OS Grid Ref (Northing)	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)
TW01	62 London Road, Southborough	R	558121	142214	NO_2	Y	4.2m	2	N	2.4
TW02	11 The Hurst, Tunbridge Wells	B	560016	141248	NO_2	N	6.0m	1.6	N	2.1
TW06	4 Surrey Close, Broadwater Down, Tunbridge Wells	B	557624	137760	NO_2	N	3.7m	1.8	N	2.8
TW07	High Street, Tunbridge Wells	R	558286	138896	NO_2	N	4.3m	1	N	2.4
TW12	Monson Road, Tunbridge Wells	R	558482	139557	NO_2	N	2.0m	1.8	N	2.4
TW19	Maidstone Road, Paddock Wood	R	566875	145083	NO_2	N	2.5m	1.8	N	2.5
TW20	Mount Ephraim, Tunbridge Wells	R	558300	139903	NO_2	Y	2.8m	2	N	2.4
TW21	46-48 Victoria Road, Tunbridge Wells	R	558670	139815	NO_2	N	1.7m	1.9	N	2.4
TW22	Pembury Road, Tunbridge Wells	R	559417	139556	NO_2	N	16.0m	1	N	2.3
TW23	2 Nevill Gate, Tunbridge Wells	B	558746	138213	NO_2	N	16.0m	0.65	N	2.4
TW24	Still Lane, 22/24 London Road, Southborough	R	557854	142697	NO_2	N	6.0m	1.75	N	2.6
TW25	Flying Dutchman	R	558136	142017	NO_2	Y	1.8m	2.6	N	2.9

TW31	London Rd/Mount Ephraim Junction	R	558227	139757	NO_2	Y	3.1m	1	N	2.7
TW34	AQ Station, The Cutout St John's Road, Tunbridge Wells	R	558239	141640	NO_2	Y	14.0m	4	Triplicate and co-located	3
TW38	Pembury Road, Seven Springs	R	560847	140395	NO_2	N	12	3	N	2.5
TW41	London Rd (38 The Pantiles/London Road), Tunbridge Wells	R	558076	138762	NO_2	Y	4.8m	1.8	N	2.3
TW43	Church Road/Clarence Road, Tunbridge Wells	R	558271	139451	NO_2	N	2.6m	1.3	N	2.6
TW44	Crescent Road/Calverly Crescent, Tunbridge Wells	R	558712	139424	NO_2	N	5.4m	2	N	2.5
TW46	A26 Eridge Road	R	557740	138538	NO_2	N	12.0m	1	N	2.4
TW47	32 High St, Pembury	R	562330	140754	NO_2	N	8m	1	N	2
TW50	A264 Mt Ephraim	R	557713	139249	NO_2	N	2.5m	1	N	2
TW51	1 Western Road	R	558101	142074	NO_2	N	4.0m	1.6	N	2.2
TW52	7 Western Road	R	558086	142070	NO_2	N	4.0m	1.6	N	2.5
TW53	Warrington Road, Paddock Wood	R	567637	144739	NO_2	N	9.0m	1.8	N	2.5
TW55	Mascalls Park, Badsell Road	R	566748	144112	NO_2	N	11.0m	1.8	N	2.5
TW56	32 Liptraps Lane, TN2 3AA	R	559923	138609	NO_2	N	7.2m	1	N	2.5

TW57	2 Liptraps Lane, TN2 3BS	R	559888	138719	NO_2	N	5.5m	1.2	N	2.85
TW58	Union House.	R	557936	138615	NO_2	Y	7.4m	1.3	N	2.5
TW60	Gorse Road	B	560230	140150	NO_2	N	10.0m	30	N	3
TW61	5 Warwick Park	R	558242	138715	NO_2	N	18.0m	1.5	N	2.5
TW62	Pembury High Street	R	562284	140746	NO_2	N	3.9m	1	N	2.5
TW63	Cranbrook Road Hawkhurst	R	576061	130599	NO_2	N	0m	1	N	1.8
TW64	Junction of Rodmell Road and Warwick Park Road	R	558373	138487	NO_2	N	13.5m	1	N	2.5
TW65	Eridge Road Bus Stop	R	557362	138168	NO_2	N	30	1.5	N	2.5
TW66 HH	8 The Colonade, Rye Road	R	576102	130567	NO_2	N	2	2	N	1.8
TW67 HH	Happy Garden Chinese	R	575998	130528	NO_2	N	7.5	1.75	N	2
TW68 HH	Old Infant School, Cranbrook Road	R	576051	130602	NO_2	N	0.2	3	N	2
TW69 HH	Near Substation, Cranbrook Road	R	576062	135116	NO_2	N	3	2.5	N	2
TW70 HH	Outside 8/9 Cranbrook Road, Hawkhurst	R	576040	130734	NO_2	N	0.2	1.2	N	2
TW71	Tube on post just beside entrance to Seven Springs	R	560838	140389	NO_2	N	7.0m	1.5	N	2

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 ($\mu g/m^3$) (3) (4)				
							2015	2016	2017	2018	2019
CM1	558260	141599	Roadside	Automatic	95	95	**44.4**	**44**	**40**	**37**	**34**
TW01	558121	142214	Roadside	Diffusion Tube	100	100	**38.7**	**44.2**	**39**	**35.4**	**32.2**
TW02	560016	141248	Urban Background	Diffusion Tube	100	100	**11.9**	**13.4**	**12.3**	**11.9**	**11.9**
TW06	557624	137760	Urban Background	Diffusion Tube	92	92	**9.8**	**11.1**	**9.4**	**10**	**13**
TW07	558286	138896	Roadside	Diffusion Tube	100	100	**26.1**	**27.9**	**28.5**	**25.1**	**24.1**
TW12	558482	139557	Roadside	Diffusion Tube	92	92	**29.2**	**29.6**	**28.1**	**28.5**	**23.4**
TW19	566875	145083	Roadside	Diffusion Tube	100	100	**25.9**	**26.9**	**22.7**	**23.3**	**16.9**
TW20	558300	139903	Roadside	Diffusion Tube	100	100	**40.7**	**43.7**	**36**	**37.1**	**34.8**
TW21	558670	139815	Roadside	Diffusion Tube	100	100	**22.1**	**23**	**22.9**	**22.2**	**21.8**
TW22	559417	139556	Roadside	Diffusion Tube	100	100	**31.4**	**33.9**	**33**	**35.7**	**30.5**
TW23	558746	138213	Urban Background	Diffusion Tube	75	75	**11**	**12.5**	**11.3**	**10.8**	**11**
TW24	557854	142697	Roadside	Diffusion Tube	92	92	**27.5**	**33.2**	**28.5**	**23.9**	**23.2**
TW25	558136	142017	Roadside	Diffusion Tube	100	100	**33.4**	**40.2**	**35.5**	**33.2**	**30.7**
TW31	558227	139757	Roadside	Diffusion Tube	92	92	**38.5**	**45**	**37.5**	**36.1**	**37.5**
TW34	558239	141640	Roadside	Diffusion Tube	100	100	**43.6**	**43.5**	**40.5**	**38.1**	**31.5**

TW38	560847	140395	Roadside	Diffusion Tube	50	50	**46.5**	**49.1**	**43.3**	**44.5**	**37.1**
TW41	558076	138762	Roadside	Diffusion Tube	92	92	**46.5**	**49.1**	**43.3**	**44.5**	**37.5**
TW42	558271	139451	Roadside	Diffusion Tube			**22.4**	**27**	**27.2**		
TW43	558712	139424	Roadside	Diffusion Tube	92	92	**32.5**	**32.9**	**30.1**	**29.3**	**27.8**
TW46	557740	138538	Roadside	Diffusion Tube	100	100	**28.7**	**29.8**	**26**	**28.9**	**27**
TW50	562330	140754	Roadside	Diffusion Tube	92	92	**24.5**	**30.7**	**28.5**	**26.8**	**24.9**
TW51	557713	139249	Roadside	Diffusion Tube	100	100	-	**19.3**	**18**	**15.6**	**17.1**
TW52	558101	142074	Roadside	Diffusion Tube	100	100	-	**20**	**14.9**	**15.6**	**16.1**
TW53	558086	142070	Roadside	Diffusion Tube	84	84	-	**15.9**	**20**	**15**	**16.7**
TW54	567637	144739	Roadside	Diffusion Tube			-	**33**	**33.3**		
TW55	566748	144112	Roadside	Diffusion Tube	100	100	-	**18.3**	**18.4**	**18.5**	**16.3**
TW56	559923	138609	Roadside	Diffusion Tube	92	92	-		**21**	**28.4**	**24.4**
TW57	559888	138719	Roadside	Diffusion Tube	100	100	-		**20.1**	**26.1**	**24.7**
TW58	557936	138615	Roadside	Diffusion Tube	75	75	-		**30.3**	**47.3**	**30.3**
TW60	560230	140150	Urban Background	Diffusion Tube	100	100	**15.5**	**18.3**	**16.1**	**16.7**	**16.3**
TW61	558242	138715	Roadside	Diffusion Tube	92	92	-			**15.7**	**13.7**
TW62	562284	140746	Roadside	Diffusion Tube	100	100	-			**24.2**	**22**
TW 63 HH	576061	130599	Roadside	Diffusion Tube	92	92	-			**52.4**	**54**
TW64	558373	138487	Roadside	Diffusion	100	100	-			**13.8**	**12.1**

				Tube							
TW65	557362	138168	Roadside	Diffusion Tube	100	100	-			**19.1**	**13.3**
TW 66 HH	576102	130567	Roadside	Diffusion Tube	33	17	-				**23.6**
TW67 HH	575998	130528	Roadside	Diffusion Tube	42	42	-				**34.4**
TW68 HH	576051	130602	Roadside	Diffusion Tube	42	42	-				**35.8**
TW69 HH	576062	135116	Roadside	Diffusion Tube	42	42	-				**41.4**
TW70 HH	576040	130734	Roadside	Diffusion Tube	42	42	-				**37**
TW71	560838	140389	Roadside	Diffusion Tube	42	42	-				**31.3**

☒ **Diffusion tube data has been bias corrected (confirm by selecting in box)**

☒ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

☒ **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 (confirm by selecting in box)**

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.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
CM1	558250	141750	Roadside	Automatic	97.8	87.8	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
CM1	558250	141750	Roadside	98.7	98.7	25.6	26	24	27	21

☒ **Annualisation has been conducted where data capture is <75%** **(confirm by selecting in box)**

Notes:

Exceedances of the PM_{10} annual mean objective of $40\mu g/m^3$ are shown in **bold.**

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

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

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

Site ID	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/m^3 (3)				
						2015	2016	2017	2018	2019
CM1	558250	141750	Roadside	98.7	98.7	**10**	**10**	**13**	**13**	10

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

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

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

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

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 (factor) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
TW01	558100	142200	55.1	47.2	46.1	45.9	40.8	46.2	36.1	19.2	37.5	43.1	55.0	42.8	42.9	32.2	
TW02	560000	141300	24.0	22.6	15.3	17.7	11.9	11.1	9.6	9.6	12.7	17.3	21.2	16.6	15.8	11.9	
TW06	557500	137800	17.1	17.7	12.7	16.2	11.2	9.1	-	-	18.1	19.5	31.2	20	17.3	13.0	
TW07	558200	138880	40.4	44.1	30.9	31.4	27.2	29.6	26.1	30	26.6	29.8	27.1	32.5	32.2	24.1	
TW12	558300	139500	37.4	47.2	31.3	33.2	-	32.2	20.8	20.6	23.4	26.2	36.8	34.5	31.2	23.4	
TW19	566800	144800	32.1	38.7		31.7	26.2	27	24.6	12	14.6	17.5	26.6	16.5	22.6	16.9	
TW20	558300	139800	47.8	50.4	43.4	54.8	43.8	42.6	42.1	43.3	45.9	47.4	54.8	40.6	46.4	34.8	
TW21	558700	139800	31.2	38.2	27.9	31.2	30.6	22.3	22	23.7	21.1	29.9	34.8	33.6	28.9	21.7	
TW22	559400	139500	50.9	46.6	38.3	47.7	44.8	37.8	33.5	28.1	38	37.3	47	38.7	40.7	30.5	
TW23	558800	138300	10.1		12.9	15.7	10.8	10.7	14.6	16	19.4		21.3	14.6	11.0		
TW24	557800	142700	41.9	44		25.1	26.6	26.1	25.4	26.9	29.4	37.4	32.5	31	32.2		
TW25	558136	142017	52.4	51.7	40.1	36.9	36.8	36	33.6	28.5	35.6	38.7	57.5	42.6	40.9	30.7	
TW31	558227	139757	60.2	50.4		47.5	45.9	41.1	46.2	47.9	51.5	53.3	57.9	47.9	50.0	37.5	
TW34.1	558250	141750	30.1	54.5	44.6	53.6	42.1	43.5	40.9	37.2	37.3	37.1	45.5	41.2	42.3	31.7	

TW34.2	558250	141750	41.4	51.3	44.5	52.7	42.5	43.2	401	35.5	28.1	38.4	43.4	42.9	42.0	31.5	
TW34.3	558250	141750	43.2	34	41.1	51.3	43.2	34.2	41.1	37.9	37.1	37.2	48.6	39.8	40.7	30.5	
TW38	520847	140395	45.4	57.3	45.1		47	52.6	49						49.4	37.1	
TW41	558076	138762	64.8	75.9		78.3	63.2	60.5	60.9	59.3	58.7	61.3	70.9	60.5	64.9	48.7	37.5
TW43	558271	139451	45.1	50.6		36.5	33.9	34.1	22	36.8	33.8	36.8	40.2	37.3	37.0	27.8	
TW46	557740	138538	37.6	44.6	36.3	42.1	34.3	33.6	32.1	30	32.4	34.2	41.2	33.2	36.0	27.0	
TW50	557000	139000	40.5	37	30.4	36.5	33.3	32.7	27.1	25.3	26.6	33.3	42.6		33.2	24.9	
TW51	558105	142071	30.5	30.5	19.7	23.1	19.1	18.5	15.8	12.8	19.2	22.6	38.8	22.6	22.8	17.1	
TW52	558081	142071	32	28.2	19.9	28.8	16.1	15.5	13.4	11.3	16.5	22	22.8	20.4	21.5	16.1	
TW53	567638	144732	25.9	22.9		22.6	16.2	13.8	14.2	22.3	24.4	30.3		29.4	22.2	16.7	
TW55	566746	144112	23.6	24.7	21.9	32.4	20.5	20.8	19.5	13.4	18.1	18.5	30.9	17.1	21.8	16.3	
TW60	560230	140150	27.6	27.2	16.4	23	17.3	21.5	18	17	18.9	22.3	29.5	21.8	21.7	16.3	
TW56	559888	141278	35	43	30.3	34.7	32.1	29.4	28.6	25.4	27.8	33.3	38.8		32.6	24.4	
TW57	559923	141560	28.6	41.6	32.8	40.7	33.1	31.7	28.2	23.9	28.5	35.1	40.9	29.7	32.9	24.7	
TW58	557927	138609	54.7			67.9	64.3	55	59.2	52	54.2	50.3	57.5		57.2	42.9	30.3
TW61	558242	138715		26.8	19.5	21.3	17.6	15.2	14.3	12.4	15	18.3	23.7	17.5	18.3	13.7	
TW62	562284	140746	36.1	38.7	27.9	32	23.7	24.2	23.8	237	25.3	27.9	40.6	27.6	29.3	22.0	
TW63 HH	576061	130599	68.1	72.7	73.1	60.2	50	88.4	65.4	88.4		68.5	84	73.8	72.1	54.0	
TW64	558373	138487	27.8	21.8	17.1	17.7	16.6	16.1	12.5	8.2	10.2	13.1	19.9	12.8	16.2	12.1	
TW65	557362	138168	27.4	25	19.2	30.7	22.9	22.3	18.8	7.6	10.7	10.1	5.9	12.5	17.8	13.3	
TW66 HH	576102	130567									32.4			30.5	31.5	23.6	
TW67 HH	575998	130528								43.5	41.4	50	47.3	47.1	45.9	34.4	
TW68 HH	576051	130602								49.6	44.1	45.5	50	49.4	47.7	35.8	
TW69 HH	576062	135116								56.5	49.8	52.1	58	59.4	55.2	41.4	
TW70 HH	576040	130734								56.8	45	49.4	51.7	43.9	49.4	37.0	
TW 71	560838	140389								45.6	40.9			38.5	41.7	31.3	

☐ **Local bias adjustment factor used (confirm by selecting in box)**

☒ **National bias adjustment factor used (confirm by selecting in box)**

☒ **Annualisation has been conducted where data capture is <75% (confirm by selecting in box)**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column (confirm by selecting in box)**

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

Diffusion Tube Bias Adjustment Factors

The diffusion tubes are supplied and analysed by Socotec Didcot utilising the 50% triethanolamine (TEA) in acetone preparation method. A bias adjustment of 0.75 for the year 2019 (based on 21 studies) has been derived from the national bias adjustment calculator.

For previous data, years 2011 to 2017, the bias adjustment factors have been taken from the Council's previous LAQM annual reports. The factors used were 0.70 (2011), 0.79 (2012) and 0.76 (2013), 0.78 (2014), 0.75 (2015), 0.77 (2016) and 0.72 (2017) and 0.74 (2018). The national bias adjustment calculator was used in 2018 (0.76)

Factor from Local Co-location Studies

Tunbridge Wells Borough Council have a set of triplicate tubes at site TW34 co-located with the A26 Roadside continuous analyser in Southborough. The local bias adjustment factor is 0.82 (see Table C.1 and Figure C.1).

Table C.1 – Local Bias Factors

Site ID	Diffusion Tube Data capture	Continuous Monitor Data Capture for Periods Used	Diffusion Tube Annual Mean ($\mu g/m^3$)	Continuous Monitor Annual Mean ($\mu g/m^3$)	Bias Factor A	Bias Factor B
CM1	100%	97.8%	31.3	34	0.82	21%

Figure C.1 – Local Bias Adjustment Factor Calculation Sheet

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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		Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	08/01/2019	06/02/2019	30.1	41.4	43.2	38	7.1	19	17.6		36.8	99.7	Good	Good
2	06/02/2019	07/03/2019	54.5	51.3	34.0	47	11.0	24	27.4		38.8	99.7	Poor Precision	Good
3	07/03/2019	01/04/2019	44.6	44.5	41.1	43	2.0	5	4.9		36.5	99.7	Good	Good
4	01/04/2019	02/05/2019	53.6	52.7	51.3	53	1.2	2	2.9		44.6	93.7	Good	Good
5	02/05/2019	04/06/2019	42.1	42.5	43.2	43	0.6	1	1.4		37	99.9	Good	Good
6	04/06/2019	02/07/2019	43.5	43.2	34.2	40	5.3	13	13.1		32	99.3	Good	Good
7	02/07/2019	05/08/2019	40.9	40.1	41.1	41	0.5	1	1.3		30	85.4	Good	Good
8	05/08/2019	05/09/2019	37.2	35.5	37.9	37	1.2	3	3.1		27	99.7	Good	Good
9	05/09/2019	30/09/2019	37.3	28.1	37.1	34	5.3	15	13.1		31	99.8	Good	Good
10	30/09/2019	05/11/2019	37.1	38.4	37.2	38	0.7	2	1.8		29	97.8	Good	Good
11	05/11/2019	04/12/2019	45.5	43.4	48.6	46	2.6	6	6.5		39.7	99.6	Good	Good
12	04/12/2019	06/01/2020	41.2	42.9	39.8	41	1.6	4	3.9		29.6	99.7	Good	Good
13														

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

Overall survey --> Good precision | Good Overall DC

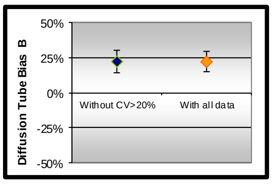
Site Name/ ID:

Precision 11 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.82 (0.77 - 0.88)
Bias B	21% (13% - 29%)
Diffusion Tubes Mean:	41 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	34 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	34 (32 - 36) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.83 (0.78 - 0.88)
Bias B	21% (14% - 28%)
Diffusion Tubes Mean:	42 μgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	34 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	35 (33 - 37) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Discussion of Choice of Factor to Use

Data have been corrected using a bias adjustment factor, which is an estimate of the systematic difference between diffusion tube concentrations and continuous monitoring, the latter assumed to be a more accurate method of monitoring. The technical guidance LAQM.TG 16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tubes. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data from NO_x / NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

With regard to the application of a bias adjustment factor for the diffusion tubes, the technical guidance LAQM.TG 16 and LAQM Helpdesk[6] recommends use of a local bias adjustment factor where available and relevant to diffusion tube sites.

The local bias adjustment factor for 2019 was calculated as 0.82 (see Figure C.1). The monitoring site had good data capture (98%) and the tubes showed good precision for 11 out of 12 months. However, the local bias correction factor has come

[6] laqm.defra.gov.uk

out as unusually high for Tunbridge Wells (usually 0.72 to 0.78). Looking at the tube co-located tube results it does appear that January 2019 had one triplicate tube record a low level (compared to the other two co located tubes) with a CV result of 19 and February was excluded as it had a CV of 24. If these are excluded, the bias correction factor reduces to 0.74. It is possible that the triplicate tubes were accidently mixed with another site and a possible reason for a higher than normal result and high CV results for January and February 2019.

For comparison, the national bias adjustment factor for the laboratory and tube preparation method for 2019 (50% TEA in Acetone) was 0.75 based on 24 studies (April 2020). This is much more consistent with the bias correction factors from previous years.

PM Monitoring Adjustment

The Council undertook monitoring of PM_{10} using a TEOM analyser at one location during 2018. The monitoring results for the TEOM have been VCM[7] corrected prior to reporting.

Short to Long Term Adjustment

Data capture for the diffusion tube sites was generally good in 2019. For Tunbridge Wells, there were 2 sites (TW 38 and TW 71) which recorded less than 75% data capture during 2019. The site for Tube TW38 was in a location that was becoming very overgrown by a neighbouring hedge and becoming increasingly difficult to deploy the tube. This site was closed in July 2019 and a new site, TW71, located a short distance away, was opened for the August 2019 analysis. Both sites which have been annualised according to the method set out in LAQM TG16 box 7.9, using data from Maidstone's rural background site. The details of the annualisation have been provided in Figure C.2 and F and Table C.2 below.

Figure C.2 - TW 38 2019 annualised data

Start Date	End Date	B1	D1	B1 when D1 is available
07/01/2019	04/02/2019	17.6	45.4	17.6
04/02/2019	06/03/2019	15	57.3	15
06/03/2019	04/04/2019	9.6	45.1	9.6

[7] Volatile Correction Model – Used to correct TEOM measurements for the loss of volatile components of particulate matter that occur due to the high sampling temperatures employed by this instrument

04/04/2019	01/05/2019	10.5		
01/05/2019	03/06/2019	6	47	6
03/06/2019	03/07/2019	6	52.6	6
03/07/2019	06/08/2019	6	49	6
06/08/2019	03/09/2019	7		
03/09/2019	01/10/2019	8		
01/10/2019	05/11/2019	9		
05/11/2019	04/12/2019	13.7		
04/12/2019	08/01/2020	10.3		
		9.89	49.4	9.03

Total of B1 (Detling) then average (divide by no. of months)
Total of D1 (tube results) then average (divide by no. of months) + 296.4/6 = 49.4
Total of B1 when D1 then average (divide by no. of months) 54.2/6 = 9.03
Divide B1/B1 when D1 = 9.89/9.03

TW38 annualisation factor = 9.89/9.03 = 1.09
D1 x annualisation factor = 49.4 x 1.09 = **53.8**

Figure C.3 - TW 71 2019 annualised data

Start Date	End Date	B1	D1	B1 when D1 is available
07/01/2019	04/02/2019	17.6		
04/02/2019	06/03/2019	15		
06/03/2019	04/04/2019	9.6		
04/04/2019	01/05/2019	10.5		
01/05/2019	03/06/2019	6		
03/06/2019	03/07/2019	6		
03/07/2019	06/08/2019	6		
06/08/2019	03/09/2019	7	45.6	7
03/09/2019	01/10/2019	8	40.9	8
01/10/2019	05/11/2019	9		
05/11/2019	04/12/2019	13.7		
04/12/2019	08/01/2020	10.3	38.5	10.3
		9.89	41.6	8.4

Total of B1 (detling) then average (divide by no. of months)
Total of D1 (tube results) then average (divide by no. of months) + 125/3 = 41.6
Total of B1 when D1 then average (divide by no. of months) 25.3/3 = 8.4
Divide B1/B1 when D1 = 9.89/8.4

TW38 annualisation factor = 9.89/9.03 = 1.18
D1 x annualisation factor = 41.6 x 1.18 = **49.1**

Table C.2 – Short-Term to Long-Term Monitoring Data Adjustment

Site	Uncorrected Diffusion Tube Mean (µg/m^3)	Maidstone Detling AF	Annualised Data Average µg/m^3	Annualised Bias Adjusted Concentration (µg/m^3)
TW38	49.4	1.09	53.8	31.1
TW71	41.6	1.18	49.9	29.3

QA/QC of Automatic Monitoring

Calibration of the A26 Roadside site is undertaken fortnightly by TWBC's Environmental Protection Team. Matts Monitors undertake 6 monthly servicing, and the QA/QC is part of the K&MAQMN which includes daily data checks and annual audits. The K&MAQMN contract is run by Air Quality Data Management and Envitech Europe who ratify the data.

QA/QC of Automatic Air Quality Instruments

Air quality measurements from automatic instruments are validated and ratified to the standards described in the Local Air Quality Management – Technical Guidance LAQM (TG16)
https://laqm.defra.gov.uk/technical-guidance
by Air Quality Data Management (AQDM) http://www.aqdm.co.uk

Validation

This process operates on data during the data collection stage. All data are continually screened algorithmically and manually for anomalies. There are several techniques designed to discover spurious and unusual measurements within a very large dataset. These anomalies may be due to equipment failure, human error, power failures, interference or other disturbances. Automatic screening can only safely identify spurious results that need further manual investigation.

Raw data from the gaseous instruments (e.g. NOx) are scaled into concentrations using the latest values derived from the manual and automatic calibrations. These instruments are not absolute and suffer drifts. Both the zero baseline (background) and the sensitivity may change over time. Regular calibrations with certified gas standards are used to measure the zero and sensitivity. However, these are only valid for the moment of the calibration since the instrument will continue to drift. Raw measurements from particulate instruments (e.g. PM_{10} and $PM_{2.5}$) generally do not require scaling into concentrations. The original raw data are always preserved intact while the processed data are dynamically scaled and edited.

Ratification

This is the process that finalises the data to produce the measurements suitable for reporting. All available information is critically assessed so that the best data scaling is applied and all anomalies are appropriately edited. Generally this operates at three, six or twelve month intervals. However, unexpected faults can be identified during the instrument routine services or independent audits which are often at 6-monthly intervals. In practice, therefore, the data can only be fully ratified in 12-month or annual periods. The data processing performed during the three and six monthly cycles helps build a reliable dataset that is finalised at the end of the year.

There is a diverse range of additional information that can be essential to the correct understanding and editing of data anomalies. These may include

- the correct scaling of data
- ignoring calibrations that were poor e.g. a spent zero scrubber
- closely tracking rapid drifts or eliminating the data
- comparing the measurements with other pollutants and nearby sites
- corrections due to span cylinder drift
- corrections due to flow drifts for the particulate instruments
- corrections for ozone instrument sensitivity drifts
- eliminating measurements for NO_2 conversion inefficiencies
- eliminating periods where calibration gas is in the ambient dataset
- identifying periods were instruments are warming-up after a powercut
- identification of anomalies due to mains power spikes
- correcting problems with the date and time stamp
- observations made during the sites visits and services

The identification of data anomalies, the proper understanding of the effects and the application of appropriate corrections requires expertise gained over many years of operational experience. Instruments and infrastructure can fail in numerous ways that significantly and visually affect the quality of the measurements. There are rarely simple faults that can be discovered by computer algorithms or can be understood without previous experience.

The PM_{10} concentrations require scaling into Gravimetric Equivalent concentration units by use of the Volatile Correction Model (VCM) http://www.volatile-correction-model.info or by corrections published by Defra https://uk-air.defra.gov.uk/networks/monitoring-methods?view=mcerts-scheme depending on the measurement technique.

Further information about air quality data management, expert data ratification and examples of bad practices are given on the Air Quality Data Management (AQDM) website http://www.aqdm.co.uk.

QC Audits

The National Physical Laboratory, (NPL) carry out annual audits to rigorously evaluate analysers to obtain an assessment of performance level. This information, in conjunction with the full analyser data set and calibration and service records, help ensure data quality specifications have been met during the preceding period. Additionally, an assessment of the station calibration cylinder concentrations provides an indication that the cylinder concentrations remain stable and therefore suitable for data scaling purposes.

The following describes the audit process:-

1 Oxides of Nitrogen

1.1 Analyser Response Factors

A stable "intercalibration standard", validated against NPL primary standards, is transported to each site and is sampled by the analyser.

The analyser also samples from a cylinder containing certified metrology grade zero air, or catalytic scrubbers of known efficiency.

The analyser factor quoted is the response to the intercalibration standard, expressed in $nmol.mol^{-1}.logged\ unit^{-1}$, with the zero point being the response to zero air.

For oxides of nitrogen analysers, the NO_x and NO channel response factors are derived from an NO in nitrogen cylinder.

1.2 Analyser Linearity

To determine analyser linearity, a series of amount fractions are produced (using dynamic dilution techniques) covering the analyser range. The analyser output is noted for each of these amount fractions. A linear regression is then carried out, relating analyser output to the dilution factor at each point. The linearity error is defined as the maximum residual of the regression slope.

1.3 Analyser noise levels.

This is defined here as the standard error of ten successive spot readings of analyser output when fully stabilised on zero (zero noise) or span (span noise) amount fraction.

1.4 NO_x analyser Converter Efficiency

NO_2 to NO Converter efficiency is determined as follows:

A stable amount fraction of NO is produced, (by two stage dynamic dilution) and the analyser outputs, NO_x and NO, are noted after a suitable stabilisation period.

Ozone is added to the sample, converting some NO to NO_2, note however, the total NO_x in the sample remains constant. Again, following appropriate stabilisation times, the NO_x and NO outputs are noted.

Converter (in)efficiency is defined as the change in scaled NO_x signal as a percentage ratio of the change in the scaled NO signal.

1.5 Estimation of Site Cylinder Amount fractions

The site cylinder amount fractions are evaluated by sampling from the site cylinder and using the analyser response factors, section 1.1, to derive their amount fraction.

2 **Particle Analysers.**

2.1 Analyser Flow Rates

Flow rates are measured by calibrated flow audit measurement systems. A leak check is also carried out.

2.2 Analyser Calibration Constants

TEOM Analyser calibration constants are measured by consideration of the change in frequency induced by placing pre-weighed masses on the analyser sensors.

QA/QC of Diffusion Tube Monitoring

Socotec is a UKAS accredited laboratory and participates in the in the new AIR-PT (Proficiency Test) Scheme previously known as the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The lab follows the procedures set out in the Harmonisation Practical Guidance. In the latest available results, Socotec Didcot scored as follows: AIR-PT AR030 (Jan to Feb 2019) 87.5%, AIR-PT AR031 (April to May 2019) 100%, AIR-PT AR033 (July to August 2019) 100% and AIR-PT AR034 (September to October 2019) 100%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of < ± 2. Based on 23 studies, 100% of all local Authority co-location studies in 2019, using the 50% TEA in acetone preparation method, were rated as 'good' (tubes are considered to have "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%).

Figure C.4 – Fall-off Distance Correction of the Site TW41

BUREAU VERITAS

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.8	metres
Step 2	How far from the KERB is your receptor (in metres)?	6.6	metres
Step 3	What is the local annual mean background NO_2 concentration (in µg/m^3)?	11	µg/m^3
Step 4	What is your measured annual mean NO_2 concentration (in µg/m^3)?	48.7	µg/m^3
Result	The predicted annual mean NO_2 concentration (in µg/m^3) at your receptor	*37.5*	µg/m^3

Figure C.5 – Fall-off Distance Correction of the Site TW58

BUREAU VERITAS

Enter data into the pink cells

Step 1	How far from the KERB was your measurement made (in metres)?	1.3	metres
Step 2	How far from the KERB is your receptor (in metres)?	8.3	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	11	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	42.9	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	30.3	$\mu g/m^3$

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

Figure D.2 – Map of Tunbridge Wells Borough Council with AQMA and Diffusion Tube monitoring sites

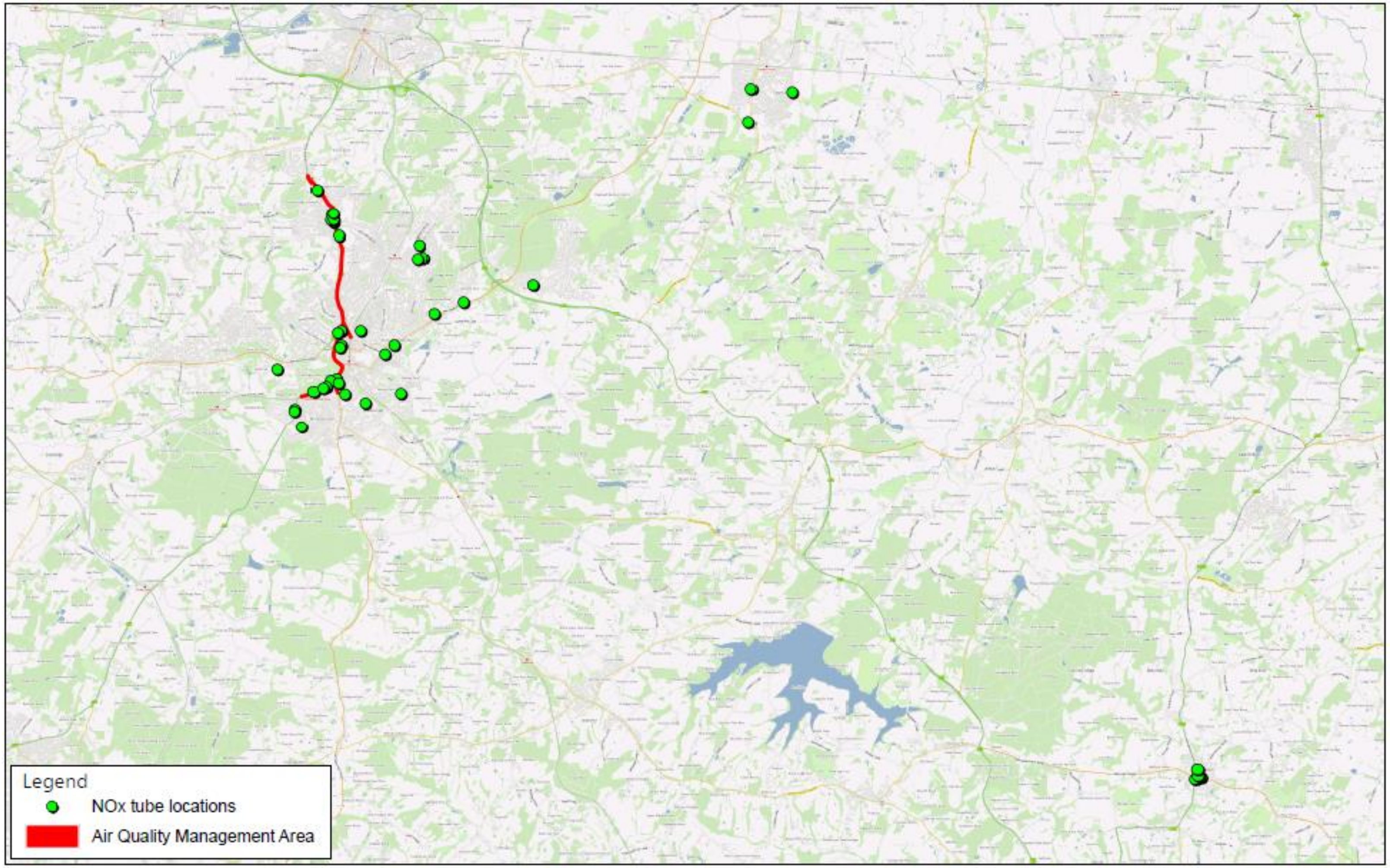


Figure D.2 – Map of Non-Automatic Monitoring Sites - Paddock Wood

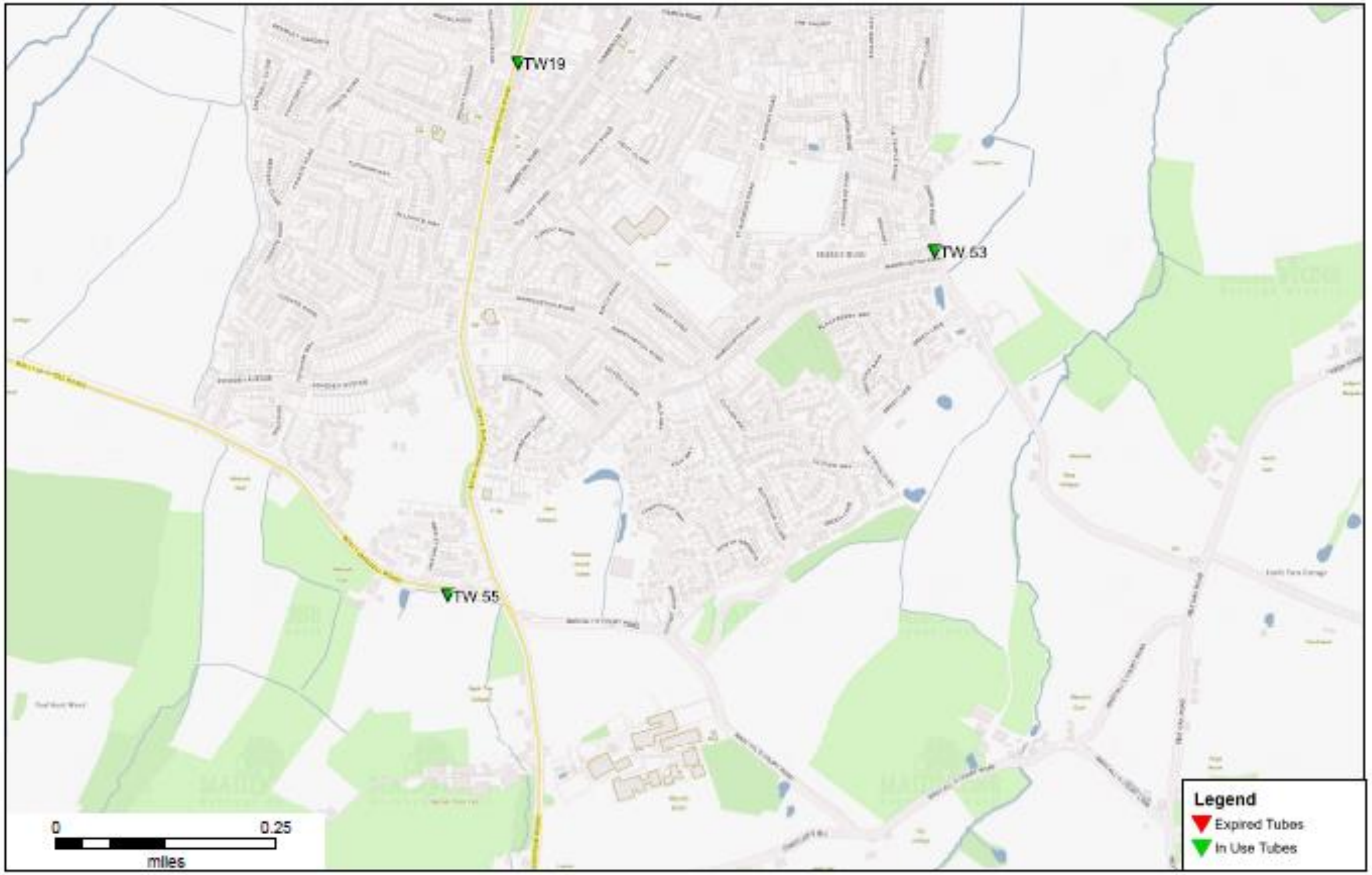


Figure D.3 – Map of Non-Automatic Monitoring Sites - Hawkhurst

Figure D.4 – Map of Non-Automatic Monitoring Sites: Southborough

Figure D.5 – Map of Non-Automatic Monitoring Sites: Tunbridge Wells - Town Centre

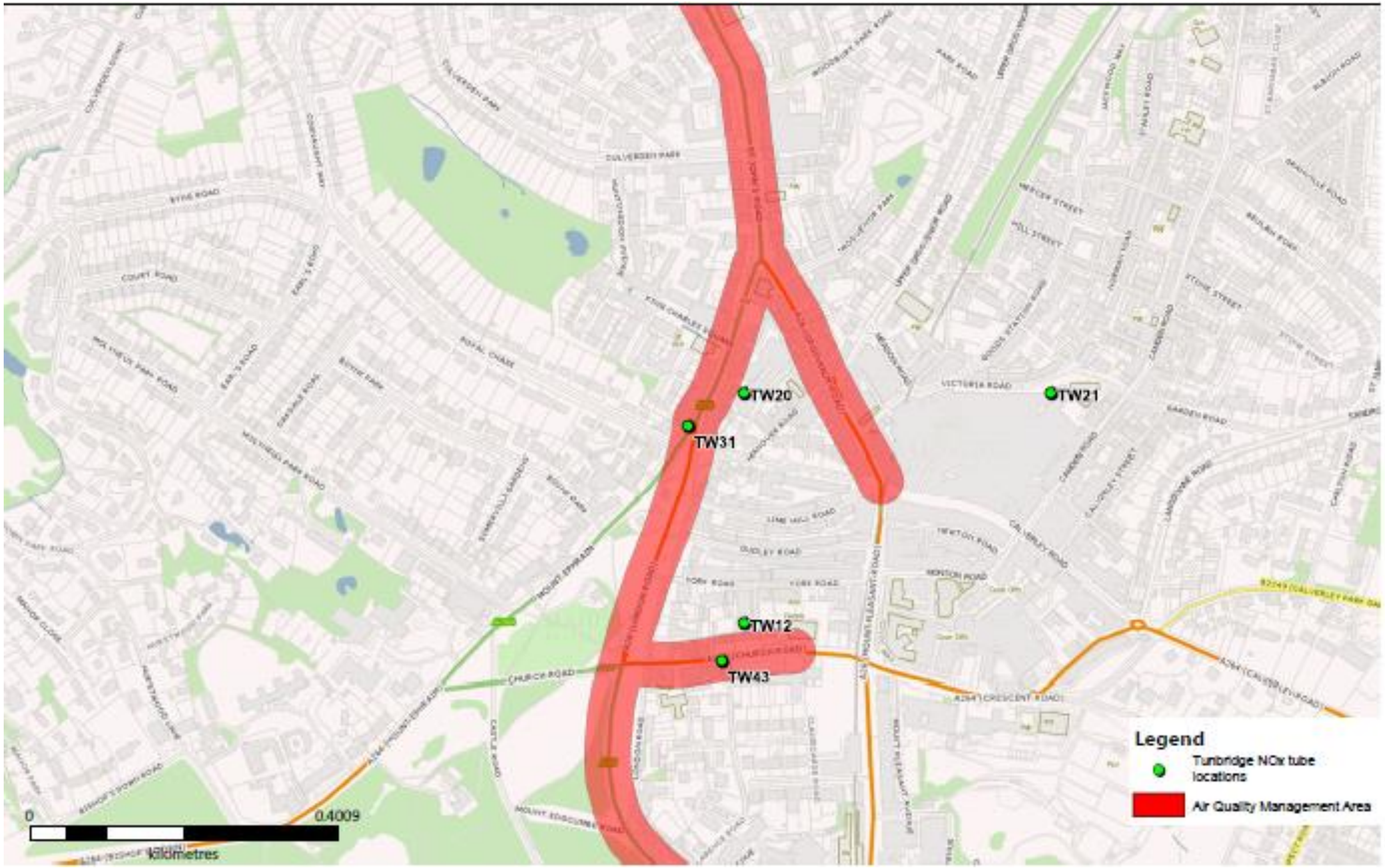


Figure D.6 – Map of Non-Automatic Monitoring Sites: Tunbridge Wells – North East/Sherwood area

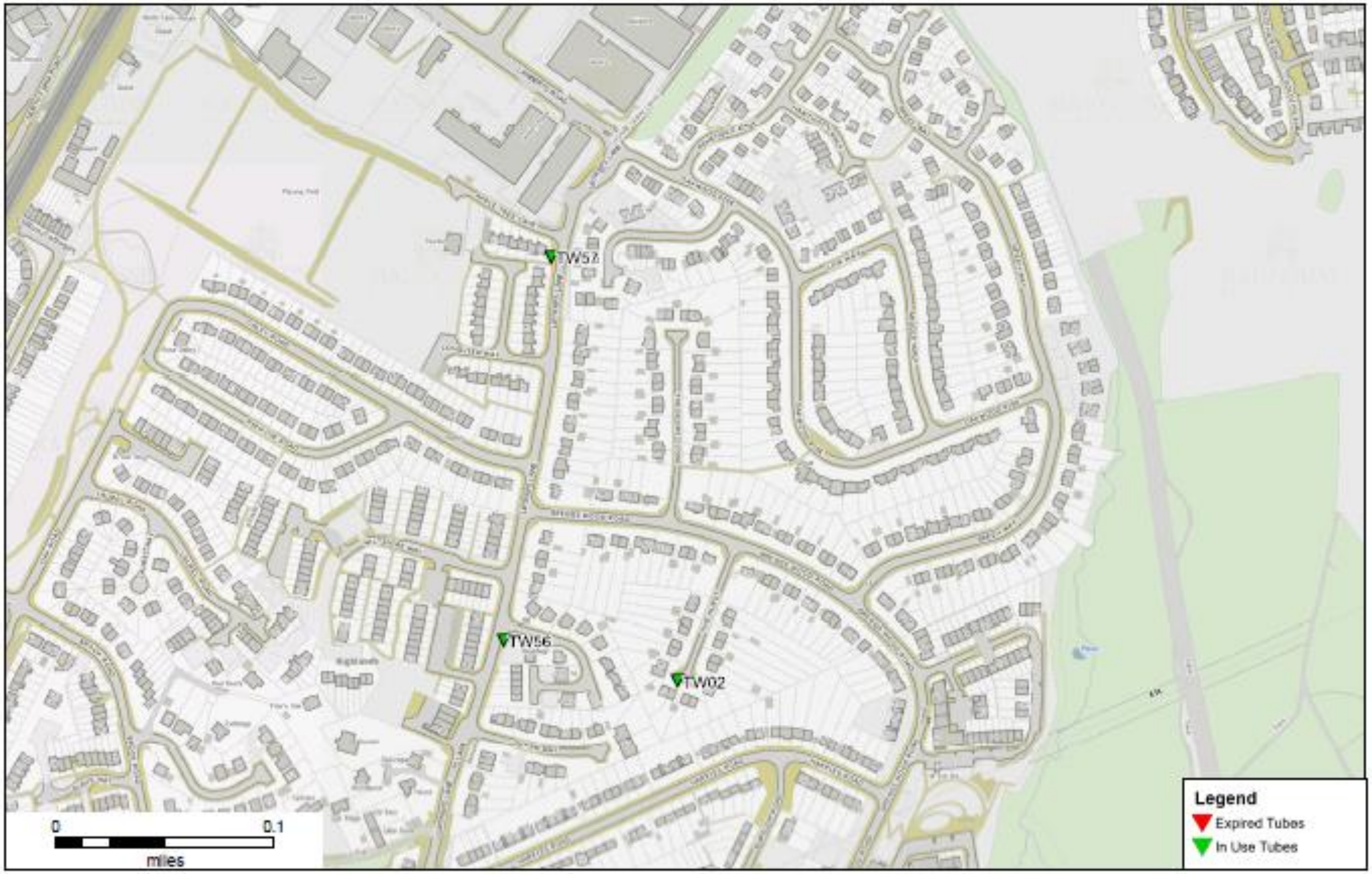


Figure D.7 – Map of Non-Automatic Monitoring Sites: Tunbridge Wells - south

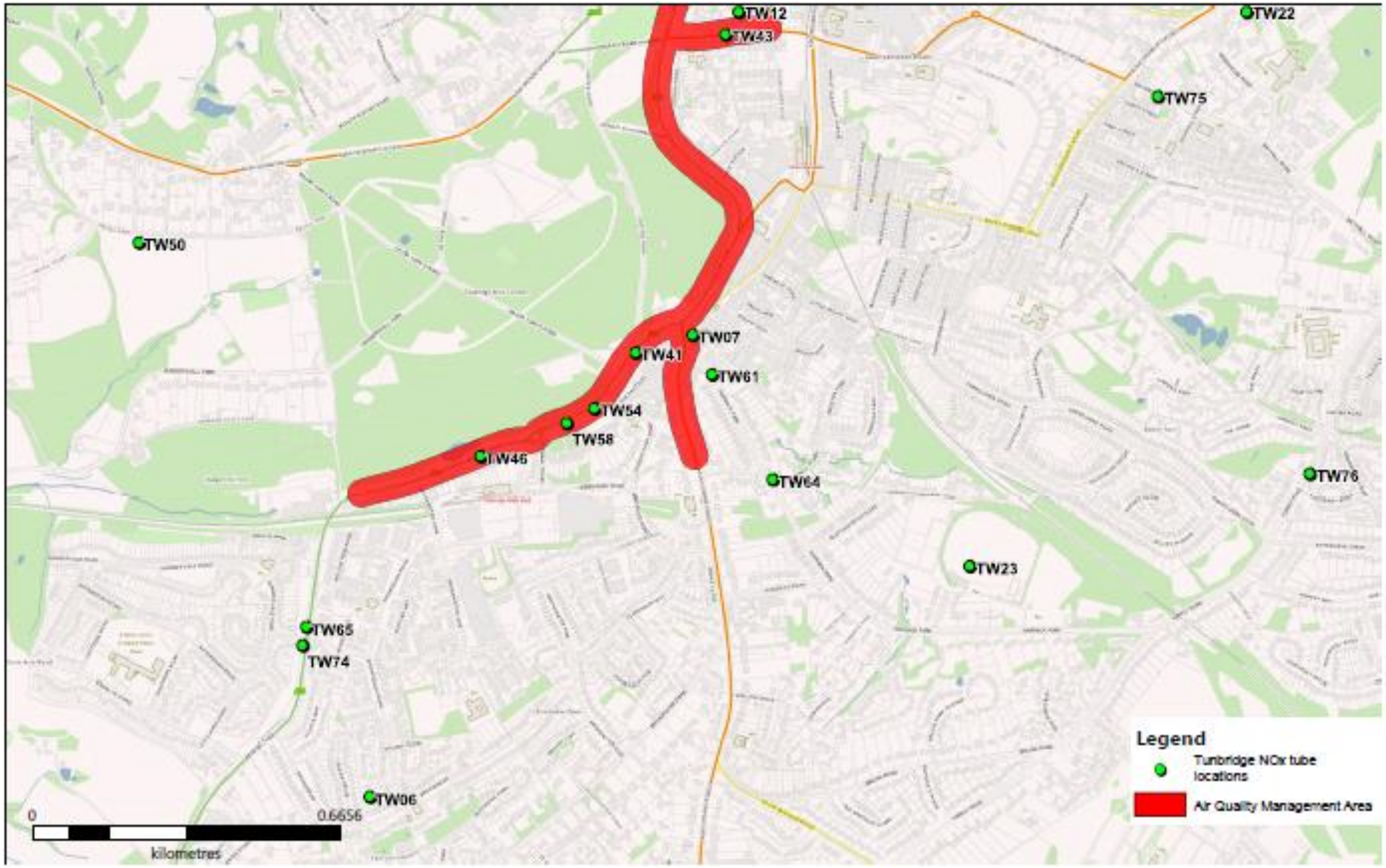


Figure D.8 – Map of Non-Automatic Monitoring Sites – Tunbridge Wells –Pembury Road

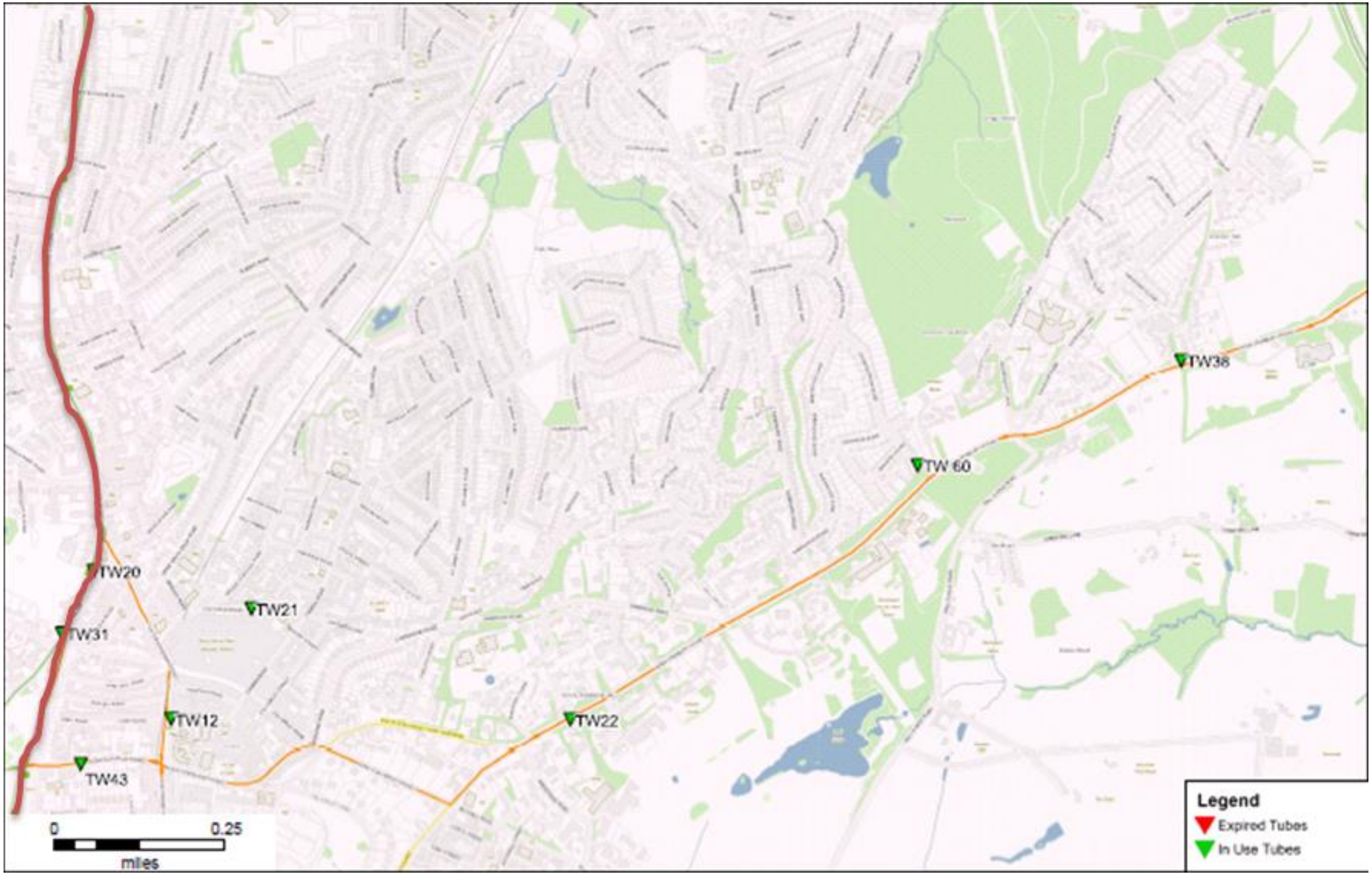
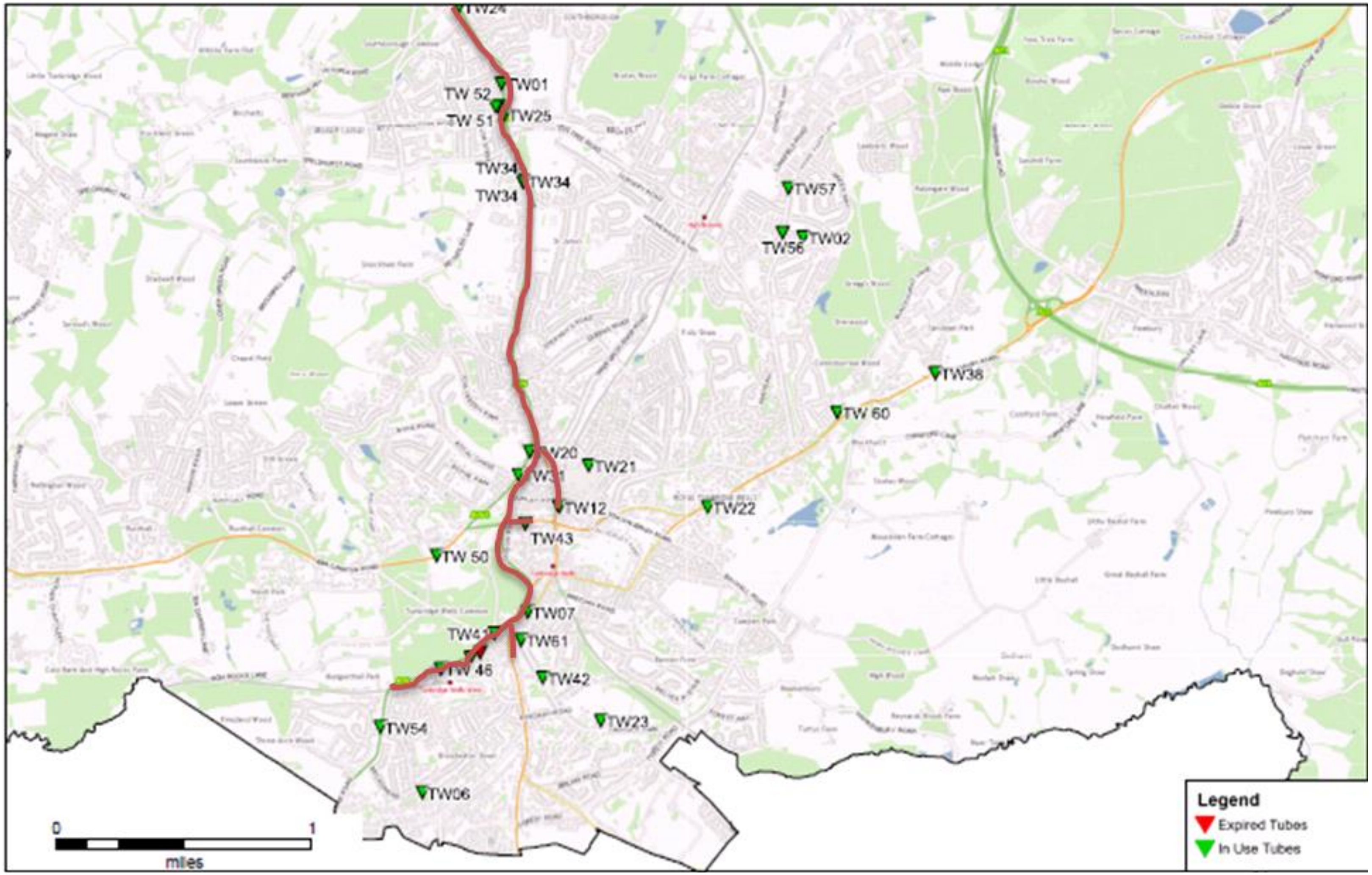


Figure D.9 – Map of Non-Automatic Monitoring Sites: Town Centre Expanded



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

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

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

Appendix F: Air quality Modelling Report, Hawkhurst Air Quality Consultants Ltd June 2020

Air Quality Modelling:
Executive summary

June 2020

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Document Control

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Job Number	J4114

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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J4114A/1/F2	25 June 2020	Final	Dr Clare Beattie (Associate Director)

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1 Introduction

1.1 Diffusion tube monitoring undertaken by Tunbridge Wells Borough Council (TWBC) at new sites in Hawkhurst in 2019 highlighted potential exceedances of the annual mean nitrogen dioxide objective. A detailed assessment was commissioned by the Council to identify where the objective is exceeded at any locations of relevant exposure, and thus whether a new Air Quality Management Area (AQMA) is required to be declared.

1.2 This report describes the dispersion modelling carried out by Air Quality Consultants Ltd (AQC) to identify 2019 annual mean nitrogen dioxide concentration at locations of relevant exposure throughout Hawkhurst. In order to develop appropriate measures to improve air quality along Cranbrook Road and inform the action plan, source apportioned nitrogen dioxide concentrations have also been calculated taking account of the different proportions of emissions emitted by different vehicle types.

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2 Background

Air Quality Strategy

2.1 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Clean Air Strategy 2019

2.2 The Clean Air Strategy (Defra, 2019a) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

The Air Pollutant of Concern

2.3 Nitrogen dioxide is associated with adverse effects on human health. Increases in daily mortality and hospital admissions for cardiovascular diseases and hospital admissions due to asthma have been associated with short-term exposure to nitrogen dioxide. Associations have been found between long-term exposure to nitrogen dioxide and all-cause, cardiovascular, respiratory mortality, lung cancer and pneumonia. However, some debate remains as to the strength of the causal associations (COMEAP, 2018). Decrease in lung function in both children and adults and respiratory infections in early childhood due to long-term exposure to nitrogen dioxide have also been reported.

The Air Quality Objectives

2.4 The Government's Air Quality Strategy (Defra, 2007) provides air quality standards and objectives for key air pollutants, which are designed to protect to protect human health and the environment.

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The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.5 The objectives for nitrogen dioxide were to have been achieved by 2005, and continue to apply in all future years thereafter. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 µg/m^3 (Defra, 2018a). Therefore, the potential for exceedances of the 1-hour nitrogen dioxide objective have only been considered possible if and where the annual mean concentration is above this level. The relevant air quality criteria for this assessment are provided in Table 3.

Table 3: Air Quality Criteria for Nitrogen Dioxide

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3

2.6 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives apply in its Local Air Quality Management Technical Guidance (Defra, 2018a). The annual mean objectives for nitrogen dioxide are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets. Both of these objectives apply at the residential properties modelled within the assessment.

3 Assessment Methodology

Modelling Methodology

3.1 Concentrations have been predicted using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v9.0) (Defra, 2020). Details of the model inputs, assumptions and the verification are provided in Appendix A2, together with the method used to derive background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

3.2 Concentrations have been predicted at thirty-two sensitive receptors throughout Hawkhurst, which are shown in Figure 1, and described in Table 4. Receptor heights have been modelled to represent ground floor exposure, unless stated otherwise in Table 4. Concentrations have also been modelled at the monitoring sites in Hawkhurst, detailed further in Section 4.

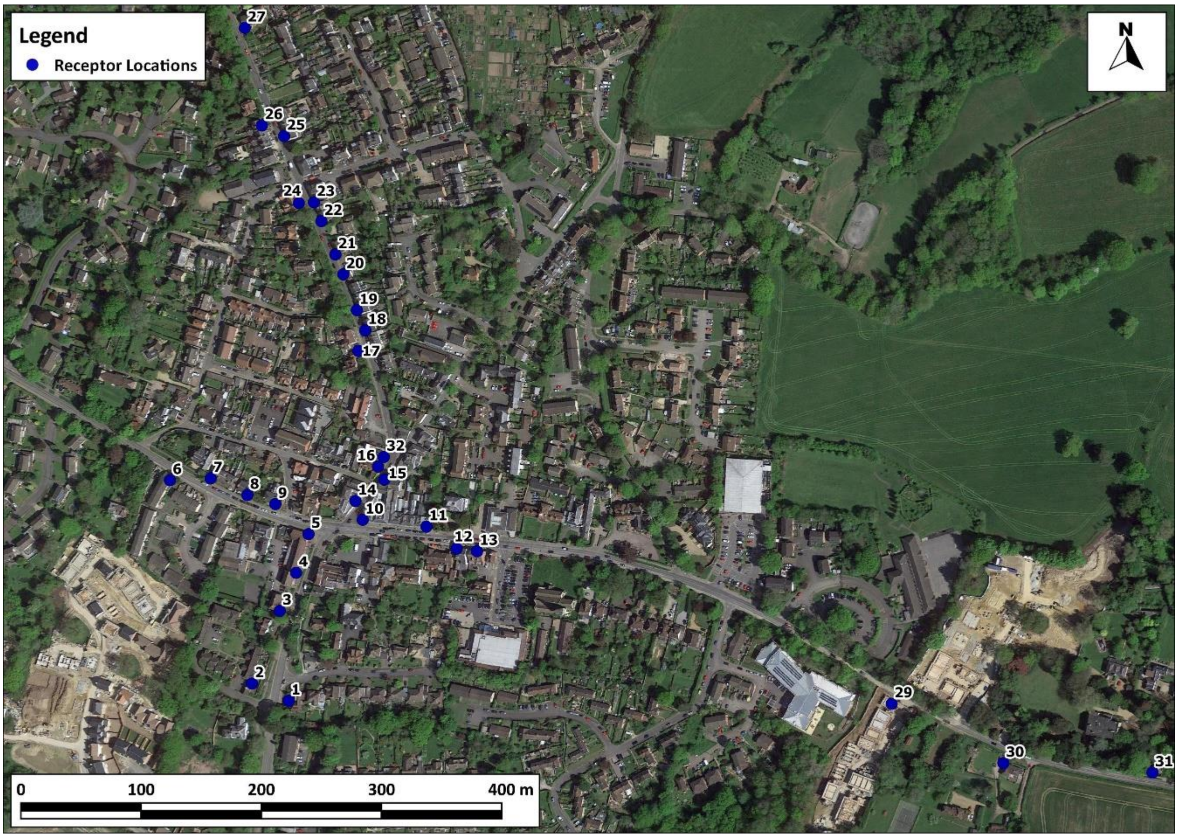

Figure 1: Receptor Locations

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Table 4: Description of Receptor Locations

Receptor	Modelled Heights	Description
Receptor 1	1.5	Residential property on Highgate Hill
Receptor 2	1.5	Residential property on Highgate Hill
Receptor 3 [a]	3.5	Residential property on Highgate Hill
Receptor 4 [a]	6	Residential property on Highgate Hill
Receptor 5 [a]	4.5	Residential property on High Street
Receptor 6	1.5	Residential property on High Street
Receptor 7	1.5	Residential property on High Street
Receptor 8	1.5	Residential property on High Street
Receptor 9	1.5	Residential property on High Street
Receptor 10 [a]	4.5	Residential property on Rye Road
Receptor 11 [a]	4.5	Residential property on Rye Road
Receptor 12 [a]	4.5	Residential property on Rye Road
Receptor 13 [a]	4.5	Residential property on Rye Road
Receptor 14 [b]	0.1, 1.5	Residential property on Cranbrook Road
Receptor 15 [a]	4.5	Residential property on Cranbrook Road
Receptor 16	1.5	Residential property on Cranbrook Road
Receptor 17	1.5	Residential property on Cranbrook Road
Receptor 18	1.5	Residential property on Cranbrook Road
Receptor 19	1.5	Residential property on Cranbrook Road
Receptor 20	1.5	Residential property on Cranbrook Road
Receptor 21	1.5	Residential property on Cranbrook Road
Receptor 22	1.5	Residential property on Cranbrook Road
Receptor 23 [c]	1	Residential property on Cranbrook Road
Receptor 24	1.5	Residential property on Cranbrook Road
Receptor 25 [c]	1	Residential property on Cranbrook Road
Receptor 26	1.5	Residential property on Cranbrook Road
Receptor 27	1.5	Residential property on Cranbrook Road
Receptor 28	1.5	Residential property on Cranbrook Road
Receptor 29	1.5	Residential property on Rye Road
Receptor 30	1.5	Residential property on Rye Road
Receptor 31	1.5	Residential property on Rye Road
Receptor 32	1.5	Residential property on Cranbrook Road

[a] Receptors modelled at an elevated height representative of the lowest floor of residential exposure, either due to there being no exposure at ground level, or the ground level being raised above that of the road.

[b] Receptor modelled at 0.1 m height to represent exposure at the window of a basement flat.

[c] Receptor modelled at 1 m height due to ground level at the property being lower than that of the road.

Uncertainty

3.3 There are many components that contribute to the uncertainty of modelling predictions.

3.4 The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. The traffic data used in the assessment has been sourced from the Department of Transport website (DfT, 2020), and any uncertainties inherent in these data will carry into the assessment.

3.5 There are then additional uncertainties as models are required to simplify real-world conditions into a series of algorithms. An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A2). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of 2019 concentrations. LAQM.TG16 (Defra, 2018a) provides guidance on the evaluation of model performance; based on the analysis shown in Table A2.2 in Appendix A2, the model performance is considered to be good.

3.6 All of the measured concentrations presented will also have an intrinsic margin of error which will also have been carried into the results of the modelling. These margins of error may be inflated at diffusion tubes TW66, TW67, TW68, TW69 and TW70 due to seven months or fewer of measured data being captured, requiring annualisation to be undertaken (see Section 4 and Appendix A3 for further details).

4 Results

Monitoring Results

4.1 Tunbridge Wells Borough Council operated six nitrogen dioxide monitoring sites in Hawkhurst during at least some of 2019 using diffusion tubes prepared and analysed by ESG Didcot (using the 50% TEA in acetone method). The monitoring sites are shown in Figure 2, with monitoring results for recent years presented in Table 5.

4.2 Monitoring site 63 is the only one that operated for every month of 2019; additional tubes were deployed in August 2019 due to elevated concentrations being measured at site 63. Measurements from these additional tubes for the period 9th August 2019 to 4th March 2020 have been annualised to 2019 annual mean concentrations following the approach recommended in LAQM.TG16 (Defra, 2018a).

4.3 Measured annual mean concentrations were above the objective in 2019 at two sites (sites 63 and 69), both located along Cranbrook Road close to the junction with Rye Road. Concentrations further north along Cranbrook Road (at site 70) are below the objective, but only marginally so. Concentrations on Rye Road (site 66) are considerably lower and well below the objective. The site on Highgate Hill (site 67) is also below the objective.

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Figure 2: Monitoring Locations

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Table 5: Measured Annual Mean Nitrogen Dioxide Concentrations (μg/m^3) [a]

Site Name	Site Type	Location	2018	2019
TW63	Roadside	Cranbrook Road, Hawkhurst	**52.4**	**52.7**
TW66	Roadside	Rye Road, Hawkhurst	-	26.2 [b]
TW67	Roadside	Highgate Hill, Hawkhurst	-	35.9 [b]
TW68	Roadside	Cranbrook Road, Hawkhurst	-	38.1 [b]
TW69	Roadside	Cranbrook Road, Hawkhurst	-	**45.3** [b]
TW70	Roadside	Cranbrook Road, Hawkhurst	-	37.7 [b]
Objective			**40**	

[a] Exceedances of the objectives are shown in bold.

[b] Results have been annualised (see Appendix A3).

Modelling Results

4.4 The modelled 2019 annual mean nitrogen dioxide concentrations at the selected receptors are presented in Table 6 and Figure 3.

Table 6: Modelled Annual Mean Nitrogen Dioxide Concentrations in 2019 (μg/m^3) [a]

Receptor	Height	Modelled Annual Mean Nitrogen Dioxide Concentration (μg/m^3)
Receptor 1	1.5	15.9
Receptor 2	1.5	13.4
Receptor 3	3.5	12.6
Receptor 4	6	27.5
Receptor 5	4.5	23.7
Receptor 6	1.5	13.2
Receptor 7	1.5	17.7
Receptor 8	1.5	16.9
Receptor 9	1.5	20.2
Receptor 10	4.5	19.0
Receptor 11	4.5	19.5
Receptor 12	4.5	20.1
Receptor 13	4.5	15.9
Receptor 14	0.1	**56.6**
Receptor 14	1.5	**54.6**
Receptor 15	4.5	35.8
Receptor 16	1.5	**46.3**

Receptor	Height	Modelled Annual Mean Nitrogen Dioxide Concentration (µg/m^3)
Receptor 17	1.5	34.9
Receptor 18	1.5	36.0
Receptor 19	1.5	**40.6**
Receptor 20	1.5	**40.1**
Receptor 21	1.5	39.8
Receptor 22	1.5	31.1
Receptor 23	1	31.1
Receptor 24	1.5	32.5
Receptor 25	1	26.2
Receptor 26	1.5	24.6
Receptor 27	1.5	16.9
Receptor 28	1.5	20.2
Receptor 29	1.5	15.9
Receptor 30	1.5	15.6
Receptor 31	1.5	18.2
Receptor 32	1.5	29.2

[a] Exceedances of the annual mean objective are shown in bold.

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Figure 3: Modelled Annual Mean Nitrogen Dioxide Concentrations in 2019 (µg/m^3)

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4.5 The results show exceedances of the annual mean nitrogen dioxide objective at receptors 14 and 16 on Cranbrook Road, close to the junction with Rye Road, as well as at receptors 19 and 20 further north along Cranbrook Road. All other receptors have modelled concentrations below 40 µg/m^3; however, this does not necessarily mean that there is no risk of exceedances at those receptors with concentrations approaching the objective, as the model is a predictive tool with associated uncertainties. A pragmatic and conservative approach to AQMA declaration that takes into account some of these uncertainties is discussed in Section 5.

4.6 There are no modelled concentrations over 60 µg/m^3 and therefore the 1-hour nitrogen dioxide objective is unlikely to be exceeded.

4.7 The use of an average verification factor (see Appendix A2) necessarily means that the model will predict slightly different concentrations at monitoring sites than those that were measured (although the differences will broadly average out across all sites). It is useful to identify where this effect has been especially pronounced, and thus where modelled concentrations may have been over or under-predicted by a discernible amount.

4.8 The modelled concentration at receptor 18 (36.0 µg/m^3) is likely to represent an under-prediction, as this receptor is adjacent to, and lower in height than, TW70, which measured a concentration of 37.7 µg/m^3. This under-prediction may also suggest that concentrations at other receptors along Cranbrook Road in a similar setting to receptor 18 and TW70 (i.e. in a canyon-like section with a notable gradient) may also be under-predicted somewhat. Thus, in determining the potential area of an AQMA, consideration should be given to the fact that concentrations at receptors 17 to 27 may in reality be slightly higher than modelled.

4.9 Similarly, while the verified model has predicted the concentration at monitoring site TW69 reasonably accurately (to within 1 µg/m^3 of that measured), it has over-predicted the concentration at TW68 by more than 7 µg/m^3 and under-predicted that at TW63 by more than 5 µg/m^3. As a result, it would be reasonable to conclude that the concentration at the first-floor level receptor 15 may have been under-predicted, and that at receptor 14 may have been over-predicted. Such over and under-predictions are unavoidable as a dispersion model cannot accurately reflect every element of the very complex setting of Cranbrook Road, with its multiple canyon-like sections with varying widths, heights and gaps in matters of metres.

4.10 Concentrations at receptor 32 are significantly lower than those at receptor 16, which is located on opposite corners of the same residential property. This is due to the property being located on the edge of a street canyon. Receptor 16 is located within a very enclosed modelled street canyon, whereas receptor 32 is located opposite a far more open section of road. A substantial difference in concentrations between these two locations might reasonably be expected in the real world, although it may not be as great as that modelled.

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5 Source Apportionment

5.1 In order to develop appropriate measures to improve air quality along Cranbrook Road and inform the action plan, it is necessary to identify the sources contributing to the objective exceedances within the study area. Source apportioned nitrogen dioxide concentrations have been calculated taking account of the different proportions of emissions emitted by different vehicle types. The percentage of emissions associated with each vehicle type is not only dependant on the emission rate from the vehicles, but also the local environment, with characteristics such as gradient also affecting emissions disproportionately from different vehicle types. The different proportions have been calculated in-line with guidance provided in Box 7.5 of LAQM.TG16 (Defra, 2020).

5.2 The following categories have been included in the source apportionment:

- Regional background;
- Local background;
- Cars;
- Lights Good Vehicles (LGV);
- Buses and Coaches;
- Rigid Heavy Goods Vehicles (HGVs);
- Artic HGVs; and
- Motorcycles.

5.3 Table 7 and Figure 4 show the contribution from each of the different categories to total predicted annual mean nitrogen dioxide concentrations at receptors where exceedances were predicted; at the top of Cranbrook Road close to the A268 junction (receptors 14 and 16), and on a steeper section of Cranbrook Road further from the A268 (receptors 19 and 20).

5.4 Table 8 and Figure 5 show the percentage contributions of each category to total predicted annual mean nitrogen dioxide concentrations. At all receptors where exceedances are predicted, the largest proportion of the overall concentration is caused by cars (34-35%), followed by LGVs (24%), and Rigid HGVs (13-17%). Background concentrations are predominately from regional sources (72%), rather than local sources (28%), however background emissions only contribute as a relatively small proportion of the overall nitrogen dioxide concentrations (15-21%).

Table 7: Contributions of Different Sources to Total Predicted Annual Mean Nitrogen Dioxide Concentrations (µg/m³) in 2019

Receptor	Annual Mean Contribution (µg/m³)							
	Regional Background	Local Background	Car	Motorcycle	LGV	Rigid HGV	Artic HGV	Buses and Coaches
Receptor 14 [a]	5.9	2.3	19.8	0.04	13.7	9.4	3.3	2.1
Receptor 16	5.9	2.3	16.9	0.04	11.7	8.0	2.8	1.8
Receptor 19	5.9	2.3	14.2	0.03	9.7	5.3	2.0	1.1
Receptor 20	5.9	2.3	14.0	0.03	9.6	5.2	2.0	1.1
Objective	40							

[a] Only data for the receptor modelled at a height of 0.1 m presented.

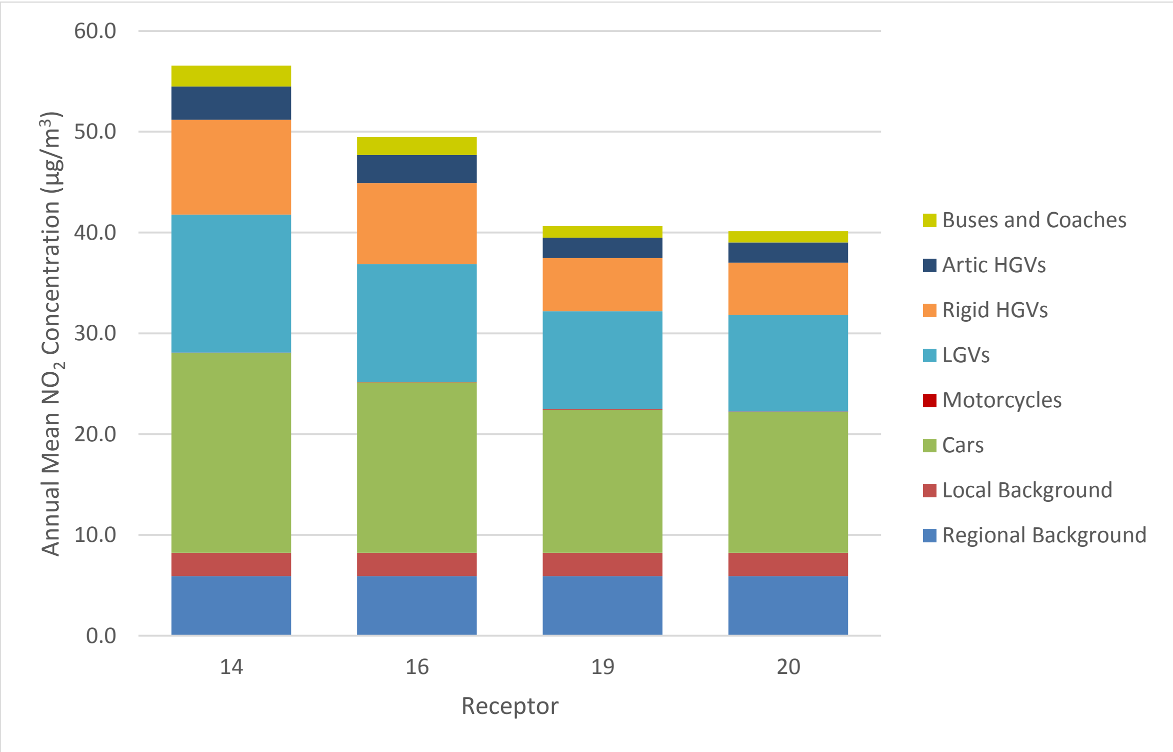

Figure 4: Contributions of Different Sources to Total Predicted Annual Mean Nitrogen Dioxide Concentration (µg/m³) at Receptors Exceeding the Air Quality Objective in 2019

Table 8: Percentage Contributions of Different Sources to Total Predicted Annual Mean Nitrogen Dioxide Concentrations (µg/m^3) in 2019

Receptor	Annual Mean Contribution (µg/m^3)							
	Regional Background	Local Background	Car	Motorcycle	LGV	Rigid HGV	Artic HGV	Buses and Coaches
Receptor 14 [a]	10.5	4.1	35.0	0.1	24.2	16.6	5.8	3.7
Receptor 16	11.9	4.7	34.2	0.1	23.6	16.2	5.7	3.6
Receptor 19	14.5	5.7	34.9	0.1	24.0	13.0	5.0	2.8
Receptor 20	14.7	5.8	34.8	0.1	23.9	13.0	5.0	2.8

[a] Only data for the receptor modelled at a height of 0.1 m presented.

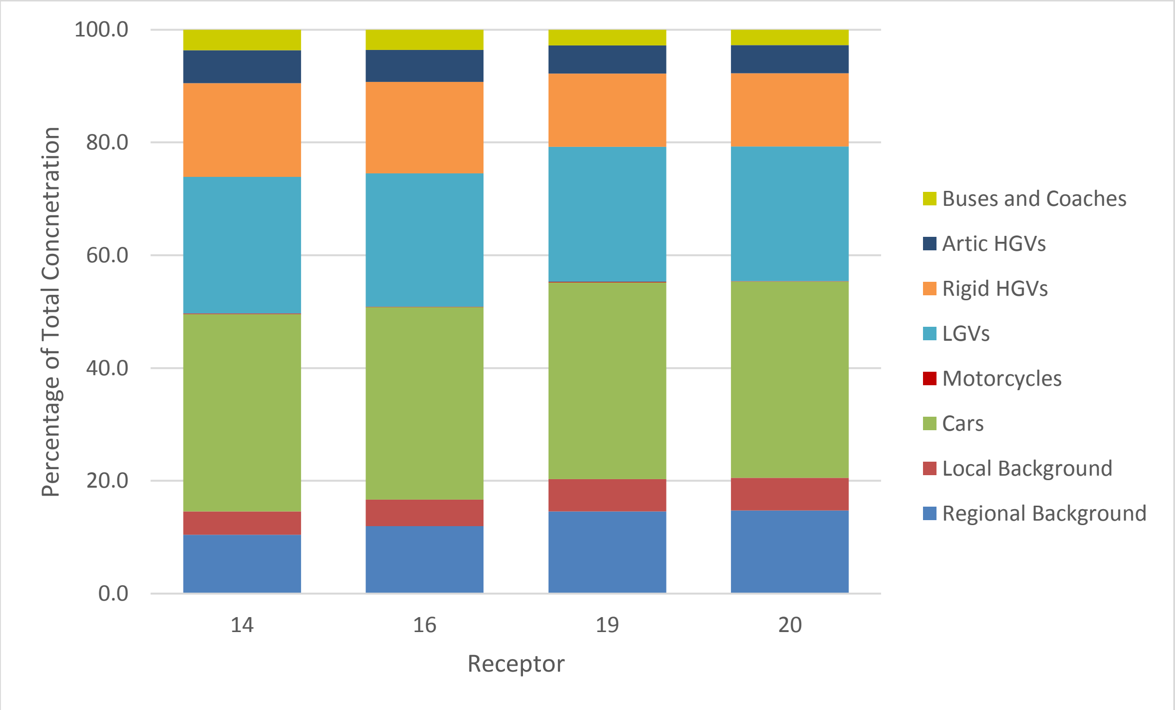

Figure 5: Percentage Contributions of Different Sources to Total Predicted Annual Mean Nitrogen Dioxide Concentrations (µg/m^3) at Receptors Exceeding the Air Quality Objective in 2019

6 Discussion and Recommendations

6.1 The modelling undertaken by AQC has shown there are predicted to be exceedances of the annual mean nitrogen dioxide objective in Hawkhurst, and as a result, an Air Quality Management Area should be declared. This section details the specific locations which could be covered by this declaration.

6.2 Figure 6 provides a recommendation for the properties that could be included within the Hawkhurst AQMA. The properties which lie within the red areas on Figure 6 are those at which receptors representative of them have modelled concentrations of over 40 µg/m^3, and therefore should be included within the AQMA. The properties within the blue areas are those which are judged to have a reasonable likelihood of an exceedance when the model uncertainties (such as those discussed in Paragraphs 4.6 to 4.9) are taken into account. These need not necessarily be included within the AQMA, but given the relative likelihood of exceedances at them, it would be pragmatic to take the conservative approach of including them.

6.3 It should, however, also be noted that progressive improvements in vehicle emissions, and a transition away from diesel vehicles and towards zero tailpipe emission vehicles is expected to lead to reduced nitrogen dioxide concentrations in future years (DfT, 2018). It is, therefore, reasonable to expect concentrations to reduce from those measured and modelled in 2019 in the coming years, more rapidly than they have in previous years. This should also be taken into account when deciding whether the properties within the blue areas on Figure 6 need be included in the AQMA, as they are unlikely to experience objective exceedances much beyond 2019.

6.4 In order to develop appropriate measures to improve air quality along Cranbrook Road and inform the action plan, source apportioned nitrogen dioxide concentrations have been calculated taking account of the different proportions of emissions emitted by different vehicle types. At all receptors where exceedances are predicted, the largest proportion of the overall concentration is caused by cars (34-35%), followed by LGVs (24%), and Rigid HGVs (13-17%).

6.5 The areas presented in Figure 6 will be provided to TWBC in the form of a GIS shapefile. Modelled receptor locations can also be provided in this format, or as a text file, if desired.

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Figure 6: Recommendation for the Hawkhurst AQMA

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8 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
kph	Kilometres Per hour
LAQM	Local Air Quality Management
LGV	Light Goods Vehicle
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide

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TWBC	Tunbridge Wells Borough Council

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9 Appendices

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A1 Professional Experience

Dr Clare Beattie, BSc (Hons) MSc PhD CSci MIEnvSc MIAQM

Dr Beattie is an Associate Director with AQC, with more than 20 years' relevant experience. She has been involved in air quality management and assessment, and policy formulation in both an academic and consultancy environment. She has prepared air quality review and assessment reports, strategies and action plans for local authorities and has developed guidance documents on air quality management on behalf of central government, local government and NGOs. She has led on the air quality inputs into Clean Air Zone feasibility studies and has provided support to local authorities on the integration of air quality considerations into Local Transport Plans and planning policy processes. Dr Beattie has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has carried out numerous assessments for new residential and commercial developments, including the negotiation of mitigation measures where relevant. She has also acted as an expert witness for both residential and commercial developments. She has carried out BREEAM assessments covering air quality for new developments. Dr Beattie has also managed contracts on behalf of Defra in relation to allocating funding for the implementation of air quality improvement measures. She is a Member of the IAQM and IES and is a Chartered Scientist.

Ricky Gellatly, BSc (Hons) CSci MIEnvSc MIAQM

Mr Gellatly is a Principal Consultant with AQC with over eight years' relevant experience. He has undertaken air quality assessments for a wide range of projects, assessing many different pollution sources using both qualitative and quantitative methodologies, with most assessments having included dispersion modelling (using a variety of models). He has assessed road schemes, airports, energy from waste facilities, anaerobic digesters, poultry farms, urban extensions, rail freight interchanges, energy centres, waste handling sites, sewage works and shopping and sports centres, amongst others. He also has experience in ambient air quality monitoring, the analysis and interpretation of air quality monitoring data, the monitoring and assessment of nuisance odours and the monitoring and assessment of construction dust. He is a Member of the IAQM and is a Chartered Scientist.

David Bailey, BSc (Hons)

Mr Bailey is a Consultant with AQC, having joined the Company in 2018. Prior to joining AQC he gained a degree in Environmental Science from the University of Brighton, where his studies included modules focused on Air Quality Management. He is now gaining experience in air quality and greenhouse gas assessments, with the use of the ADMS-Roads and ADMS-5 dispersion modelling software. The use of modelling has been used in a wide variety of schemes ranging from large residential EIA developments, and detailed assessments for Local Authorities, to assessing the impacts of gas power generation and agricultural facilities. In addition, he has also gained experience in diffusion tube and automatic monitoring, including data ratification.

A2 Modelling Methodology

Model Inputs

A2.1 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 9.0) published by Defra (2020). Road gradients have also been included within the emissions calculations.

A2.2 Hourly sequential meteorological data from Herstmonceux for 2019 have been used in the model, which is considered suitable for this area.

A2.3 AADT flows and fleet composition data have been determined from the interactive web-based map provided by DfT (2020). DfT flows for the most recent year available, 2018, were used; it was not considered necessary to adjust the flows to 2019 as there would be very little difference between flows in the two years, and any adjustment would be consistent along all links and thus unlikely to affect the model outcomes. The traffic data used in this assessment are summarised in Table A2.1.

Table A2.1: Summary of Traffic Data used in the Assessment (AADT Flows)

Road Link	AADT	%Car	%LGV	%Rigid HGV	%Artic HGV	%Bus and Coach	%Motor cycle
Cranbrook Road	8,680	74.7	19.6	3.5	1.3	0.4	0.5
Highgate Hill	8,732	72.1	22.5	2.9	1.1	0.6	0.8
A268 (Rye Road/ High Street)	6,638	77.1	17.4	2.4	1.5	1.3	0.3

A2.4 Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2019).

A2.5 Figure A2.1 shows the road network included within the model, including the speed that each link was modelled, and defines the study area. The modelled street canyons are shown in Figure A2.2.

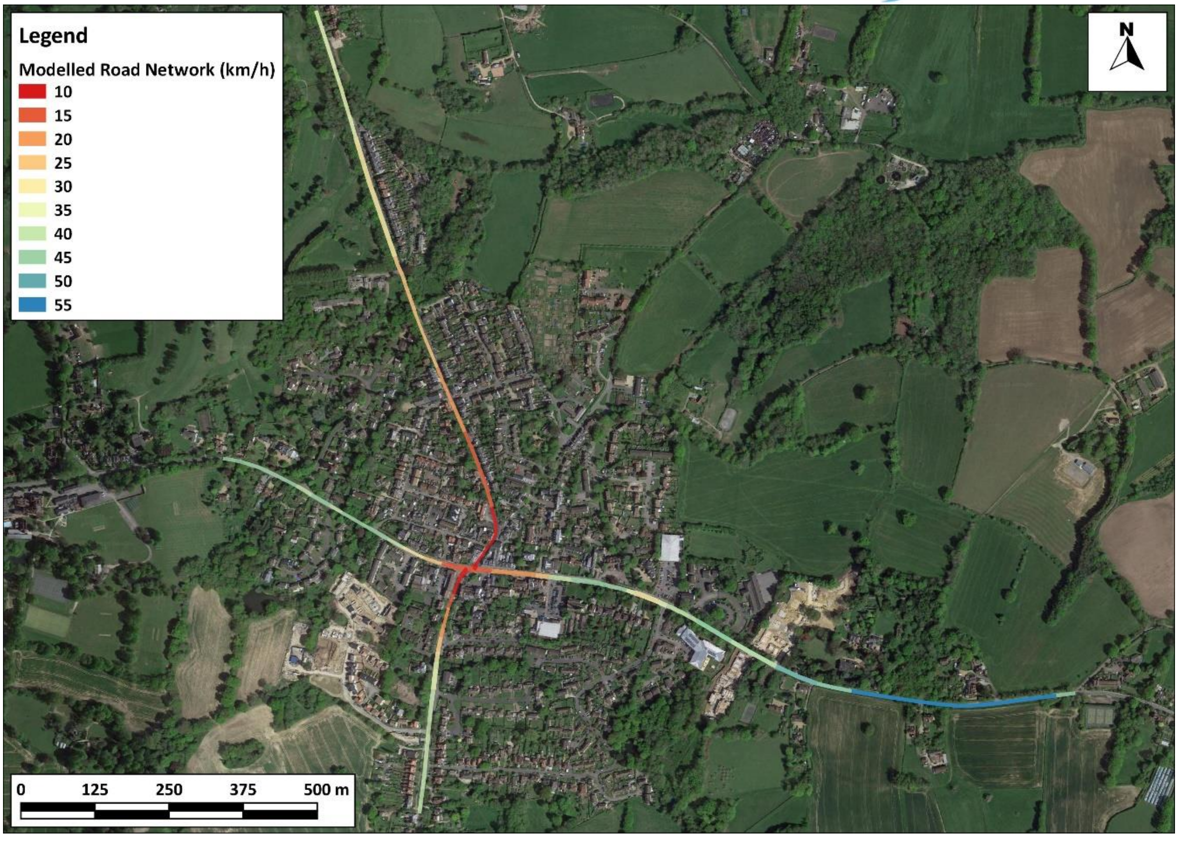

Figure A2.1: Modelled Road Network & Speed

Imagery © Google.

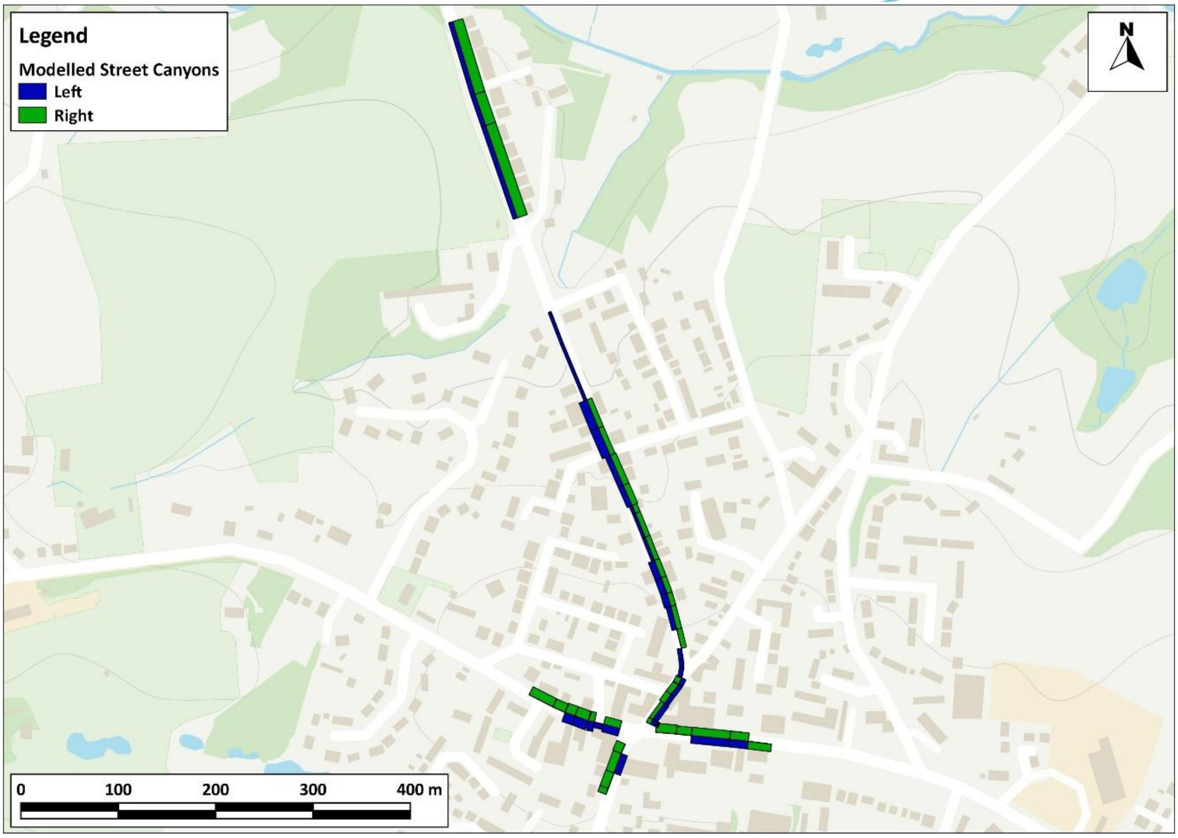

Figure A2.2: Modelled Street Canyons

Background Concentrations

A2.6 Background pollutant concentrations have been defined using the 2017-based national pollution maps published by Defra (2020). These cover the whole of the UK on a 1x1 km grid and are published for each year from 2017 until 2030. While the model domain extended across more than one of the background map grid squares, annual mean background nitrogen dioxide concentrations in these squares were all very similar, and it was decided to use a consistent value at all receptors; the value selected was that of the square covering central Hawkhurst, which was also the highest of all of the squares within which receptors were located. The 2019 annual mean background nitrogen dioxide concentration used was 8.24 µg/m^3.

Model Verification

A2.7 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the annual mean NOx concentrations during 2019 at the TW63, TW66, TW67, TW68, TW69, TW70 diffusion tube monitoring sites. Concentrations have been modelled at 1.8 m at TW63 and 2 m at the other sites, as advised by TWBC.

A2.8 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the ‘measured’ road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 7.1) available on the Defra LAQM Support website (Defra, 2020).

A2.9 The unadjusted model has under predicted the road-NOx contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the ‘measured’ road contribution and the model derived road contribution, forced through zero (Figure A2.3). The calculated adjustment factor of 1.402 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A2.10 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A2.4 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

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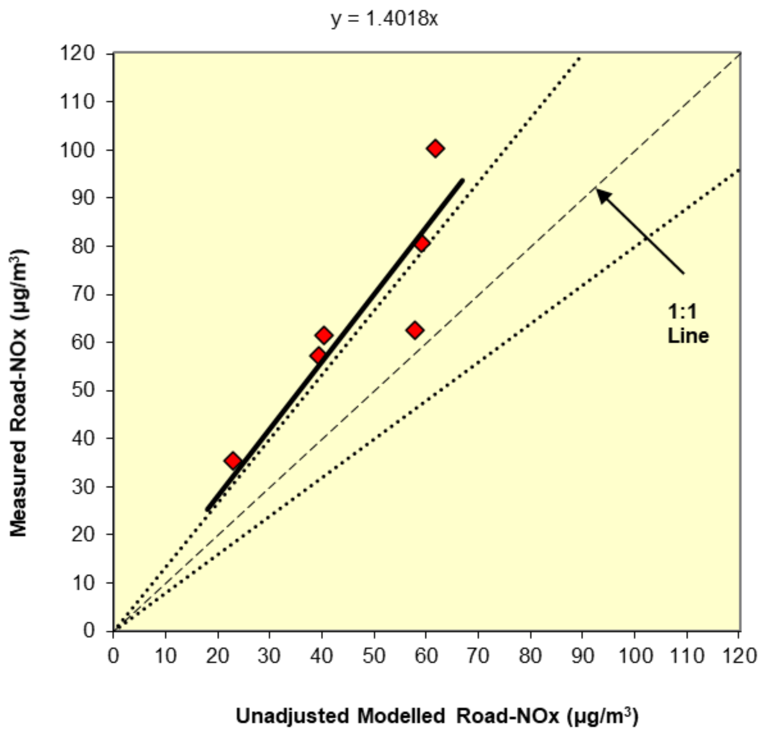

Figure A2.3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

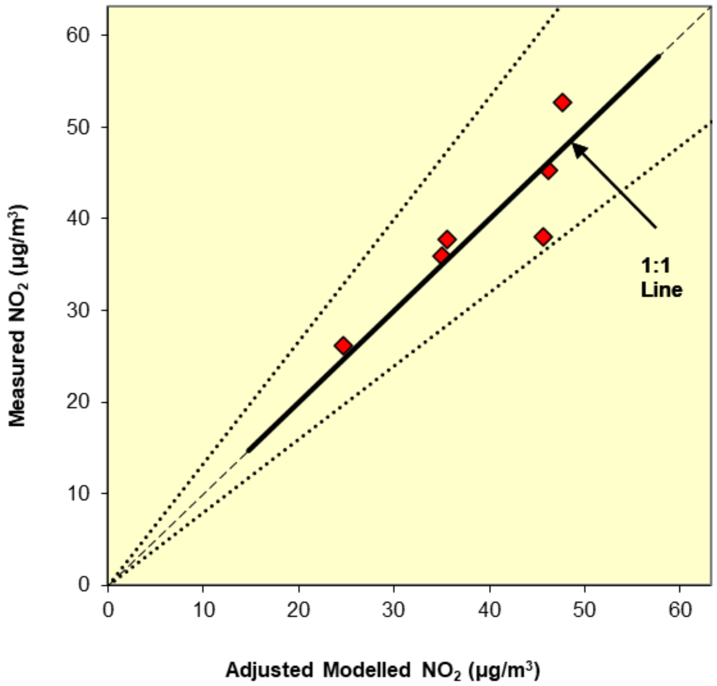

Figure A2.4: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

2.10.1 Table A2.2 presents the statistical parameters relating to the performance of the model, as well as the 'ideal' values (Defra, 2018c). The values calculated for the model demonstrate that it is performing well.

Table A2.2: Statistical Model Performance

Statistical Parameter	Model-Specific Value	'Ideal' Value
Correlation Coefficient [a]	0.89	**1**
Root Mean Square Error (RMSE) [b]	3.86	**0**
Fractional Bias [c]	0.00	**0**

[a] Used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.

[b] Used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared (i.e. $\mu g/m^3$). TG16 (Defra, 2018a) outlines that, ideally, a RMSE value within 10% of the air quality objective ($4\mu g/m^3$) would be derived. If RMSE values are higher than 25% of the objective ($10\ \mu g/m^3$) it is recommended that the model is revisited.

[c] Used to identify if the model shows a systematic tendency to over or under predict. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.

Model Post-processing

A2.11 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2 concentration, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2018b). The traffic mix within the calculator has been set to “All other urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

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A3 Adjustment of Monitoring Data to Annual Mean

Calculating Annualisation Factors

A3.1 Diffusion tube monitoring sites have been annualised as per Technical Guidance LAQM.TG16 (Defra, 2018a) in instances where valid data capture was less than 75% (and at least 25%).

A3.2 Sites TW66, TW67, TW68, TW69, and TW70 have been annualised against automatic monitoring sites operated by TWBC at 'Swale Newington', 'Swale Ospringe', 'Swale St Pauls Street', and 'Tunbridge Wells A26'. These sites are considered to have the most appropriate annual profile with which to annualise the data, and also have over 85% data capture in 2019.

A3.3 Four adjustment factors (one for each of the automatic sites used) have been calculated for each diffusion tube site based on the ratio of the mean concentration measured by the automatic sites during the monitoring period for which data for the diffusion tube site was available and annual mean concentrations measured by the automatic sites (see Table A3.1, Table A3.2, and Table A3.3). An average of the four adjustment factors was then calculated (see Table A3.4) and applied to the diffusion tube bias adjusted annual means.

Table A3.1: TW66 Annualisation Factor Calculation

Period	Exposure Days	Raw Diffusion Tube Mean NO_2 Conc. (µg/m^3)	Automatic Mean NO_2 Conc. (µg/m^3) when Diffusion Tube Data is Available			
		TW66	Swale Newington	Swale Ospringe	Swale St Pauls Street	Tunbridge Wells A26
02/09/19 to 30/09/19	**28.0**	32.4	22.1	28.0	31.7	30.5
30/09/19 to 07/11/19	**37.9**	32.8	24.2	29.7	36.7	29.6
07/11/19 to 02/12/19	**25.1**	36.8	34.8	34.8	45.8	38.6
PERIOD MEAN		*33.8*	*26.5*	*30.6*	*37.7*	*32.3*
ANNUAL MEAN:			**26.9**	**31.4**	**39.0**	**34.4**
ANNUALISATION FACTOR:			**1.015**	**1.025**	**1.036**	**1.064**

Table A3.2: TW67, TW69, TW70 Annualisation Factor Calculations

Period	Exposure Days	Raw Diffusion Tube Mean NO_2 Conc. (µg/m^3)			Automatic Mean NO_2 Conc. (µg/m^3) when Diffusion Tube Data is Available			
		TW67	TW69	TW70	Swale Newington	Swale Ospringe	Swale St Pauls Street	Tunbridge Wells A26
09/08/19 to 02/09/19	23.9	43.5	56.5	56.8	21.1	26.8	35.0	28.4
02/09/19 to 30/09/19	28.0	41.4	49.8	45	22.1	28.0	31.7	30.5
30/09/19 to 07/11/19	37.9	50	52.1	49.4	24.2	29.7	36.7	29.6
07/11/19 to 02/12/19	25.1	47.3	58	51.7	34.8	34.8	45.8	38.6
02/12/19 to 07/01/20	35.9	47.1	59.4	43.9	23.9	27.7	37.6	31.0
07/01/20 to 05/02/20	29.0	33.4	56.7	43.7	24.3	29.1	37.7	32.9
05/02/20 to 04/03/2020	27.8	39.1	51.9	30.7	17.8	22.9	32.1	26.1
PERIOD MEAN		*43.5*	*54.9*	*45.7*	*23.9*	*28.4*	*36.6*	*30.9*
ANNUAL MEAN:					**26.9**	**31.4**	**39.0**	**34.4**
ANNUALISATION FACTOR:					**1.122**	**1.104**	**1.065**	**1.113**

Table A3.3: TW68 Annualisation Factor Calculation

Period	Exposure Days	Raw Diffusion Tube Mean NO_2 Conc. (µg/m^3)	Automatic Mean NO_2 Conc. (µg/m^3) when Diffusion Tube Data is Available			
		TW68	Swale Newington	Swale Ospringe	Swale St Pauls Street	Tunbridge Wells A26
09/08/19 to 02/09/19	23.9	49.6	21.1	26.8	35.0	28.4
02/09/19 to 30/09/19	28.0	44.1	22.1	28.0	31.7	30.5
30/09/19 to 07/11/19	37.9	45.5	24.2	29.7	36.7	29.6
07/11/19 to 02/12/19	25.1	50.0	34.8	34.8	45.8	38.6
02/12/19 to 07/01/20	35.9	49.4	23.9	27.7	37.6	31.0

07/01/20 to 05/02/20	**29.0**	46.7	24.3	29.1	37.7	32.9
PERIOD MEAN		*47.4*	*24.9*	*29.3*	*37.3*	*31.7*
ANNUAL MEAN:			**26.9**	**31.4**	**39.0**	**34.4**
ANNUALISATION FACTOR:			**1.079**	**1.072**	**1.045**	**1.087**

Table A3.4: Average Annualisation Factors

TW66	TW67	TW68	TW69	TW70
1.035	**1.101**	**1.071**	**1.101**	**1.101**

Bias Adjustment

A3.4 Diffusion tubes are known to exhibit bias when compared to results from automatic analysers. Therefore diffusion tube results need to be adjusted to account for this bias. One of the main factors influencing diffusion tube performance is the laboratory that supplies and analyses the tubes. The diffusion tubes exposed at Hawkhurst are supplied and analysed by SOCOTEC Didcot. (50% TEA in acetone). Defra releases national bias adjustment factors from co-location studies undertaken by local authorities around the UK. The bias adjustment factor used to obtain the final 2019 concentrations at all diffusion tubes in Hawkhurst was 0.75 (based on 24 studies), available from the spreadsheet released in April 2020 by Defra (Defra, 2020b). This bias adjustment factor was applied to all the 2019 annual means, whether annualised or not.

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Glossary of Terms

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

References

- Department for Environment, Food and Rural Affairs (Defra) (2016) *Local Air Quality Management Technical Guidance LAQM.TG 16.*
- Department for Environment, Food and Rural Affairs (Defra) (2016) *Local Air Quality Management Policy Guidance LAQM.PG 16*
- Kent and Medway Air Quality Partnership (2011) *Air Quality and Planning Technical Guidance (updated 2016)*
- Tunbridge Wells Borough Council (2015) *Updating and Screening Assessment.*
- National Diffusion Tube Bias Adjustment Spreadsheet, version 03/19 published in March 2019.
- Tunbridge Wells Borough Council Air Quality Action Plan – November 2009
- TWBC Draft Local Plan https://beta.tunbridgewells.gov.uk/planning/planning-policy/local-plan/draft-local-plan.
- Tunbridge Wells Borough Transport Strategy – July 2015 http://www.tunbridgewells.gov.uk/__data/assets/pdf_file/0019/132256/Transport-Strategy-2015-26-low-res.pdf
- http://www.phoutcomes.info/public-health-outcomes-framework#page/0/gid/1000043/pat/6/par/E12000008/ati/101/are/E07000114
- http://laqm.defra.gov.uk/documents/LAQM-AIR-PT-Rounds 19 to 30 (Apr 2017 - Feb 2019)

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