Swansea Council

2017 Air Quality Progress Report

In fulfillment of Part IV of the Environment Act 1995

Local Air Quality Management

Date (December, 2018)

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Report Reference number	Swansea Annual Progress Report 2018
Date	December 2018

Executive Summary: Air Quality in Our Area

Air Quality in Swansea Council

This report contains the latest air quality monitoring results within the City and County of Swansea. The conclusions reached are that the objectives for benzene, lead and sulphur dioxide will be met and that there is no requirement to proceed further with these pollutants.

Ozone is monitored at four sites within Swansea. Compliance with the 8-hour mean UK objective (not set in regulation) has been seen during 2017 at all monitoring stations except the St. Thomas DOAS (14 exceedences in total).

The City and County of Swansea participates in the UK Heavy Metals Monitoring Network and there are two UK Heavy Metal Network funded sites at Coedgwilym Cemetery and Morriston Groundhog. These sites will remain and have confirmed continued and ongoing compliance with the 4th Daughter Directive critical threshold monitoring target value for nickel.

All monitoring sites remain compliant with both the annual mean and daily mean exceedance (35 days permitted) for Particulate matter PM_{10}.

The Pollutant currently exceeding the Objective Concentration in Swansea is Nitrogen Dioxide (NO_2), for the annual mean Objective of 40µgm^{-3}. The latest monitoring data, 2017, indicates that concentrations are decreasing from those in 2016 and are following a downward trend over the last five years. There are currently only exceedences of the annual mean NO_2 Objective at locations within existing Air Quality Management Areas (AQMA's https://uk-air.defra.gov.uk/aqma/details?aqma_ref=82#1313) and Swansea Council intends to continue to monitor at these locations.

Swansea Council is currently updating the Draft Air Quality Action Plan, submitted to Welsh Government in 2018, with a view to going out for public consultation by April 2019.

Actions to Improve Air Quality

The opening of the Morfa Distributor Road and the implementation of the Nowcaster system within the Hafod area of Swansea has led to reductions in NO_2 being recorded along this road link in 2017. Recent junction improvement works carried out on Gower Road, in Sketty, have also potentially had effect upon concentrations of NO_2 recorded; further assessment of data will take place with Highways colleagues at this location to better understand potential effects observed.

Swansea Council takes an active role within the Welsh Air Quality Forum https://airquality.gov.wales/ and is taking part in collaborative discussions with Swansea University to work together towards carrying out research into areas of 'public health interest' for all parties.

Local Priorities and Challenges

Swansea Council will continue to undertake monitoring at the fixed locations for pollutants reported upon in this report. The assessment of locations for NO_2 diffusion tube monitoring will continue to be carried out, sites returning low concentrations will be closed down in order to allow new sites to be created to enable Swansea Council to enhance their quantitative data.

Swansea Council is working towards publicly consulting upon their draft action plan in 2019 and facing the challenges of working with all interested parties to implement schemes/works to achieve Welsh Government's aims to maintain compliance and further reduce public health exposure.

How to Get Involved

Swansea Council publishes its real-time monitoring data on their website http://swansea.airqualitydata.com/ and data can be downloaded from this site; this site is scheduled to be upgraded in 2019.

Also, Swansea Council's data can be viewed and downloaded via the Welsh Air Quality Forum website https://airquality.gov.wales/

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1. Actions to Improve Air Quality

1.1 Previous Work in Relation to Air Quality

The local authority review and assessment process is multi-staged. This Authority carried out its first stage review in 1999. The conclusion reached was to progress to a second and third stage review for Benzene, Particulate Matter (PM_{10}), Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2).

In between these stages, the authority had to deal with, and resolve a burning, disused coal spoil tip at the former Brynlliw Colliery site. This absorbed most resources available between 1999 and 2000.

Along with all other local authorities, this authority has completed its stage 2 and stage 3 reviews. The third stage review and assessment concluded that despite the indication that the air quality objective for benzene would not be met that the declaration of an AQMA was not appropriate. Given the fundamental changes proposed to the Lower Swansea Valley's infrastructure and the technical improvements proposed in the reduction in the benzene content in fuel, it was recommended that a further benzene monitoring study be carried out for a period of at least 12 months. During the stage 3 process, it was determined that the authority would not breach the objectives laid down for Particulate Matter (PM_{10}) and Sulphur Dioxide (SO_2).

Section 83(1) of the Environment Act 1995 requires the Authority to designate as Air Quality Management Areas (AQMA's) those areas where it is likely that the standards for any of the identified pollutants would be exceeded. As a result of the detailed work carried out in the authorities' third stage review and assessment it was found that areas of the Hafod were likely to fail the NO_2 annual mean objective of $40\mu g/m^3$ by the compliance date of 31st December 2005.

On the 12th September 2001 the Authority declared The Hafod Air Quality Management Area (NO_2), cited as the City & County of Swansea (Hafod Air Quality Management Area (NO_2)) Order 2001. The Order came into force on the 14th September 2001. Annexe 1 contains a map indicating the AQMA area.

The Stage 4 review required under Section 84(1) of the Environment Act 1995 confirmed the earlier findings and that the declaration of the Hafod AQMA was justified as several locations were projected to fail the nitrogen dioxide (NO_2) annual mean objective in 2005.

Section 84 of the Environment Act 1995 requires the formulation of a written plan in pursuit of the achievement of air quality standards and objectives within the designated AQMA and has become known as the “Action Plan”. The City and County of Swansea have undertaken a considerable amount of feasibility and infrastructure work in formulating its Action Plan taking a few years to produce the completed Action Plan in December 2004.

In 2004, the authority commenced works on the second round of review and assessment. In accordance with the policy and technical guidance documents, the second round of review and assessment was carried out in two stages;

- An Updating and Screening Assessment (USA) - intended to identify aspects that have changed since the first round of review and assessment (from 1999 in Swansea's case) and identify those that require further assessment; namely
- A Detailed Assessment of those pollutants that have been identified as requiring further work and investigation

The Updating and Screening Assessment was submitted to the Welsh Assembly Government in July 2004 with a recommendation to proceed to a detailed assessment for nitrogen dioxide at identified narrow congested streets and busy junctions. The USA also concluded that particulate matter PM_{10} should also be investigated using real-time techniques at the identified narrow, congested streets and busy junctions, despite the then 2010 provisional objectives not being set in regulation.

A brief summary of the results and conclusions of the Detailed Assessment into NO_2 levels can also be found within the Progress Report 2004 – section 2.3.2.3 page 95. The Detailed Assessment itself was submitted to the Welsh Assembly Government during December 2005. This assessment concluded that there was no justification in declaring additional AQMA’s. At the time of submission, there was a debate with the auditors and Welsh assembly Government over the bias factor used to correct the nitrogen dioxide passive diffusion tube data. The authority used the bias factor quoted by Harwell Scientifics to correct for tube bias. Whilst the Detailed Assessment report was eventually accepted by the Welsh Assembly Government and the auditors as a result of the authority providing additional supporting information and justification for the use of the Harwell Scientific bias factor it was agreed that the authority would undertake co-location studies with its chemiluminescent analysers at 3 sites namely, the Swansea AURN on Carmarthen Road, and at the Morfa and Morriston Groundhog sites. This work commenced during December 2006 and was delayed until the Swansea AURN had been relocated and commissioned to prevent any additional uncertainties. The authority has now completed these co-location tasks at all three automatic sites within Swansea and has determined a local bias factor for the correction of the passive nitrogen dioxide diffusion tubes exposed within Swansea during 2008. Further details on this area of work can be found within section 2.1.13

The Progress Report for 2004/05 was submitted for consideration during July 2005.

The infrastructure required for a real-time assessment of PM_{10} in Swansea, is still being developed. The authority have purchased ten Met One E-Type light scattering PM_{10} dust samplers and are in the process of deploying these at the identified narrow, congested roads and busy junctions mentioned within the USA submitted in July 2004 and the Detailed Assessment. Identification of suitable sites is now complete but what has proved time consuming are the practical considerations of the site location itself together with the provision of suitable services i.e. un-metered electricity feeds and suitable mounting points. Significant problems have been, and continue to be encountered with the operation of the EType samplers. It is recognised that these analysers do not have formal UK type approval but due to both the expense and considerable practical considerations of deploying Rupprecht & Patashnick Co., Inc. FDMS/TEOM's, these E Type samplers will provide a more accurate assessment than use of the DMRB screening tool would be able to provide. It is thought that if the technical difficulties being experienced with the equipment can be resolved that the modelling will supplement the data collected by the E Type samplers.

Additional works underway include the collection of real-time classified counts of traffic data via the Vodafone GPRS network together with the construction of an emissions database. It is these latter items, particularly communications problems with the GPRS system that have delayed the modelling capabilities to date. The USA dated April 2006 was submitted for consideration to the Welsh Assembly Government in July 2006.

The authority undertook a further Progress Report in 2007 which was submitted to the Welsh Assembly and the auditors during July 2007. The same issues arose from this report with the auditors – the rationale behind the bias factor used to correct the passive diffusion tube was again raised despite the report clearly outlining the authorities' reasons for using the bias factor that was used to correct for tube bias. This issue as mentioned above should now have been resolved with the determination of a local Swansea bias factor

Progress Report 2008

The authority submitted its Updating and Screening Assessment 2008 to the Welsh Assembly Government during July 2009. The conclusions of this assessment were that exceedances of the nitrogen dioxide annual mean objective continued to be seen within the existing Hafod Air Quality Management Area along the Neath Road corridor, Cwm Level Road (Brynhyfryd Cross Roads) and Carmarthen Road (Dyfatty area). Additional monitoring within the then Hafod AQMA area around the High Street Railway Station highlighted the potential of exceedance of both the annual mean and 1-hour nitrogen dioxide objectives. Monitoring from outside of the then existing Hafod AQMA identified new areas that were failing the nitrogen dioxide annual mean objective. These areas are along Gower Road in Sketty, along Carmarthen Road within Fforestfach, and at numerous sites within the city centre. The city centre area was treated with caution as at the time of submission, only the minimum 9 months of data was available for analysis. An update on the city centre monitoring for nitrogen dioxide is presented below within section 2.1.2. The authority doubled its passive nitrogen dioxide tube survey during November 2009 from 134 to 274 sites, as a result of new LAQM Technical Guidance (LAQM.TG(09)) and the conclusions reached within the USA 2009 that used the new guidance, that additional initial screening of narrow/congested streets was required where the AADT flow was greater than 5000 vehicles. Monitoring data is presented for the periods available for the 140 additional sites within section 2.1.2.

Following the USA 2009, the authority intended to amend the existing Hafod Air Quality Management Area to include these newly identified areas (Sketty and

Fforestfach) along with the renaming of the declared air quality management area. All declared areas are to be collectively known as The Swansea Air Quality Management Area 2010. However, considerable delays were encountered with the mechanisms of obtaining the necessary Council Order. Details were presented before Council during August 2010. Annexe 2 contains a map indicating the adopted Swansea Air Quality Management Area 2010

Progress Report 2010

The authorities Progress Report 2010 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Sketty and Fforestfach areas of Swansea. These areas have now been included within the Swansea Air Quality Management Area 2010.

Progress Report 2011

The authorities Progress Report 2011 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Sketty and Fforestfach areas of Swansea. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, Llansamlet and Ynystawe areas were found to be exceeding the nitrogen dioxide annual mean objective. It was stated that further monitoring would be undertaken to confirm such exceedances before any additional AQMS were declared.

Updating and Screening Assessment 2012

The authorities USA 2012 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Hafod, Sketty and Fforestfach areas of the Swansea AQMA 2010. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, and St.Thomas areas were found to be exceeding the nitrogen dioxide annual mean objective. It was stated that the authority would consider the amendment of the Swansea Air Quality Management area 2010 and that further monitoring would be undertaken within the areas to confirm such exceedances before any additional AQMS were declared. Additional real-time chemiluminescent monitoring has not been possible. Similarly, no passive diffusion tube monitoring has been possible at first floor level within the Newton Road area of Mumbles

Progress Report 2013

The authorities Progress Report 2013 identified continuing exceedances of the nitrogen dioxide annual mean objective within the existing Swansea AQMA 2010 and also outside of the existing AQMA, notably within the city centre, Mumbles and Fabian Way areas.

It was stated that the authority intended to locate a real-time chemiluminescent analyser within the High Street area of the city centre prior to year-end 2013. This site is not now planned until July 2014.

Details on the various stages completed by the authority in the Local Air Quality Management process are given below within table 2. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. This was a long-term burning tip which required large scale monitoring and control.

Progress Report 2014

The authorities Progress Report 2014 identified continuing exceedances of the nitrogen dioxide annual mean objective within the existing Swansea AQMA 2010 and also outside of the existing AQMA, notably within the city centre, Mumbles and Fabian Way areas.

It was stated that the authority intended to locate a real-time chemiluminescent analyser within the High Street area during July 2014. This work was completed on schedule with the site becoming operational on the 7th July 2014. The new site is mentioned within chapter 2.1 below with additional details provided within chapter 2.1.13. The available data is presented within chapter 2.2.2 Automatic Real Time Nitrogen Dioxide data but no conclusions can be reached at present due to the monitoring period achieved so far.

Details on the various stages completed by the authority in the Local Air Quality Management process are given below within table 2. Brynlliw Colliery remediation is shown for information purposes due to the delays in the LAQM process that this introduced. This was a long-term burning tip which required large scale monitoring and control.

Updating and Screening Assessment 2015

The authorities USA 2015 continued to highlight and confirm exceedances of the nitrogen dioxide annual mean objective within the Hafod, Sketty and Fforestfach areas of the Swansea AQMA 2010. Additionally, other sites outside of the Swansea Air Quality Management Area 2010 in the Mumbles, Uplands, Morriston, and St.Thomas areas were found to be exceeding the nitrogen dioxide annual mean objective. Due to the reductions in nitrogen dioxide annual mean concentrations being witnessed year on year, along Newton road, Mumbles, it was not proposed to declare an AQMA. The authority will work towards the introduction of a Traffic Regulation Order along Newton Road prohibiting delivery vehicles delivering goods during busy periods of the day to restrict congestion along Newton Road. In view of the reductions in annual mean concentrations being measured, concentrations at first floor level above the canopy to flats will not be investigated further.

Due to the wide ranging implications of the City Centre review and likely highway alterations, it was not proposed to declare an AQMA within the city centre until the outcomes and recommendations of the review are known. The review is so wide ranging that the source i.e. the highway network, may be removed from where there are currently receptor locations. Discussions will continue on how best the desired provision of housing within the city centre can be achieved within the overall development proposals both in terms of the air quality implications and also exposure to noise for those residents. These discussions remain ongoing.

Progress Report 2016

This report contains the latest air quality monitoring results within the City and County of Swansea. The conclusions reached are that the objectives for benzene, lead and sulphur dioxide will be met and that there is no requirement to proceed further with these pollutants. However, there is evidence that the annual mean objective for nitrogen dioxide of 40ug/m^3 will continue to be exceeded within the existing Swansea Air Quality Management Area 2010. Latest monitoring undertaken also indicates areas of exceedances of the nitrogen dioxide annual mean objective outside of the Swansea Air Quality Management Area 2010 within city centre area of the authority. However there is currently no relevant exposure. It is therefore proposed to undertake additional nitrogen dioxide monitoring within the city centre area. Several other areas also exhibit the potential to exceed the annual mean objective as the measured annual means are within the range 37-40 ug/m^3.

Progress Report 2017

This report contains the latest air quality monitoring results within the City and County of Swansea. The conclusions reached are that the objectives for benzene, lead and sulphur dioxide will be met and that there is no requirement to proceed further with these pollutants. However, there is evidence that the annual mean objective for nitrogen dioxide of 40ug/m^3 will continue to be exceeded within the existing Swansea Air Quality Management Area 2010.

Latest monitoring undertaken also indicates areas of exceedances of the nitrogen dioxide annual mean objective outside of the Swansea Air Quality Management Area 2010 within the following areas of the authority:

- Newton Road,
- Fabian Way,
- Vale of Neath Terrace,
- High Street

It was therefore proposed to proceed to a Detailed Assessment for nitrogen dioxide concentrations within these areas. Several other areas also exhibit the potential to exceed the annual mean objective as the measured annual means are within the range 37-40 ug/m^3.

All monitoring sites remain compliant with both the annual mean and daily mean exceedance (35 days permitted) for Particulate matter PM_{10}.

Ozone is monitored at four sites within Swansea. Compliance with the 8-hour mean UK objective (not set in regulation) has been seen during 2016 at all monitoring stations.

Table 1 – Summary of LAQM Actions

Report	**Date Completed**	**Internet URL**
1st Stage Review	1999	http://www.swansea.gov.uk/index.cfm?articleid=5563
Brynlliw Colliery Remediation	1999-2000	N/A
2nd & 3rd Stage Review	2001	http://www.swansea.gov.uk/index.cfm?articleid=5565
Declaration of Hafod AQMA	September 2001	http://www.swansea.gov.uk/index.cfm?articleid=5557
Stage 4 Review	October 2003	http://www.swansea.gov.uk/index.cfm?articleid=5568
2nd Round Review USA	July 2004	http://www.swansea.gov.uk/index.cfm?articleid=5561
Hafod AQMA Action Plan	December 2004	http://www.swansea.gov.uk/index.cfm?articleid=9930
Progress Report 2004	July 2005	http://www.swansea.gov.uk/index.cfm?articleid=9929
Detailed Assessment	December 2005	http://www.swansea.gov.uk/index.cfm?articleid=5561
Progress Report 2006	July 2006	http://www.swansea.gov.uk/index.cfm?articleid=9929
USA 2006	April 2006	http://www.swansea.gov.uk/index.cfm?articleid=5561
Progress Report 2007	July 2007	http://www.swansea.gov.uk/index.cfm?articleid=9929
Progress Report 2008	May 2008	http://www.swansea.gov.uk/media/pdf/l/3/Progress_Report_2008.pdf
USA 2009	July 2009	http://www.swansea.gov.uk/media/pdf/e/1/City_and_County_of_Swansea_USA_2009_PDF.pdf
Progress Report 2010	July 2010	http://www.swansea.gov.uk/media/pdf/2/5/Progress_Report_2010.pdf
Progress Report 2011	September 2011	http://www.swansea.gov.uk/media/pdf/d/4/Progress_Report_2011.pdf
USA 2012	September 2012	http://www.swansea.gov.uk/media/pdf/n/1/USA2012.pdf
Progress Report 2013	June 2013	http://www.swansea.gov.uk/media/pdf/i/3/SwanseaProgressReport2013.pdf
Progress Report 2014	July 2014	http://swansea.gov.uk/media/6538/Progress-Report-2014/pdf/Swansea_Progress_Report_2014.pdf

USA 2015	June 2015	http://www.swansea.gov.uk/media/13539/Updating-and-Screening-Assessment-2015/pdf/Swansea_USA_2015.pdf
Progress 2016	December 2016	http://www.swansea.gov.uk/media/20406/Progress-Report-2016/pdf/Swansea_Progress_Report_2016.pdf
Progress 2017	November 2017	https://www.swansea.gov.uk/media/25115/Progress-report-2017/pdf/Progress_Report_2017.pdf

1.2 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when air quality is close to or above an acceptable level of pollution (known as the air quality objective (Please see Appendix A)). After declaring an AQMA the authority must prepare an Air Quality Action Plan (AQAP) within 18 months setting out measures it intends to put in place to improve air quality to at least the air quality objectives, if not even better. AQMA(s) are seen by local authorities as the focal points to channel resources into the most pressing areas of pollution as a priority.

A summary of AQMAs declared by Swansea Council can be found in Table 1.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at

https://uk-air.defra.gov.uk/aqma/details?aqma_ref=82#1313

Table 1.1 – Declared Air Quality Management Areas

AQMA	Relevant Air Quality Objective(s)	Comments on Air Quality Trend	Description	Action Plan
Swansea AQMA 2010	• NO_2 annual mean	This year's monitoring results indicate a significant improvement in air quality compared to previous years.	Elevated annual mean NO2 concentrations at residential properties alongside main arterial routes, which located within Hafod, Sketty and Fforestfach area	https://www.swansea.gov.uk/media/2640/Air-Quality-Action-Plan/pdf/Swansea_Action_Plan_2004.pdf

AMQA boundary maps within Swansea Council can be viewed at

https://laqm.defra.gov.uk/images/aqma_maps/1489_Swansea%202010%20AQMA.jpg and are included in Appendix D.

1.3 Implementation of Action Plans

Swansea Council has taken forward a number of measures, since the publication of the 2004 Action Plan, in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 1.2. More detail on these measures can be found in the Air Quality Action Plan relating to any designated AQMAs.

Air Quality Action Plans are continuously reviewed and updated whenever deemed necessary, but no less frequently than once every five years. Such updates are completed in close consultation with local communities. Swansea Council has submitted a draft Action Plan to Welsh Government in 2018 and is working towards public consultation by April 2019.

Table 1.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Nowcaster Model	Traffic Management	Congestion Management and Traffic Reduction	Swansea Council	2004	2017		e.g. 27% Reduction in Road NOx required Neath Road	Model Complete	01/10/2017	Effects of Nowcaster Model to be verified with traffic flow data and NO_2 Concentrations
2	Nowcaster System	Public information	Via other Mechanisms	Swansea Council	2004	2017			Ongoing assessment of trigger thresholds for VMS		Variable Messaging Signs to be verified and trigger concentrations assessed for effectiveness
3	Nowcaster Model Output Progression	Public Information	Via the Internet and App based technology	Swansea Council	2017	2018/19			CHERISH-DE application accepted Awaiting next stage		Collaborative working with Swansea University Psychology Department to look at behavioural change approach with messages.
4	Collaborative Research Studies	Traffic Management	Congestion Management	Swansea University	2018						Application bids for funding with collaborative partners to undertake work looking at behavioural change at congested areas

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
5	Morfa Distributor Road	Traffic Management	Strategic Highway Improvements	Swansea Council		August 2017	10% reduction in traffic along Neath Road		Road Complete	04/08/2017	Effects on Traffic Flow to be assessed alongside NO_2 concentration
6	Living Fences	Transport Planning and Infrastructure	Other	Swansea Council				Work towards 20% Reduction in Road NOx required along Carmarthen Road Work Towards 18% Reduction in Road NOx required along Gower Road			Targeted at hotspot location along Carmarthen Road (Fforestfach Area of Swansea AQMA 2010)
7	UK Prevention Research Partnership Bid	Policy Guidance and Development Control	Regional Groups Co-ordinating Programmes to develop Area wide Strategies to reduce emissions and improve air quality	School of Management Bay Campus Swansea University Fabian Bay, Swansea	2017	2018			Expression of interest to apply submitted		
8	LDP Policy RP	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	Swansea Council		2018		Creation of specific Air Pollution Policy within the LDP	Hearing Stage	2018	Hearing session has been held and final comments submitted for consideration 'Material Amendments Consideration' (MAC) stage
9	Highway Infrastructure Works	Traffic Management	Strategic Highway Improvements	Swansea Council	2018						

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
10	Council Vehicle Fleet								Ongoing		Increase in electric vehicles and newer diesel vehicles within the council fleet

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

2.1 Summary of Monitoring Undertaken in 2017

2.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how results compare with the objectives.

Swansea Council undertook automatic (continuous) monitoring at 12 sites during 2017.

Table 2.1.1 presents the details of the sites. National monitoring results are available at https://uk-air.defra.gov.uk/data/ , https://airquality.gov.wales/maps-data and http://www.swansea.airqualitydata.com/cgi-bin/data.cgi

Maps showing the location of the monitoring sites are provided in Figure 2.1.

Swansea Roadside AURN, Carmarthen Road, Waun Wen

The station is located roadside on Carmarthen Road at Waun Wen. The Annual Average Daily Traffic flow (AADT) for 2017 was 21,336 vehicles. The site is detailed and outlined below and is within the boundary of the Swansea Air Quality Management Area 2010. The site has receptors close by with additional sensitive receptors in close proximity - a Nursing Home and a Primary School are within 100m of the monitoring location.

The station has been given a site classification Roadside, Figure 2.1.1 below is an aerial view of the site and the surrounding locations. The site is located in an open aspect approximately 55m above sea level with direct views over Swansea Bay. It is therefore more exposed to the prevailing south westerly winds than the monitoring sites located on the valley floor (i.e. Morriston and Hafod DOAS). It is thought probable that this site may well sit above any inversions that form within the lower Swansea Valley and therefore, does not experience the elevated concentrations seen at the other monitoring stations during such conditions.

Figure 2.1.1.1 – Aerial view of Swansea Roadside AURN

All equipment is housed within an air-conditioned unit and operated continuously. The equipment comprises of an Advanced Pollution Instrument (API) real-time analyser measuring NO_x with Thermo FDMS units measuring PM_{10} and $PM_{2.5}$ until the 16th November 2011 when they were removed due to their unreliability and were replaced with Met One1020 BAM units on the 28th November 2011. The API gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours).

Hourly ratified data for 2017 covering the pollutants Nitrogen Dioxide and Particulate Matter PM_{10} and $PM_{2.5}$ (BAM 1020) have been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector . This data has then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation.

Morriston Groundhog

Morriston Groundhog has been operational since September 2000 and is located adjacent to the southbound slip road to the busy A4067 dual carriageway at Morriston Underpass. The Swansea Air Quality Management Area 2010 (former Hafod AQMA) boundary is approximately one mile south of this location. Receptor locations can be found to the right of the station in the form of terraced housing. To the left of the site and on the opposite side of the dual carriageway is Morriston Primary School. The school buildings abut the red brick retaining wall to the northbound Morriston slip road exit. The A4067 carries on for approximately one mile northbound where it meets the M4 motorway at junction 45. The station has been given a site classification Roadside. Figure 2.1.1.2 below is an aerial view of the site and the surrounding locations.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring O_3, and NO_x .The R&P PM_{10}TEOM was upgraded to a Thermo FDMS PM_{10} unit on the 27th October 2006 with data capture for the FDMS unit commencing at 17:00. This unit had now been replaced by a Met One 1020 BAM PM2.5 unit; data collection commenced 14.01.2016. The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours).

In June 2017 the site was temporarily removed to enable an upgrade to be carried out, decommissioning occurred on the 9th June 2017. The upgrade included a new enclosure, a new Teleydene real-time chemiluminescent NOx Analyser and a Continuous UV Absorption Ozone Analyser and the reinstall of the PM2.5 BAM1020; the site was operational again on the 27th June 2017.

Figure 2.1.1.2 - Aerial view - Morriston Groundhog

Cwm Level Park, Landore

The authority established a NO_x and Ozone urban background monitoring station at Cwm Level Park, Landore during late November/early December 2008 within the compound of its 30m Meteorological monitoring mast.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of Advanced Pollution Instruments (API) real-time analysers measuring NO_x and Ozone.

Figure 2.1.1.3 Cwm Level Park Monitoring

A map showing the location of the Cwm Level Park station is given above as Figure 2.1.1.3. The boundary of part of the Swansea Air Quality Management Area 2010 is shown as the black/yellow dashed line.

There are no “major” sources closes by as would be expected with the site classification, with the nearest road being nearly 80m away and having an Annual Average Daily Traffic flow (AADT) during 2017 of 14,160 vehicles. Some light industry / warehouse front the site but are insignificant as a source. Receptor dwellings are within 100m of the site.

The OPSIS Hafod Differential Optical Absorption Spectroscopy (DOAS) Monitoring Station

The OPSIS DOAS open path light source measures the pollutants Nitric Oxide, Nitrogen Dioxide, Ozone and Benzene along a 250-metre section of Neath Road, within the Hafod district of the lower valley area and within the Swansea Air Quality Management Area 2010. These measurements take place at first floor level - a height of approximately 3 metres and less than 0.3m away from the front facade of the terraced dwellings. The DOAS transmitter ❶ is fixed externally to the front wall of a terraced dwelling that fronts onto Neath Road at one end of the open path measurement. The receiver module ❷ is located on the front wall of another dwelling that also fronts onto Neath Road at the other end of the open path measurement length. The receiver focuses the light received and transmits the light via fibre optic cable into a spectra analyser. Figure 2.1.1.4 below shows an aerial photograph of the location of the transmitter and receiver heads. This section of Neath Road has an annual average daily traffic flow (AADT) during 2017 of 14,184 vehicles and forms the “traditional” route up/down the Swansea Valley. The whole length of Neath Road through the Lower valley area is characterised by slow moving traffic through the narrow, congested, B route corridor.

The transmitter emits a light beam from a xenon lamp and contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The principle used is based on the Beer-Lambert absorption law; the receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored.

Figure 2.1.1.4 Hafod Opsis DOAS Monitoring

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants, as the carriageway is approximately 2 metres away from the front facade of these dwellings. The highway at this location can loosely be referred to as a "street canyon". Valid data capture commenced on the 8th January 2004 at 16:00hrs. The station has been given a site classification Roadside.

The DOAS system returns data in the form of cyclonic means, not always of the same averaging period - the system has been configured to measure each pollutant for a set period of time: 1 minute each for NO and Benzene and 30 seconds each for nitrogen dioxide and ozone. This gives a cycle time of approximately 3 minutes. The system stores the information as a cycle period of measurement for each pollutant within a "logger value" dataset. During the QA/QC processes that have been completed, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted on the individual cycled means for each pollutant. The validation process produces the same cyclonic means within a separate database. All individual measurement points that have not met the QA/QC conditions (detailed below) are replaced with null values within the new dataset. The user can then compile 5 minute means from the validated dataset and undertake analysis.

The Opsis St. Thomas Differential Optical Absorption Spectroscopy (DOAS) Monitoring Station

The St. Thomas OPSIS Differential Optical Absorption Spectroscopy (DOAS) was installed during September 2005 along a 280m path length of Pentreguinea Road within the St. Thomas area to measure the pollutants sulphur dioxide, nitrogen dioxide, and ozone. Valid data capture commenced on the 12th September 2005 at 09:30am. This route is intended for use within the Action Plan to attempt traffic management during forecast pollution episodes by diverting traffic from the central Neath Road corridor

Measurements take place at a height of approximately 3-4 metres and less than 2m away from the front facade of the majority of terraced dwellings. The DOAS transmitter ❶ is fixed on top of a concrete column located north of the junction of Kilvey Terrace and Pentreguinea Road as shown in photo 1 below. The receiver module ❷ is located on top of a concrete column and site housing at the other end of the open path measurement length as shown in photo 2 below.

Figure 2.1.1.5 - St Thomas DOAS Transmitter

Figure 2.1.1.6 - St Thomas DOAS Receiver Station

The principle used is based on the Beer-Lambert absorption law; the transmitter emits a light beam from a xenon lamp that contains a range of wavelengths, from ultraviolet to visible. Different pollutant molecules absorb light at different wavelengths along the path between the emitter and receiver. The receiver is connected to the analyser that measures the intensity of the different wavelengths along the entire light path and converts this into concentrations for each of the gaseous pollutants being monitored. The station has been given a site classification Roadside.

The monitoring location is allowing measurements' running parallel to the carriageway to be made of the above pollutants. The location of the open path monitoring can be seen within Figure 2.1.1.7 below. The site of the transmitter lies just outside of the southern boundary of the Swansea Air Quality Management Area 2010.

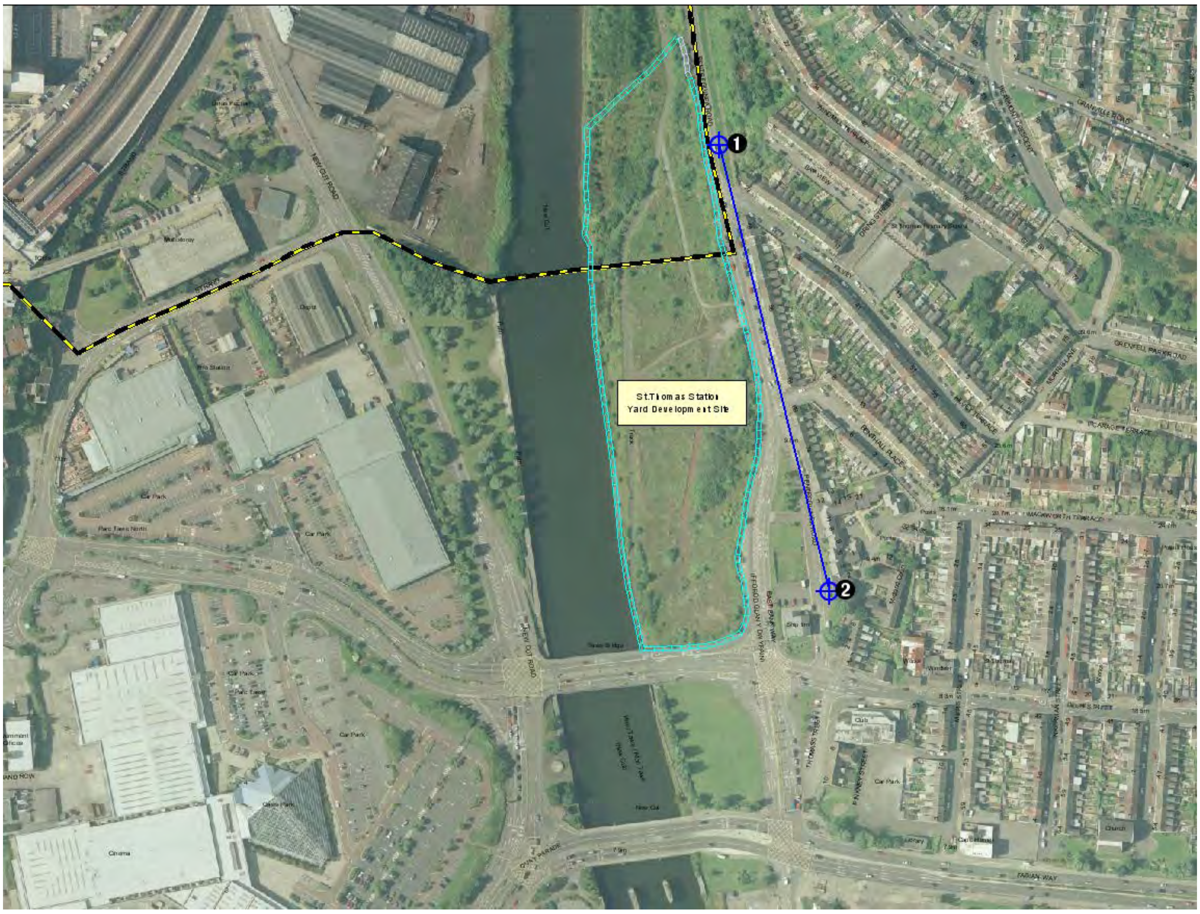


Figure 2.1.1.7 – Aerial View of St. Thomas OPSIS DOAS and surrounding area

The DOAS system returns data in the form of cyclonic means, not always of the same averaging period - the system has been configured to measure each pollutant for a set period of time: 1 minute for Benzene and 30 seconds each for sulphur dioxide, nitrogen dioxide and ozone. This gives a cycle time of approximately 3 minutes. The system stores the information as a cycle period of measurement for each pollutant within a “logger value” dataset. During the QA/QC processes that have been completed by this authority, conditions were imposed on the minimum acceptable light levels and maximum standard deviations of the measurements permitted on the individual cycled means for each pollutant. The validation process produces the same cyclonic means within a separate database.

It should be noted that the data presented here represents the spatial average over the whole of the 280-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations. It should also be noted that the DOAS methodology of monitoring does not comply with the EU Directive methods of measurement (chemiluminescent for NO_2, UV fluorescence for SO_2 etc.) at present but the system has achieved MCERTS certification and TUV certification.

Met One EBam PM_{10} (Five units installed)

The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[1]. Installation and operation of the MetOne EBam has been undertaken in accordance with the Operational manual which can be viewed at http://www.metone.com/ebamdocs/E-BAM_Manual(RevL).pdf.

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM10 particulate concentration levels using the principle of beta ray attenuation. This method provides a simple determination of concentration in units of milligrams of particulate per cubic meter of air. A small 14C (Carbon 14) element emits a constant source of high-energy electrons known as beta particles. These beta particles are detected and counted by a sensitive scintillation detector. A

vacuum pump pulls a measured amount of dust-laden air through the filter tape, which is positioned between the source and the detector thereby causing an attenuation of the beta particle signal. The degree of attenuation of the beta particle signal is used to determine the mass concentration of particulate matter on the filter tape, and the volumetric concentration of particulate matter in ambient air. In this installation a MetOne approved external pump delivering a flow rate of 16.7 l/min has been included within the site enclosure. The integration of sampling has been set at 1-hour with the tape advancing every 3-hours. Tape life is therefore greater than 3 months with the PM_{10} head being cleaned every month between tape exchanges. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

Fforestfach Cross - Met One EBam PM_{10}

The Fforestfach Cross EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations around the busy Fforestfach Cross junction. The A483 Carmarthen Road has junctions with the A4216 Station Road to the south and Ravenhill Road to the north. Relevant receptors exist at numerous dwellings either side of the junctions. Considerable traffic congestion can be seen on all arms of the junction primarily during working hours. The authority also has numerous NO_2 passive diffusion tube locations within this area. The chosen monitoring location is to the north-west of the junction in front of the war memorial on Carmarthen Road and within 19m of a residential property. Location and ease of connection to an electricity supply dictated the final location.

The EBam PM_{10} is similar in operation to the MetOne Bam 1020 deployed at the Swansea AURN approximately 2.3Km away in a south-easterly direction on Carmarthen Road.

A map of the site and surrounding area is given below as figure 2.1.1.8.

Figure 2.1.1.8 – Fforestfach Cross EBam PM_{10}

Uplands Crescent - Met One EBam PM_{10}

The Uplands Crescent EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations along Uplands Crescent which is heavily congested during working hours. The site is located between the signalled controlled junction of Uplands Crescent and Gwydr Square to the west and between the junction of Uplands Crescent with Walter Road/Brynymor Crescent/Eaton Crescent and Mirador Crescent to the east. The authority also has numerous NO_2 passive diffusion tube locations within this area.

Monitoring is undertaken within 11m of residential properties to the north and 17m of residential properties on the opposite side of the road. Location of, and ease of connection to an electricity supply dictated the final location.

A map of the site and surrounding area is given below as figure 2.1.1.9.

Figure 2.1.1.9 – Uplands Crescent EBam PM_{10}

Sketty Cross - Met One EBam PM_{10}

The Sketty Cross EBam PM_{10} station was established during late October 2012 to provide a basic screening opinion on PM_{10} concentrations along the A4118 Gower Road which is heavily congested during working hours. The site is located between the signalled controlled crossroad junction of Gower Road with Dillwyn Road and Vivian Road to the north-east and the mini roundabout "junction" of De-La-Beche Road with Gower Road and Sketty Road. A major comprehensive school along with a Welsh Primary School are located along De-La-Beche Road. A significant number of pupils attending the comprehensive school arrive, and depart, by contract bus. The area is subject to congestion during the am and pm peak periods as the A4118 Gower Road forms the main artery into and out of Swansea City Centre (and further eastern destinations) from the west of Swansea and Gower. GPRS ATC counters have been installed on each arm of the signalled controlled junction of Gower Road with Dillwyn Road and Vivian Road. No ATC provision has been possible as yet along De-La-Beche Road. The authority also has numerous NO_2 passive diffusion tube locations within this area.

Monitoring is undertaken within 13m of residential properties on the opposite side of the road. It proved necessary to locate the EBam outside of a petrol station as to site the EBam within pavements fronting any residential properties proved to problematic. Location of, and ease of connection to an electricity supply therefore dictated the final location.

A map of the site and surrounding area is given below as figure 2.1.1.10

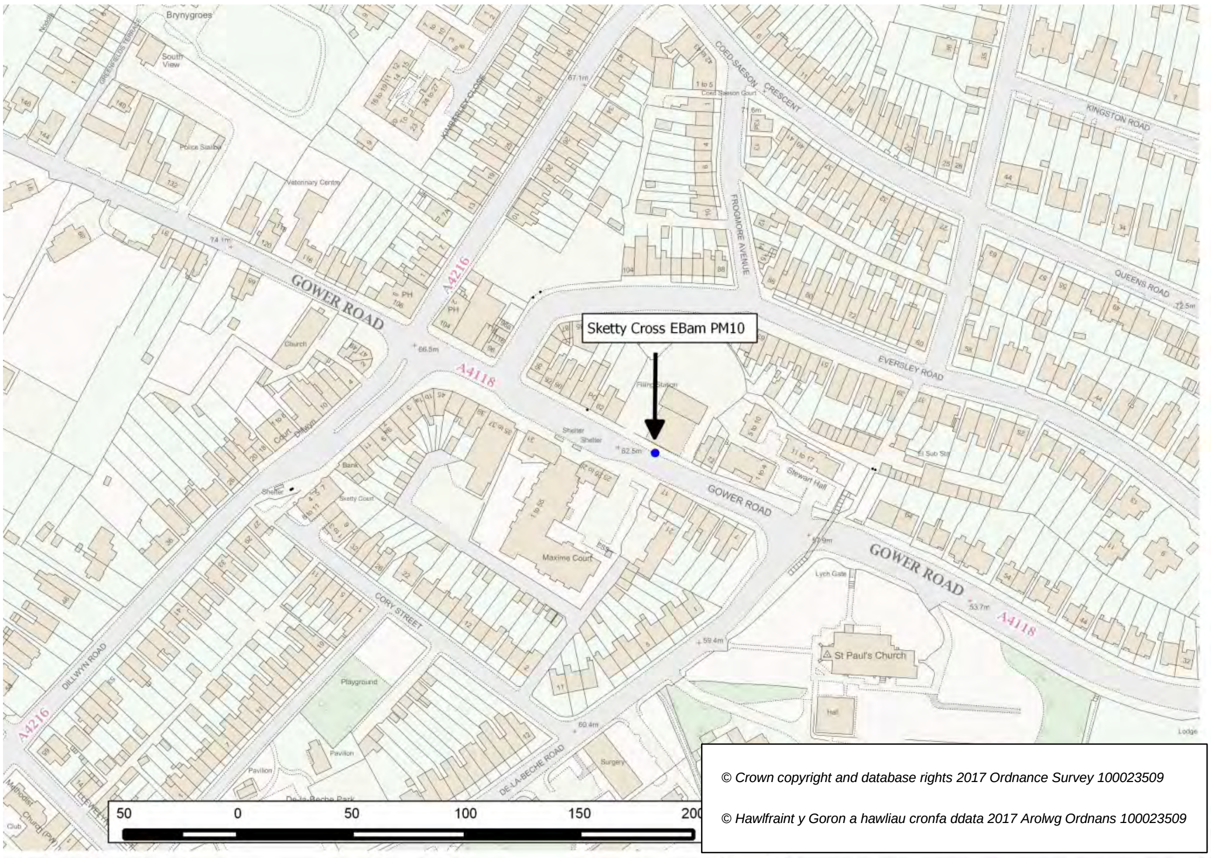


Figure 2.1.1.10 – Gower Road EBam PM_{10}

Westway Quadrant Bus Station - MetOne EBam PM_{10}

The Westway EBam PM_{10} station was established during late August 2012 to provide a basic screening opinion on PM_{10} concentrations along Westway opposite the Quadrant Bus Station. This is the major public transport hub within Swansea with both local and "long-haul" services using the facilities provided. Significant volumes of traffic use Westway but it has not been possible due to budget restraints to install the required number of GPRS ATC's to cover all of the arms and turning movements. The road infrastructure is complex with additional volumes of traffic being attracted not only by the city centre destinations but also by a major superstore located to the south of the site. It is desirable to also record the movements into and out of the superstore as well as the significant number of bus movements/traffic movements along Westway in order to obtain an accurate picture of the total number of movements. As some sections of highway along Westway are 9 lanes in width a total of 3 GPRS ATCs fitted with dual loop cards has been determined as the minimum number necessary to capture all of the movements along Westway. At the present moment in time this financial commitment is not possible.

There are receptor locations within approximately 30m of the boundary of the Quadrant Bus Station and within 3m of Westway itself as there are blocks of warden sheltered flat accommodation over 5 or more stories setback off Westway.

A map of the site and surrounding area is given below as figure 2.1.1.11.

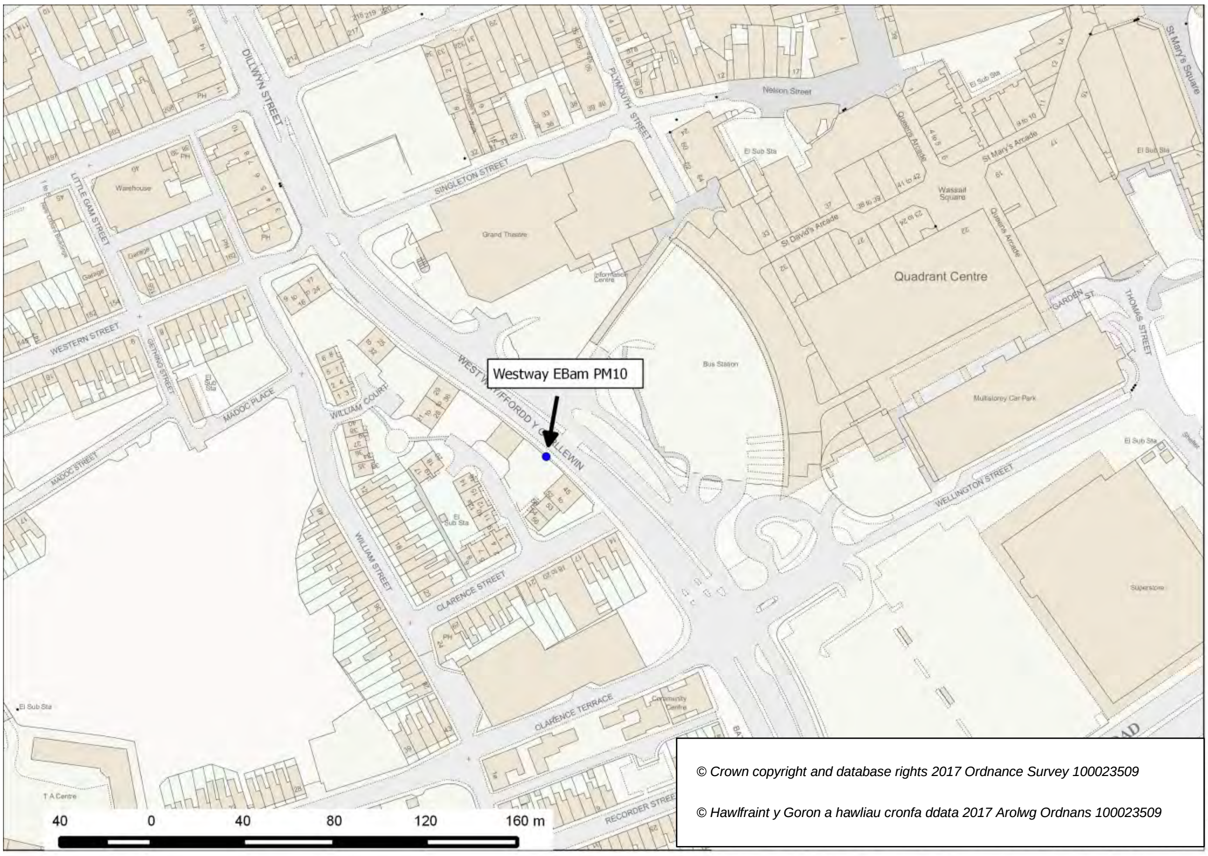


Figure 2.1.1.11 – Westway EBam PM_{10}

SA1 Junction Port Tennant Road - MetOne EBam PM_{10}

The SA1 Port Tennant EBam PM_{10} station was established during late November 2012 to provide a basic screening opinion on PM_{10} concentrations along the A483 Fabian Way at the recently constructed signal controlled SA1 junction with Port Tennant Road. The A483 Fabian Way is a major artery into/from Swansea centre from/to junction 42 of the M4. The authority operate a GPRS ATC (site 20) approximately 200m west of the EBam monitoring location between Quay Parade bridges and the signalled controlled SA1 junction with Fabian Way/Port Tenant Road. The Annual Average Daily Traffic (AADT) flow for 2017 was 34,704.

A summary of the composition of the flow during 2017 is given below:

Table 2.1.1.2

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	1.0	45.5
Cars or light Vans	93.2	45.0
Cars or light Vans with Trailer	0.2	36.6
Heavy Van, Mini bus, L/M/HGV	4.1	42.2
Articulated lorry, HGV+Trailer	0.4	40.2
Bus	1.2	39.6

Whilst relatively “free flow” is achieved at the ATC site, traffic queues back from the signal controlled junction in both directions. Therefore, significant stationary traffic queues west past the block of terraced housing on Port Tennant Road (their facades are within 6m of the EBam itself) and also eastwards in front of the newly constructed Mariners Court block of flats that front onto Fabian Way. The authority also has a passive NO_2 monitoring location front façade of the terraced properties on Port Tennant Road and also several within the general vicinity.

A map of the site and surrounding area is given below as figure 2.1.1.12

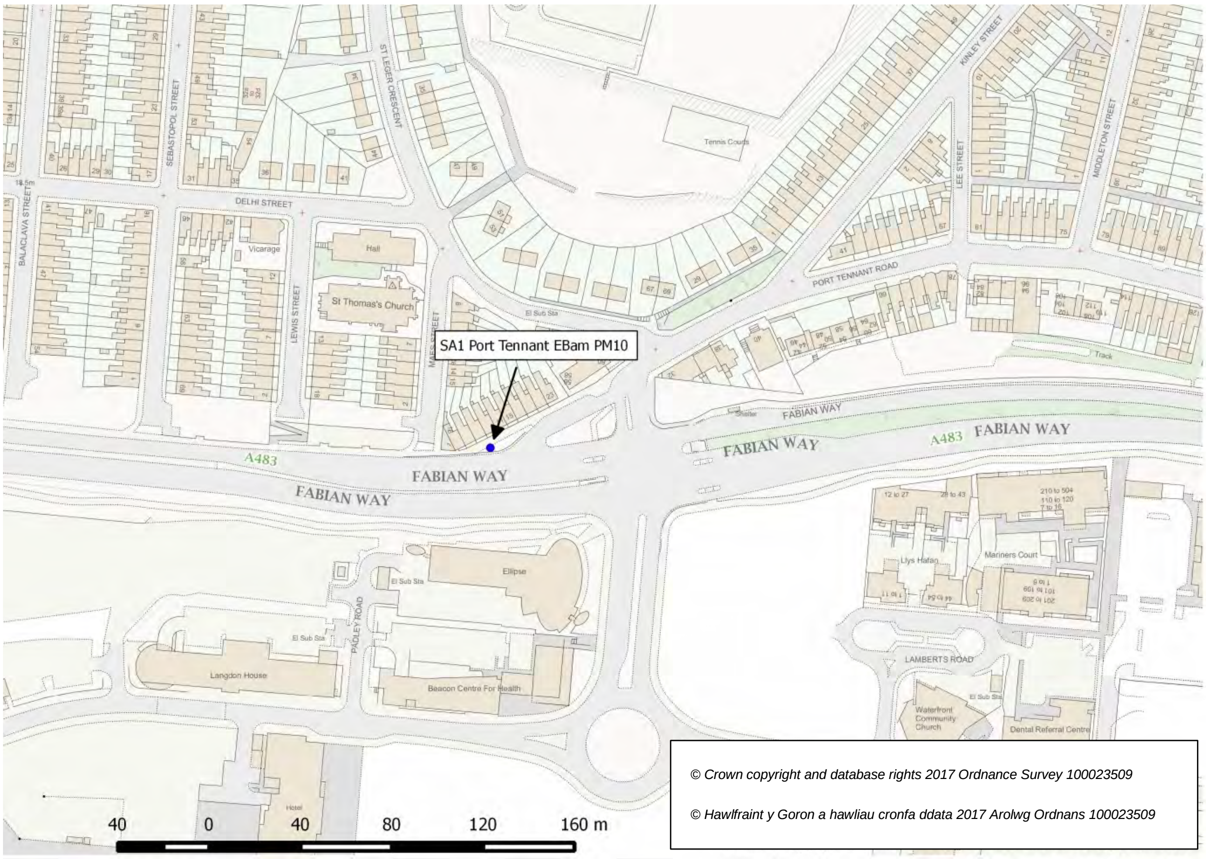


Figure 2.1.1.12 - SA1 Port Tennant EBam PM_{10}

Station Court High Street – Teledyne Chemiluminescent NOx box

The authority has located a real-time chemiluminescent NOx analyser outside a block of flats at Station Court, High Street, Swansea.

The station has been given a site classification of Roadside[2]. Figure 2.1.1.13 below shows its location in relation to a series of bus stops and the block of flats immediately behind the site. The site is opposite Swansea railway station and is heavily influenced by not only the bus stops but congestion caused by its proximity to signal controlled junctions and mini roundabouts. The site lies within the boundary of the existing Swansea 2010 AQMA. Congestion is noticeable most days during peak periods. The sample inlet can be seen in the photograph to the left top of the site enclosure and is at a height of 1.5m.

[2] *Source LAQM.TG(16) Table 7.8 page 7-41*

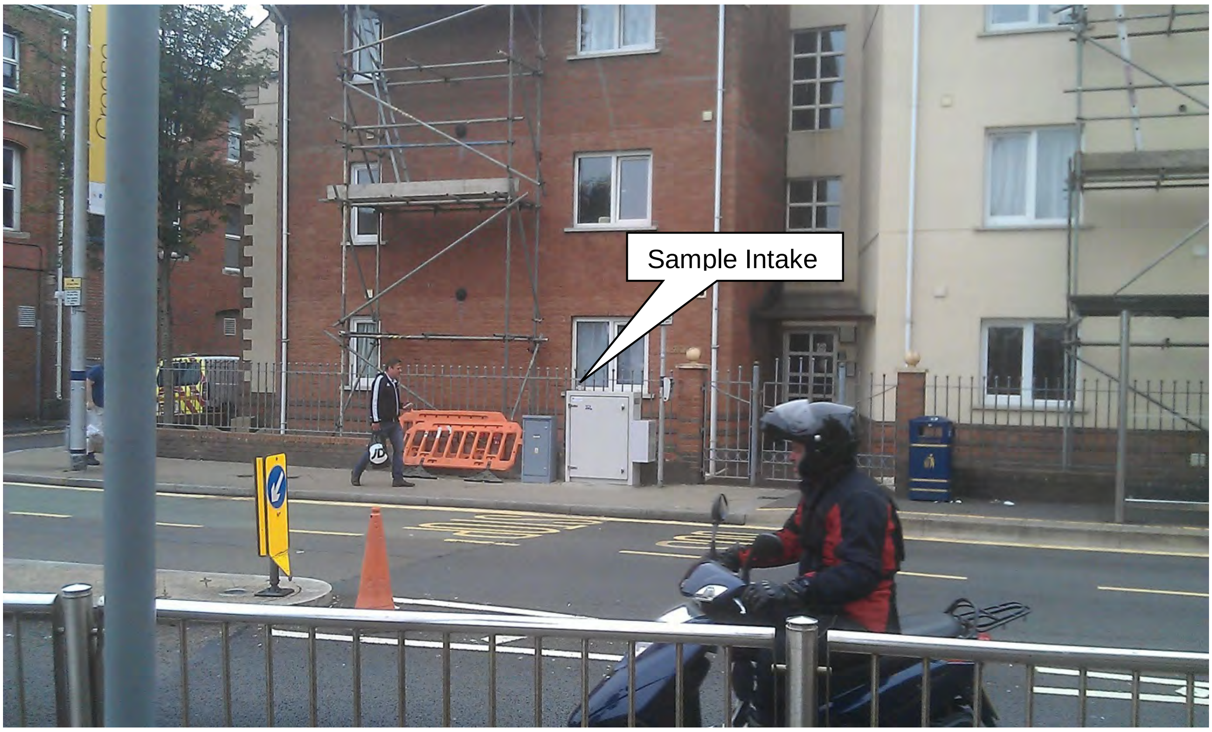


Figure 2.1.1.13 – Station Court, High Street NO_x monitoring site.

All equipment is housed within an air-conditioned unit and operates continuously. The equipment comprises of a Teledyne real-time analyser measuring NO_x . The Teledyne gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger.

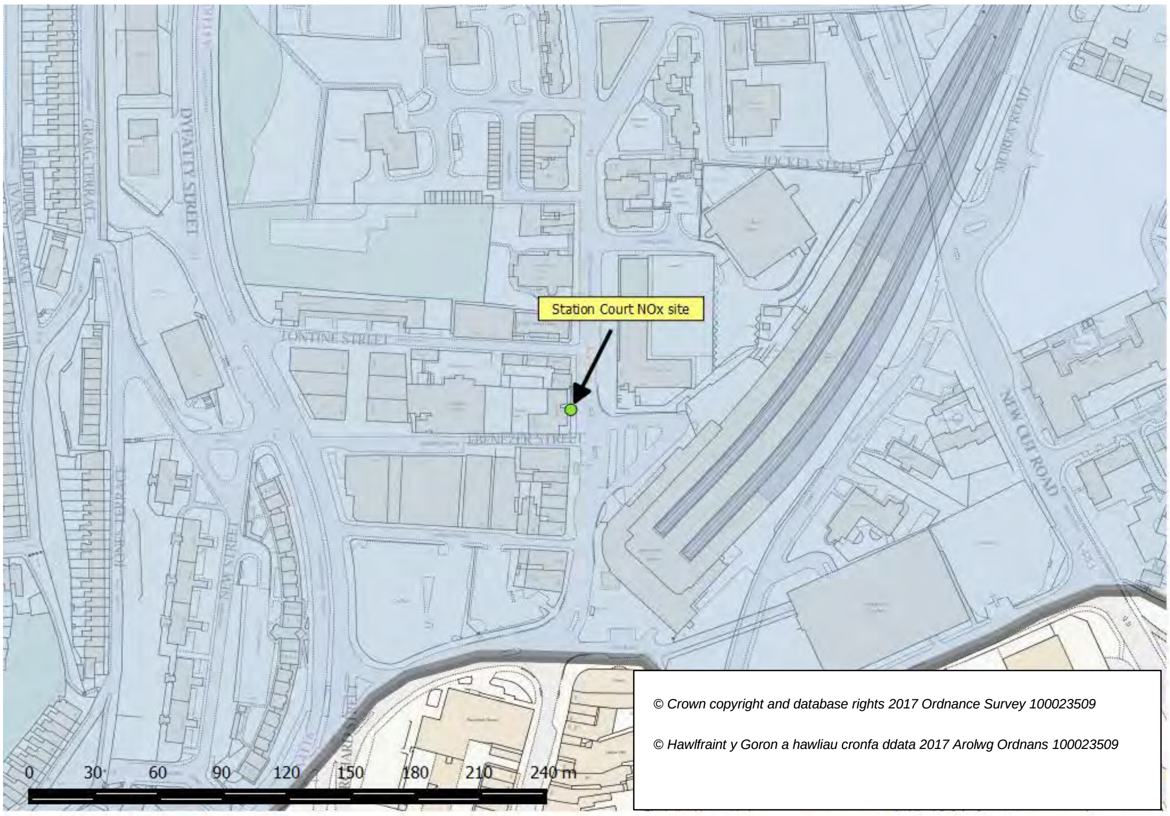


Figure 2.1.1.14 – Station Court High Street, Swansea NOx box

Morfa Road – Teledyne Chemiluminescent NOx box

Swansea Council has added another NOx analyser to its network in 2017 in order to assess the potential exposure at the St Davids Student Accommodation development at the junction of Morfa Road and New Cut Road, at the Southern Boundary of the Hafod area of the Swansea Air Quality Management Area 2010. The analyser is a real-time chemiluminescent NOx analyser and is located at ground level approximately 6.5m from the kerb; the station has been given a site classification of Roadside in line with the site classifications within the 2016 Technical Guidance.

The site was installed on the 28th July 2017.

A map showing the location of the monitoring site is provided in Figure 2.1.1.15 below. Further details on how the monitor is calibrated and how the data has been adjusted are included in Appendix C.

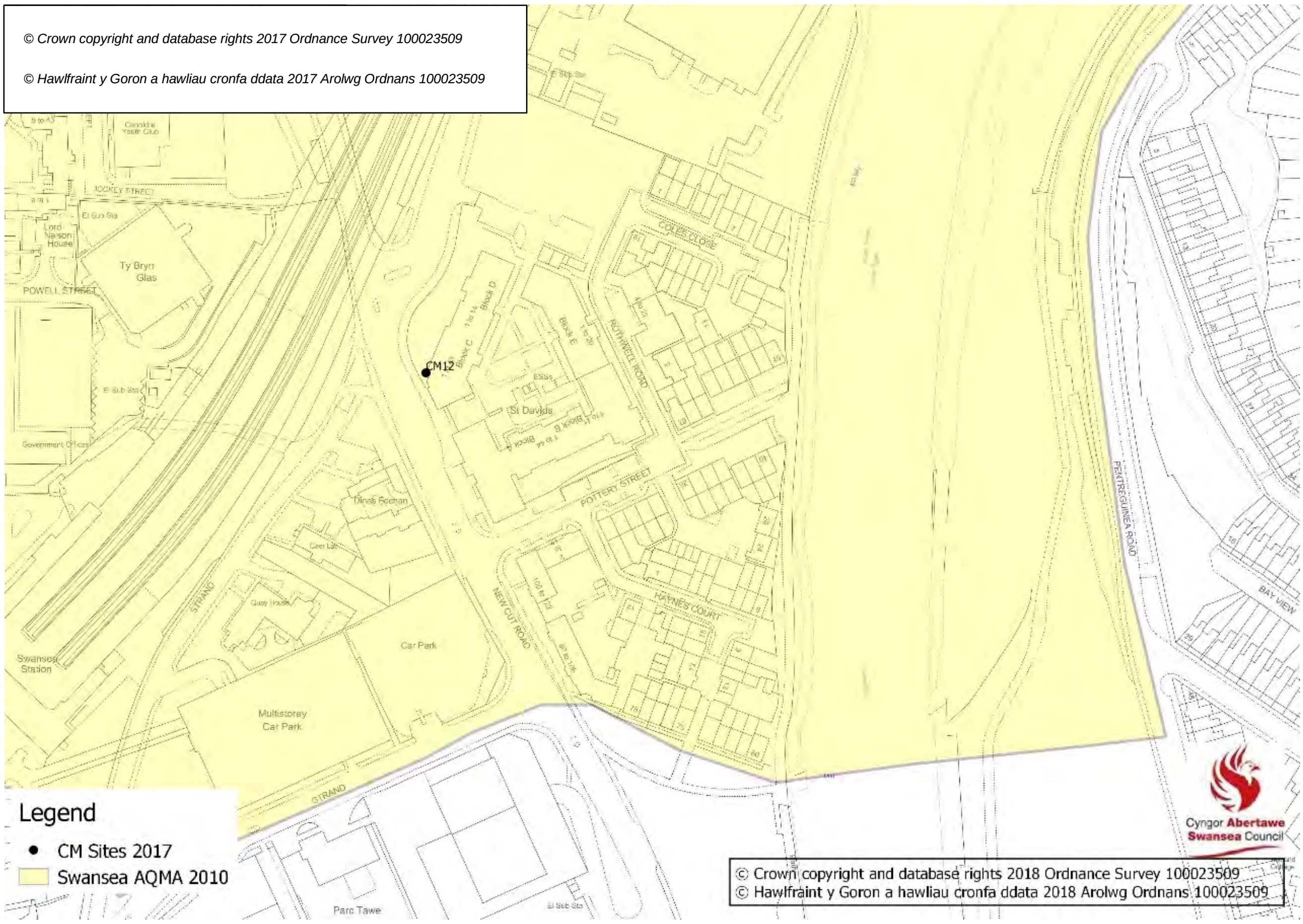


Figure 2.1.1.15 Location of New NOX Analyser at Morfa Road, Swansea (CM12)

Table 2.1.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	Associated with (Named) AQMA?	OS Grid Reference		Pollutants Monitored	Monitoring Technique	Inlet Height (m)	Distance from Kerb to Nearest Relevant Exposure (m) (1)	Distance from Kerb to Monitor (m) (2)
				X	Y					
CM1	Swansea Roadside AURN	Roadside	Swansea AQMA 2010	265299	194470	NO_2, PM_{10}, $PM_{2.5}$	Chemiluminescence and BAM1020	2.0	16.5	4.5
CM2	Morriston Groundhog	Roadside	Swansea AQMA 2010	267210	197674	NO_2, PM_{10} and Ozone	Chemiluminescence, UV Absorption and BAM1020	2.0	22	5.0
CM3	Cwm Level Park	Urban Background	Swansea AQMA 2010	265912	195890	NO_2 and Ozone	Chemiluminescence, UV Absorption	1.5		78
CM4	Hafod Doas	Roadside	Swansea AQMA 2010	Transmitter 265927 Receiver 265991	Transmitter 194453 Receiver 194706	NO_2, Ozone and Benzene	Differential Optical Absorption Spectrometry	4.0	1.7	1.5
CM5	St Thomas DOAS	Roadside		Transmitter 266191 Receiver 266263	Transmitter 266263 Receiver 193370	NO_2, SO_2, Ozone and Benzene	Differential Optical Absorption Spectrometry	4.0	7.5	7.3
CM6	Fforestfach Cross	Roadside	Swansea AQMA 2010	263236	195489	PM_{10}	EBam	3.0	22	3
CM7	Uplands Crescent	Roadside		264078	192888	PM_{10}	EBam	3.0	13	1
CM8	Sketty Cross	Roadside	Swansea AQMA 2010	262681	192871	PM_{10}	EBam	3.0	15	1

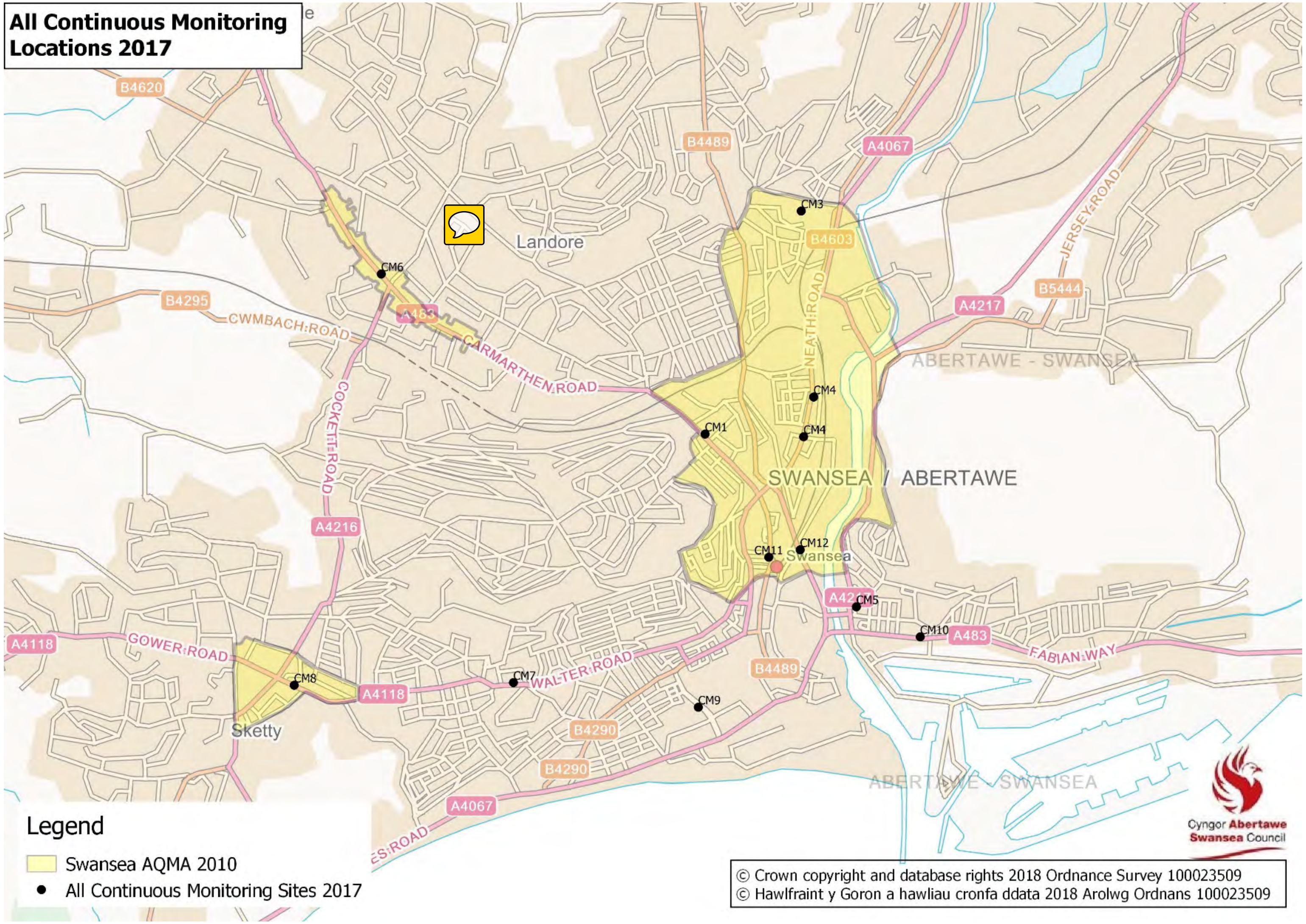
Site ID	Site Name	Site Type	Associated with (Named) AQMA?	OS Grid Reference		Pollutants Monitored	Monitoring Technique	Inlet Height (m)	Distance from Kerb to Nearest Relevant Exposure (m) (1)	Distance from Kerb to Monitor (m) (2)
				X	Y					
CM9	Westway Quadrant Bus Station	Roadside		265256	192731	PM_{10}	EBam	3.0	13	2
CM10	SA1 Junction Port Tennant	Roadside		266670	193179	PM_{10}	EBam	3.0	9	3
CM11	Station Court High Street	Roadside	Swansea AQMA 2010	265705	193686	NO_2	Chemiluminescence	1.5	3	2
CM12	Morfa Road	Roadside	Swansea AQMA 2010	265905	193733	NO_2	Chemiluminescence	1.5	6.5	6

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.

Figure 2.1.1.16 – Map of Automatic Monitoring Sites https://airquality.gov.wales/



2.1.2 Non-Automatic Monitoring Sites

Swansea Council undertook non-automatic (passive) monitoring of NO_2 at 248 sites during 2017 of which 52 were closed during the year.

Table 2.1.2.1 presents the details of the sites.

Over the years Swansea Council has focused its NO_2 diffusion tube monitoring at roadside locations in-line with the requirements of Box 5.1 of the Local Air Quality Management Technical Guidance (TG16). Wherever possible, passive diffusion tubes are located directly on receptor locations – typically front façade of dwellings, mainly on front down pipes etc. Where this has not been possible, the tubes have been located on the nearest lamppost etc. to the dwelling and concentrations corrected to façade.

Maps showing the location of the monitoring sites are provided in Figure 2.1.2.1. Due to the number of passive diffusion tube locations, it is not possible to label the site numbers clearly within figure 2.1.2.1 so additional maps have been provided to show a more detailed view of the monitoring locations.

Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

Table 2.1.2.1 – Details of Non-Automatic Monitoring Sites. NO_2 Diffusion Tubes

Site ID	Site Type	Within AMQA	OS Grid Reference		Site Height (m)
			X	Y	
4	Roadside	Y	262497	192857	3
5	Roadside	Y	262548	192943	3
6	Roadside	Y	262612	192995	3
7	Roadside	Y	262691	192852	3
8	Roadside	Y	262990	195820	3
9	Roadside		263190	195205	3
10	Roadside	Y	263219	195513	3
11	Roadside	Y	263344	195474	3
12	Roadside	Y	263680	195103	3
13	Roadside		264830	193066	3
14	Roadside		265285	192696	3
15	Roadside		265334	192608	3
16	Roadside		265339	192534	3
18	Roadside	Y	265526	195807	3
19	Roadside	Y	265597	194061	3
20	Roadside	Y	265594	194175	3
21	Roadside	Y	265634	195316	3
22	Roadside	Y	265682	195374	3
23	Roadside	Y	265728	195494	3
25	Roadside	Y	265845	195547	3
26	Roadside	Y	265876	194318	3
27	Roadside	Y	265922	194428	3
28	Roadside	Y	265949	194891	3
29	Roadside	Y	265973	195222	3
31	Roadside		266153	196003	3
32	Roadside		266209	193867	3
33	Roadside		266236	193488	3
34	Roadside		266272	196168	3
35	Roadside		266314	193298	3
36	Roadside		266455	193300	3
40	Roadside		266951	198278	3
41	Roadside		266953	198085	3
43	Roadside		267093	198063	3
44	Roadside		267639	199543	3
45	Roadside		267661	199451	3
48	Roadside		268011	193101	3
50	Roadside		268530	197419	3
54	Roadside		268693	197416	3
55	Roadside		268789	197420	3
56 *	Roadside		269306	198661	3
58	Roadside		264052	192884	3
59	Roadside	Y	265918	194463	3
60	Roadside		265036	192931	3
61	Roadside		264959	192878	3
63	Roadside	Y	262675	192775	3
64	Roadside	Y	262719	192840	3
65	Roadside	Y	262735	192855	3
66	Roadside	Y	262802	192829	3
67	Roadside	Y	265903	193683	3
68	Roadside		265573	193432	3
69	Roadside		265543	193450	3
70	Roadside		266649	195435	3
71 **	Roadside		266514	195485	3
72	Roadside		264091	192900	2
73	Roadside		264138	192868	2
74	Roadside		264163	192853	2
75	Roadside		264072	192869	2
76	Roadside		263968	192880	2

Site ID	Site Type	Within AMQA	OS Grid Reference		Site Height (m)
			X	Y	
78	Roadside		263819	192948	2
79	Roadside		263842	192896	2
83	Roadside	Y	262785	192838	2
84	Roadside	Y	262714	192839	2
85	Roadside	Y	262702	192847	2
86	Roadside	Y	262704	192865	2
87	Roadside	Y	262697	192798	2
88	Roadside	Y	262605	192916	2
89	Roadside	Y	262587	192956	2
90	Roadside	Y	262631	192996	2
91	Roadside	Y	262534	192950	2
92	Roadside	Y	262545	192869	2
93	Roadside		263406	195534	2
94	Roadside		263444	195572	2
95	Roadside		262815	196090	2
96	Roadside		262922	195950	2
97	Roadside	Y	262946	195902	2
98	Roadside	Y	263142	195548	2
99	Roadside	Y	263387	195332	2
100	Roadside	Y	263470	195250	2
101	Roadside	Y	263843	195047	2
102	Roadside		266379	193307	2
104	Roadside		268538	197389	2
107	Roadside		268765	197420	2
108	Roadside		267608	199461	2
109	Roadside		267510	199487	2
110	Roadside		267369	199521	2
111	Roadside		267705	199426	2
114	Roadside		264622	192971	2
115	Roadside		265031	193097	2
116	Roadside		265192	193138	2
117	Roadside		265288	193211	2
⊗118	Roadside		265483	193385	2
119	Roadside		265522	193390	2
120	Roadside		265570	193366	3
121	Roadside	Y	265706	193662	2
122	Roadside		265694	193505	3
123	Roadside		265655	193423	2
⊗124	Roadside		265651	193253	2
⊗125	Roadside		265641	193162	3
⊗126	Roadside		265475	193144	2
⊗127	Roadside		265348	193110	2
⊗128	Roadside		265297	193085	2
⊗129	Roadside		265153	193098	2
131	Roadside		265137	192846	2
132	Roadside		265229	192753	3
133	Roadside		265350	192566	2
⊗134	Roadside		265113	192903	2
^135	Roadside		262605	192916	5
^136	Roadside		262612	192995	5
^137	Roadside		262631	192996	5
140	Roadside		266863	199009	3
143	Roadside		267089	198608	3
144	Roadside		267141	198591	3
145	Roadside		267139	198578	3
146	Roadside		267156	198571	3
147	Roadside		267165	198580	3
148	Roadside		267170	198564	3
149	Roadside		267204	198561	3

Site ID	Site Type	Within AMQA	OS Grid Reference		Site Height (m)
			X	Y	
150	Roadside		267205	198545	3
151	Roadside		267192	198518	3
160	Roadside		269049	201744	3
182	Roadside		259050	197790	3
183	Roadside		259036	197795	3
197	Roadside		258797	198701	3
198	Roadside		258811	198701	3
206	Roadside		261565	188211	3
207	Roadside		261561	188222	3
208	Roadside		261541	188215	3
209	Roadside		261534	188198	3
210	Roadside		261516	188207	3
211	Roadside		261501	188188	3
212	Roadside		261486	188200	3
213	Roadside		261490	188186	3
214	Roadside		261315	188193	3
215	Roadside		261299	188191	3
216	Roadside		261276	188190	3
238	Roadside		266902	197660	3
239	Roadside		266181	196022	3
240	Roadside		266169	195995	3
241	Roadside		266159	196013	3
242	Roadside		265655	193423	3
243	Roadside		265474	194949	3
244	Roadside		265466	194930	3
245	Roadside		265448	194922	3
247	Roadside		265394	194899	3
249	Roadside		265326	194871	3
251	Roadside		265263	194845	3
252	Roadside		265226	194830	3
256	Roadside		264995	194777	3
271	Roadside		266879	198078	3
272	Roadside		266888	198074	3
275	Roadside		265658	194856	3
276	Roadside		265610	194871	2
277	Roadside		265596	194875	2
278	Roadside		265573	194882	2
279	Roadside		265555	194926	2
280	Roadside		265542	194980	2
281	Roadside		265542	194872	2.5
282	Roadside		265540	194840	2.5
284	Roadside		265452	195899	2
285	Roadside		266955	197415	2
286	Roadside		266938	197377	2
287	Roadside		265715	193902	2
288	Roadside		265698	193878	2
289	Roadside		265702	193842	2
290	Roadside		263014	195737	2
291	Roadside		267952	193121	2
295	Roadside		258998	198698	3
296	Roadside		259054	198679	2
323	Roadside		266765	193224	2
324	Roadside		269815	197657	2
331	Roadside		265741	193545	2
333	Roadside		265673	193477	2
334	Roadside		265688	193483	2
335	Roadside		265682	193461	2
336	Roadside		265664	193395	2
337	Roadside		265637	193335	2

Site ID	Site Type	Within AMQA	OS Grid Reference		Site Height (m)
			X	Y	
338	Roadside		265651	193331	2
339	Roadside		265652	193313	2
340	Roadside		265632	193292	2
341	Roadside		265635	193224	2
342	Roadside		265655	193197	2
343	Roadside		265640	193173	2
344	Roadside		265658	193169	2
345	Roadside		265661	193140	2
346	Roadside		265681	193096	2
347	Roadside		265562	193518	2
348	Roadside		265572	193549	2
349	Roadside		265578	193576	2
350	Roadside		265577	193606	2
351	Roadside		265606	193466	2
352	Roadside		265602	193429	2
353	Roadside		265596	193389	2
354	Roadside		265595	193377	2
355	Roadside		265574	193269	2
356	Roadside		265471	193359	2
357	Roadside		265498	193162	2
358	Roadside		265414	193141	2
359	Roadside		265396	193111	2
360	Roadside		265267	192750	2
361	Roadside		265303	192719	2
362	Roadside		265271	192774	2
363	Roadside		265287	192797	2
364	Roadside		265301	192814	2
365	Roadside		265258	193075	2
366	Roadside		265237	193056	2
367	Roadside		265189	193044	2
368	Roadside		265143	193083	2
373	Roadside		258859	196513	2
374	Roadside		258824	196435	2
375	Roadside		258798	196371	2
376	Roadside		258765	196368	2
377	Roadside		258763	196317	2
378	Roadside		258722	196365	2
379	Roadside		261714	188096	2
380	Roadside		261675	188060	2
381	Roadside		261660	188041	2
382	Roadside		261631	188116	2
383	Roadside		261694	188038	2
384	Roadside		261720	188015	2
385	Roadside		267001	198231	2
386	Roadside		266698	195334	3
387	Roadside		267990	193091	2
388	Roadside		267964	193076	2
389	Roadside		267933	193111	2
390	Roadside		267974	193132	2
391	Roadside		259467	198509	2
392	Roadside		257959	188908	2
393	Roadside		262620	192740	2
394	Roadside		262445	192645	2
395	Roadside		262413	192630	2
396	Roadside		262370	192609	2
397	Roadside		265407	197414	2
398	Roadside		265584	197442	2
399	Roadside		265224	197412	2
400	Roadside		265172	197360	2

Site ID	Site Type	Within AMQA	OS Grid Reference		Site Height (m)
			X	Y	
401	Roadside		265243	197312	2
402	Roadside		265907	193721	2
403	Façade		265115	192895	2
404	Roadside		261713	199051	2
405	Roadside		267981	193053	2
406	Façade		265973	195222	2
407	Façade	Y	265539	195664	2
408	Roadside		266655	193177	2
409	Roadside		265093	192953	2
410	Roadside		265156	192992	2
411	Roadside		265257	193042	2
412	Roadside		258957	196766	2
413	Roadside		258950	196721	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.

Figure 2.1.2.1 – Map(s) of Non-Automatic Monitoring Sites

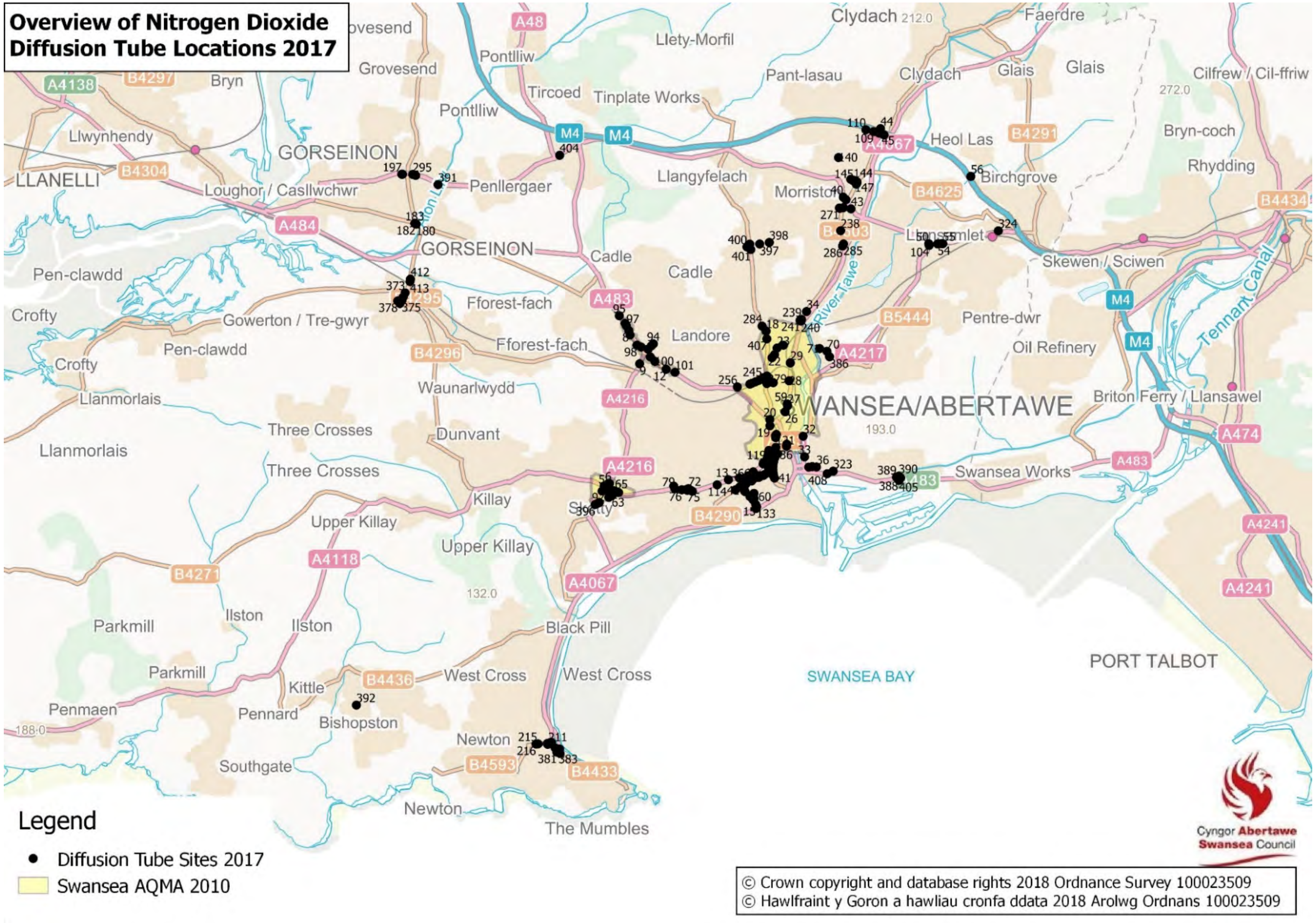


Figure 2.1.2.2 – Map(s) of Non-Automatic Monitoring Sites

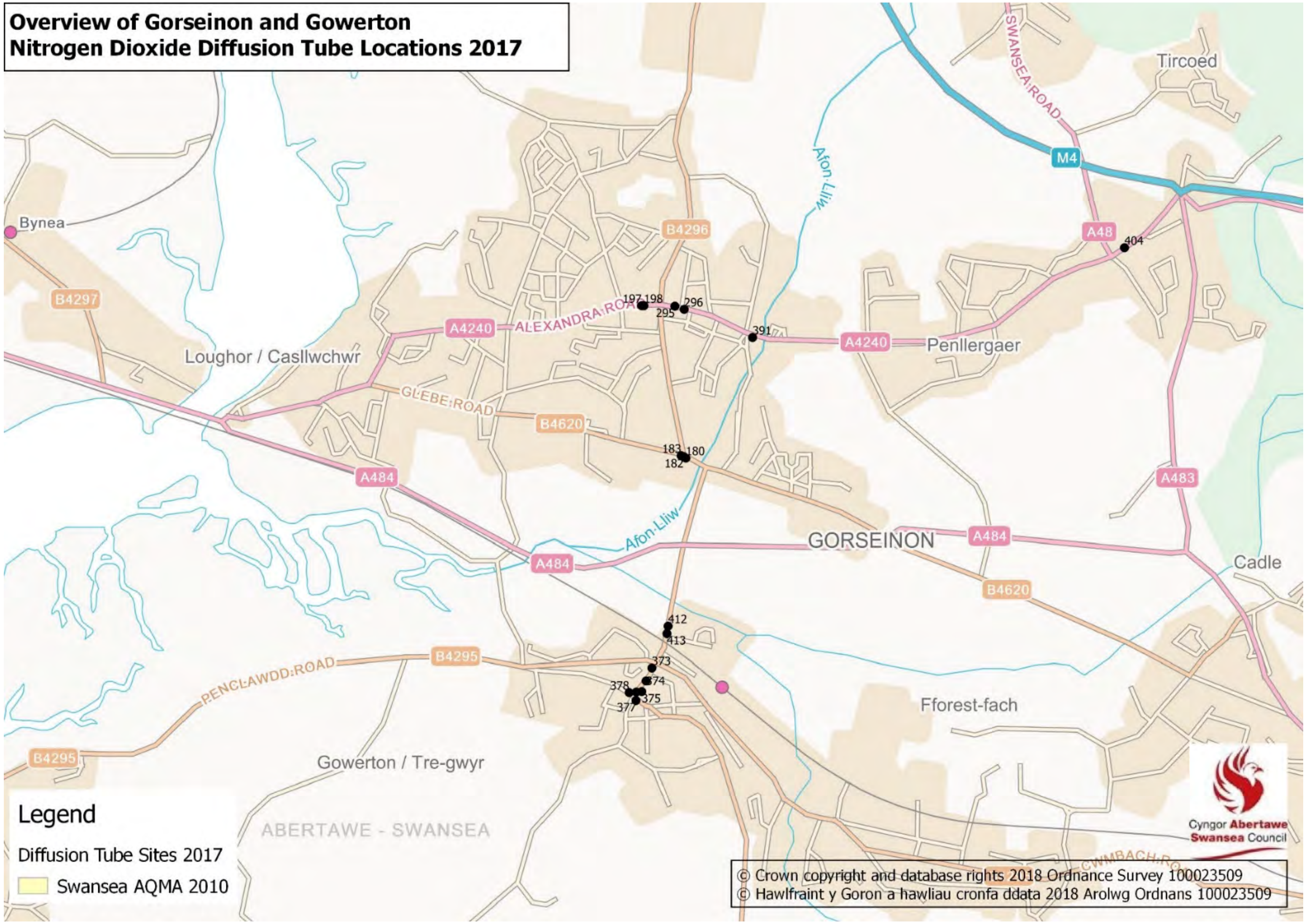


Figure 2.1.2.3 – Map(s) of Non-Automatic Monitoring Sites

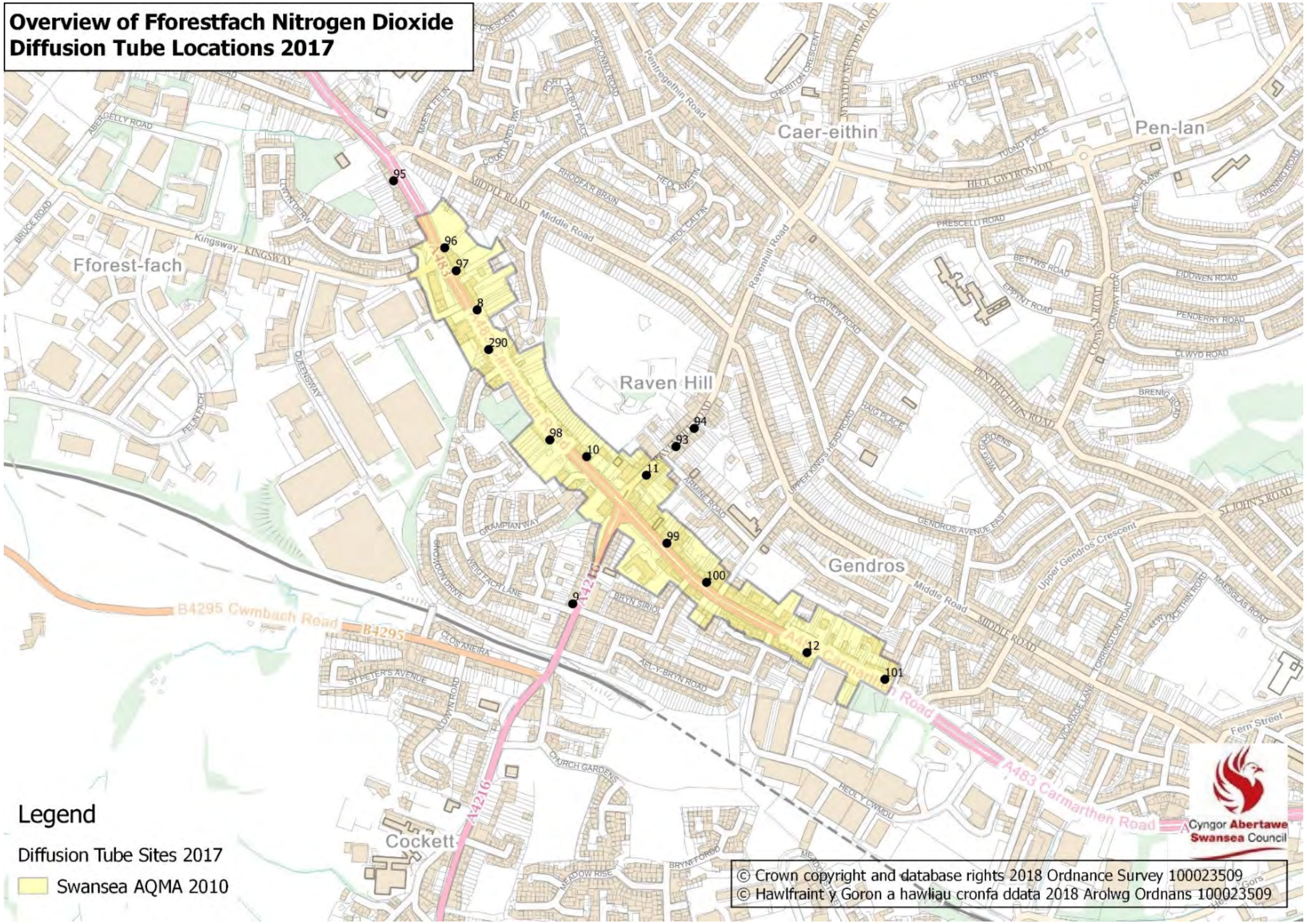


Figure 2.1.2.4 – Map(s) of Non-Automatic Monitoring Sites

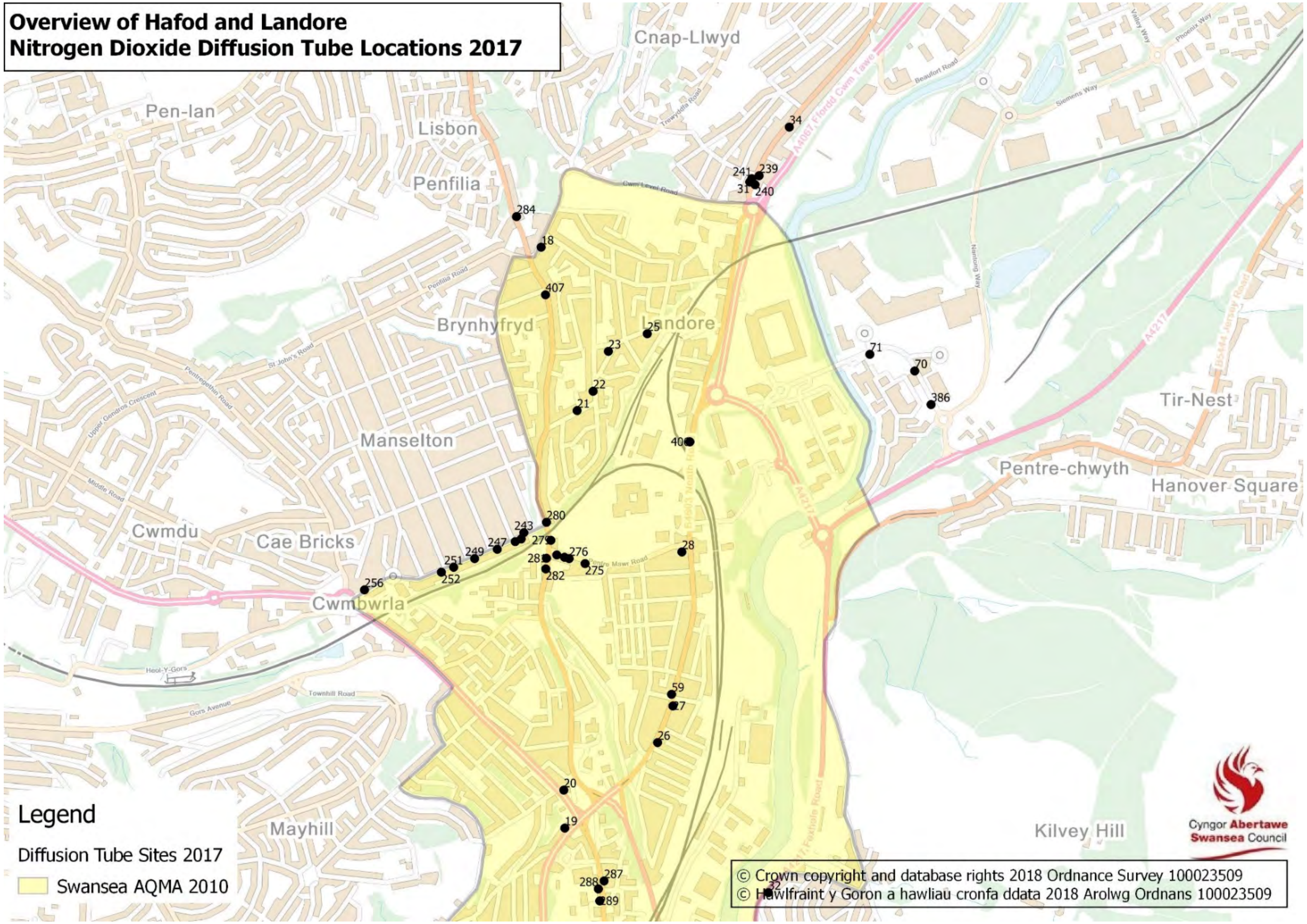


Figure 2.1.2.5 – Map(s) of Non-Automatic Monitoring Sites

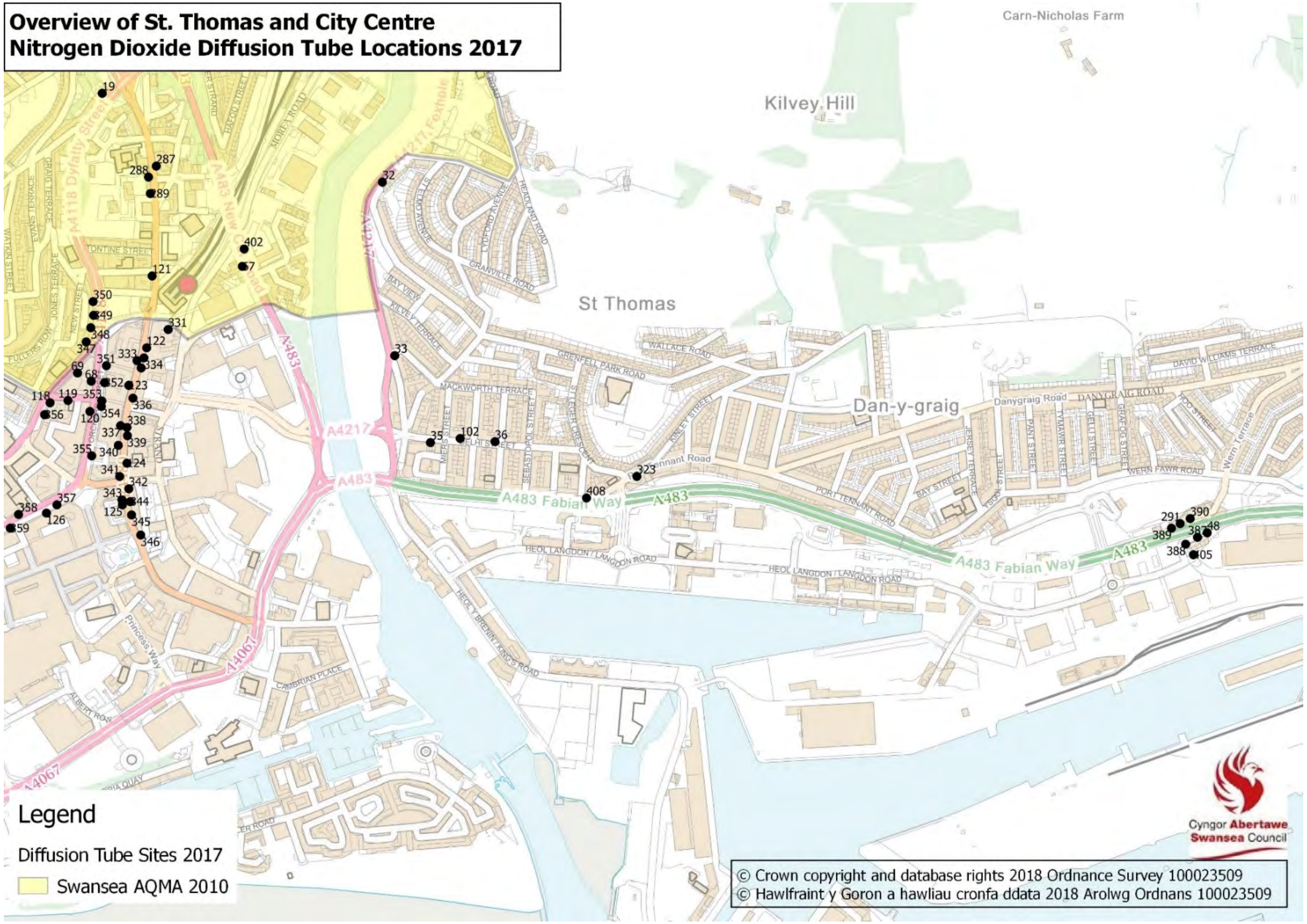


Figure 2.1.2.6 – Map(s) of Non-Automatic Monitoring Sites

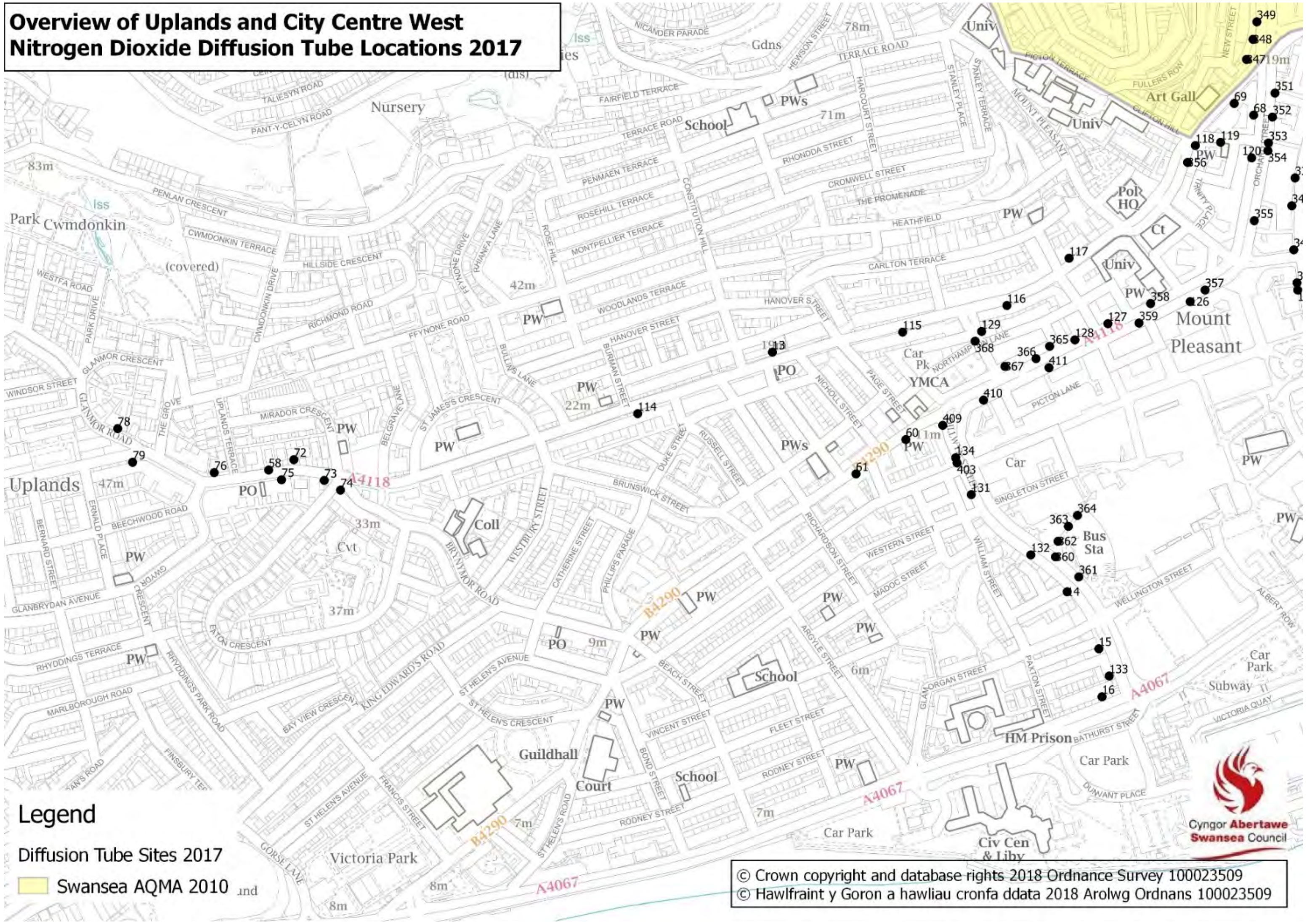


Figure 2.1.2.7 – Map(s) of Non-Automatic Monitoring Sites

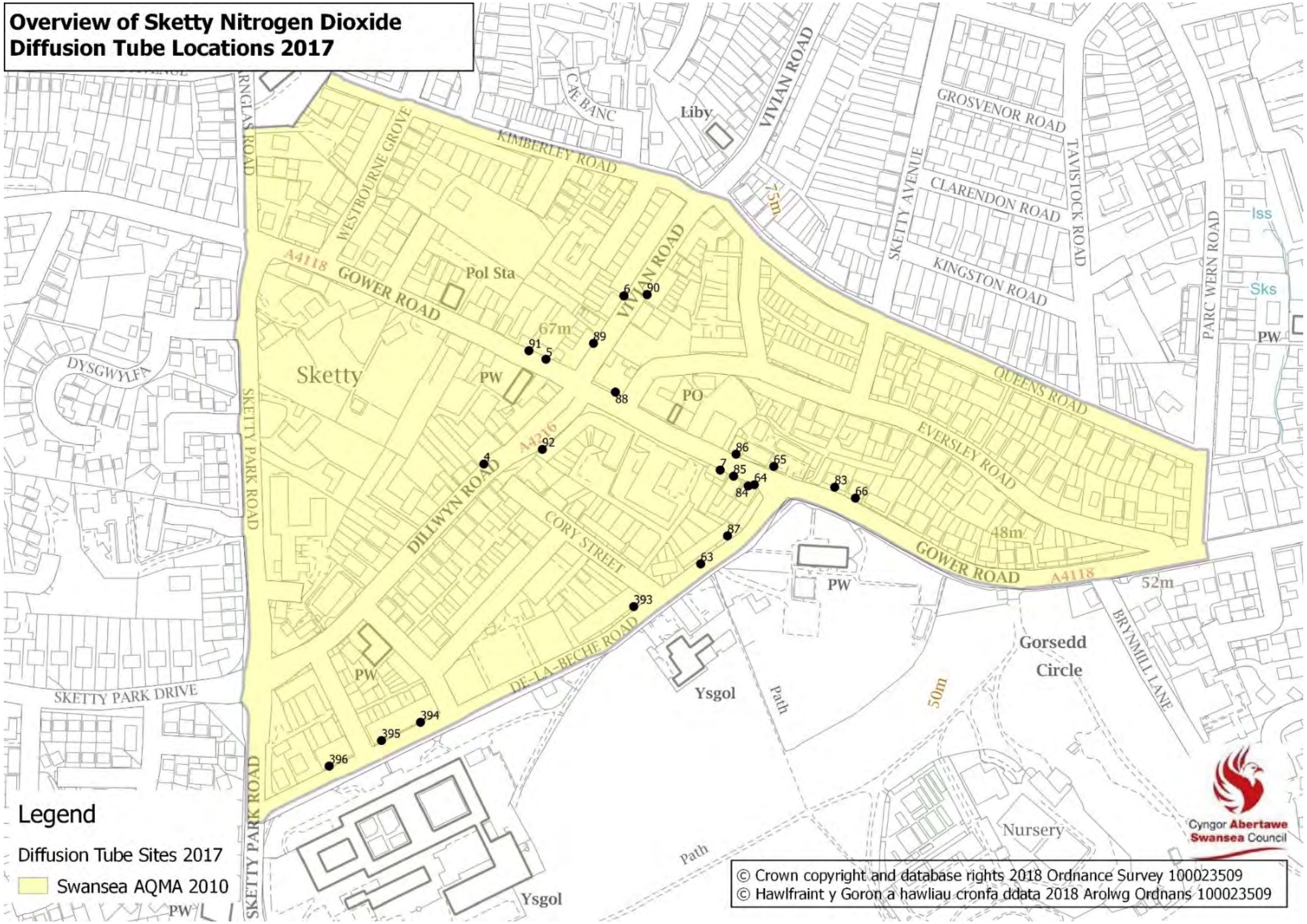


Figure 2.1.2.8 – Map(s) of Non-Automatic Monitoring Sites

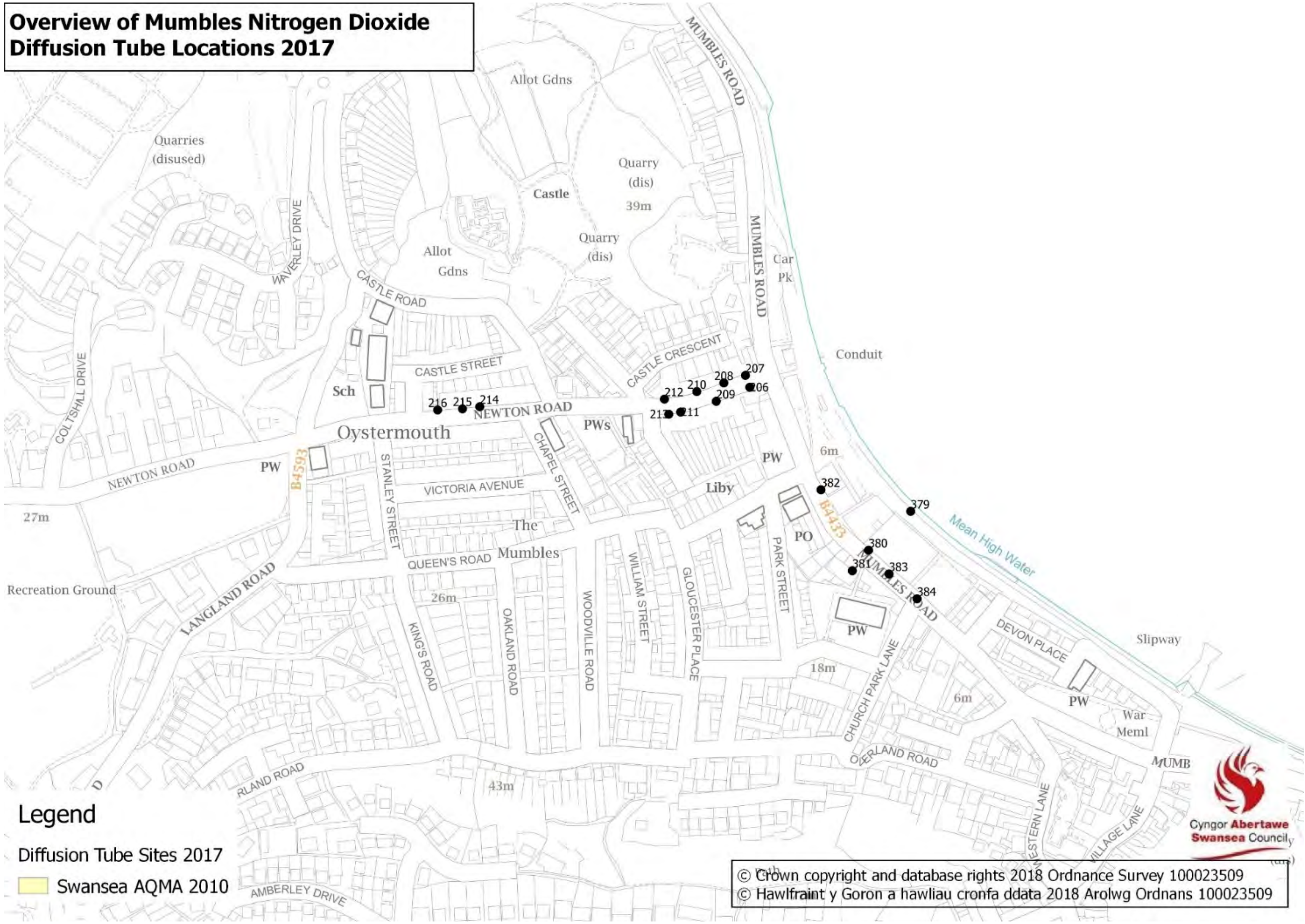
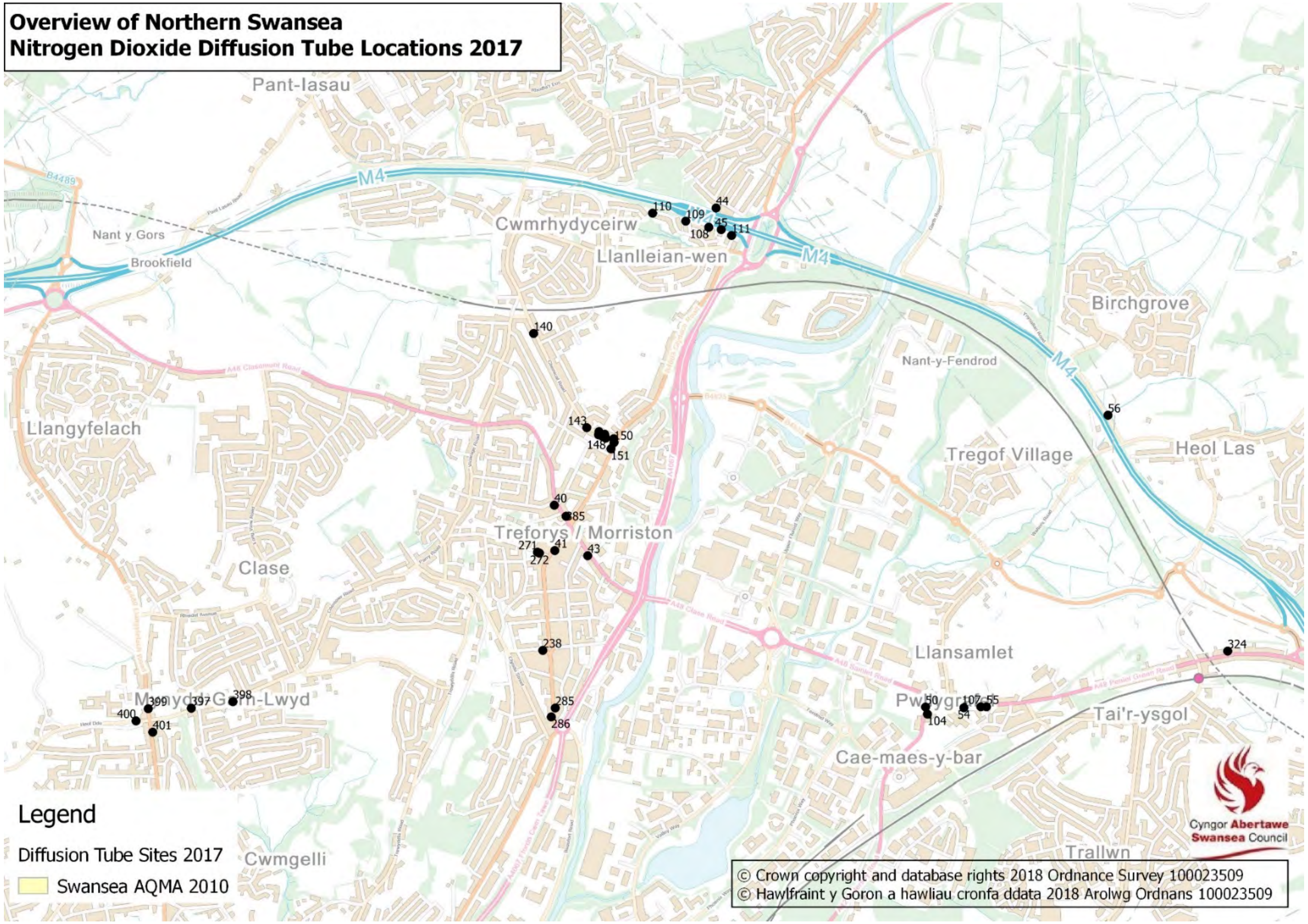


Figure 2.1.2.9 – Map(s) of Non-Automatic Monitoring Sites



Determination of a "Swansea" bias factor

There has been great debate surrounding the use of a locally derived bias factor when correcting diffusion tubes for bias. Indeed, previous auditor's comments have indicated that such a local derived correction factor should be obtained for Swansea. The auditor's comments have been taken on board and for the last several years tri located diffusion tubes have been located on the sample intake at the authority's chemiluminescent analyser site at the Swansea Roadside AURN. This co-location work is required to be repeated yearly given the advice within section 6.3.1 of the report prepared by the then AEA Energy and Environment (now Ricardo on behalf of DEFRA and the Devolved Administrations: NO_2 Diffusion Tubes for LAQM: Guidance note for Local Authorities .

The ratified data has been obtained for the Swansea Roadside AURN via the UK Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector. Ricardo AEA undertakes the QA/QC work on behalf of DEFRA at the Swansea AURN site.

The bias correction to be used for diffusion tube exposure during 2017 in Swansea is therefore 0.74. A spreadsheet containing the automatic real-time data and the passive diffusion tube data used to derive the bias factor is shown within Appendix C.

2.2 2017 Air Quality Monitoring Results

Table 2.2.1 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
CM1**	Roadside	Automatic	98.63	98.63	26.8 (31.15)	25 (30.76)	23 (27.43)	24.4 (30.37)	20 (24.41)
CM2**	Roadside	Automatic	91.63	91.63	23.2 (28.58)	21.1 (25.89)	20.5 (25.02)	22.3 (29.69)	20.6 (29.14)
CM3	Urban Background	Automatic	90.73	90.73	18.54	17.08	14.75	16.39	13.41
CM4	Façade	Automatic	95.34	95.34	**50.68**	**48.99**	**40.24**	**45.59**	**40.04**
CM5	Roadside	Automatic	99.14	99.14	39.45	35.83	33.71	35.83	32.19
CM11**	Roadside	Automatic	98.66	98.66	N/A	**56.85***	**50.9 (54.52)**	**48.3 (51.76)**	**44 (47.20)**
CM12	Roadside	Automatic	25.7	25.7	N/A	N/A	N/A	N/A	25.73***
4	Roadside	Diffusion Tube	33.33	33.33	29.92	29.78	27.28	29.49	21.90
5	Roadside	Diffusion Tube	100.00	100.00	34.78	32.46	29.70	31.65	28.35
6	Roadside	Diffusion Tube	100.00	100.00	30.65	28.52	26.57	27.58	23.11
7	Roadside	Diffusion Tube	100.00	100.00	**46.74**	**48.66**	**42.69**	**45.84**	**39.05**
8	Roadside	Diffusion Tube	100.00	100.00	**44.77**	**41.76**	**40.36**	**46.59**	34.63
9	Roadside	Diffusion Tube	33.33	33.33	30.03	27.89	24.87	26.47	27.49
10	Roadside	Diffusion Tube	100.00	100.00	25.29	24.97	23.94	24.52	20.80
11	Roadside	Diffusion Tube	100.00	100.00	**39.45**	**37.58**	33.81	**37.19**	30.32
12	Roadside	Diffusion Tube	100.00	100.00	**40.22**	**42.78**	**38.39**	**42.72**	34.80
13	Roadside	Diffusion Tube	100.00	100.00	29.30	27.78	25.66	27.40	22.58
14	Roadside	Diffusion Tube	100.00	100.00	28.69	24.30	23.86	24.95	19.54
15	Roadside	Diffusion Tube	100.00	100.00	26.91	24.45	24.30	26.39	22.10
16	Roadside	Diffusion Tube	83.33	83.33	31.63	28.61	26.80	31.35	26.64
18	Roadside	Diffusion Tube	100.00	100.00	**47.01**	**45.85**	**42.07**	**46.38**	**37.06**
19	Roadside	Diffusion Tube	100.00	100.00	**43.75**	**42.61**	**39.14**	**44.11**	**38.29**
20	Roadside	Diffusion Tube	100.00	100.00	36.50	**37.74**	35.42	33.73	29.87
21	Roadside	Diffusion Tube	33.33	33.33	30.04	27.96	26.93	29.48	18.79
22	Roadside	Diffusion Tube	100.00	100.00	33.89	31.43	29.91	32.02	26.78

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m³) (3)				
					2013	2014	2015	2016	2017
23	Roadside	Diffusion Tube	100.00	100.00	30.93	28.49	28.69	30.29	24.27
25	Roadside	Diffusion Tube	33.33	33.33	27.88	27.06	26.47	26.61	18.64
26	Roadside	Diffusion Tube	100.00	100.00	**39.11**	**38.59**	35.44	38.43	29.54
27	Roadside	Diffusion Tube	100.00	100.00	**38.03**	**39.25**	34.78	36.69	29.33
28	Roadside	Diffusion Tube	33.33	33.33	28.30	28.21	25.67	24.17	17.05
29	Roadside	Diffusion Tube	100.00	100.00	**43.86**	**47.36**	**48.90**	**48.42**	30.14
31	Roadside	Diffusion Tube	100.00	100.00	30.81	31.70	28.42	30.16	25.29
32	Roadside	Diffusion Tube	100.00	100.00	35.24	33.38	30.15	33.88	26.73
33	Roadside	Diffusion Tube	100.00	100.00	31.09	31.33	29.45	31.69	26.64
34	Roadside	Diffusion Tube	33.33	33.33	31.11	29.80	27.33	27.27	19.80
35	Roadside	Diffusion Tube	91.67	91.67	31.27	32.21	31.35	33.53	27.76
36	Roadside	Diffusion Tube	100.00	100.00	30.12	27.49	26.49	29.74	24.85
40	Roadside	Diffusion Tube	83.33	83.33	28.19	27.42	24.83	26.17	22.06
41	Roadside	Diffusion Tube	75.00	75.00	36.54	35.33	31.89	33.05	26.77
43	Roadside	Diffusion Tube	91.67	91.67	**38.62**	36.22	32.16	34.75	28.62
44	Roadside	Diffusion Tube	100.00	100.00	25.69	27.35	26.55	26.08	23.86
45	Roadside	Diffusion Tube	100.00	100.00	32.06	30.78	28.19	30.92	23.28
48	Roadside	Diffusion Tube	100.00	100.00	23.43	21.72	19.59	22.15	17.44
50	Roadside	Diffusion Tube	100.00	100.00	32.89	36.43	33.79	38.03	30.77
54	Roadside	Diffusion Tube	100.00	100.00	31.88	33.93	31.38	31.26	26.61
55	Roadside	Diffusion Tube	100.00	100.00	32.39	32.31	31.04	31.21	25.92
56 *	Roadside	Diffusion Tube	100.00	100.00	21.20	22.00	22.20	20.7	15.84
58	Roadside	Diffusion Tube	100.00	100.00	32.50	29.70	28.50	33.8	27.38
59	Roadside	Diffusion Tube	100.00	100.00	**47.99**	**50.28**	**47.78**	**48.41**	**39.60**
60	Roadside	Diffusion Tube	100.00	100.00	35.71	34.21	29.70	30.19	26.39
61	Roadside	Diffusion Tube	91.67	91.67	36.45	**38.16**	33.93	36.75	27.92
63	Roadside	Diffusion Tube	91.67	91.67	22.10	21.00	19.40	22	16.50
64	Roadside	Diffusion Tube	100.00	100.00	**38.90**	**38.30**	36.10	32.8	26.94
65	Roadside	Diffusion Tube	100.00	100.00	22.92	24.77	21.99	25.77	21.45
66	Roadside	Diffusion Tube	100.00	100.00	29.11	26.45	26.53	29.48	24.13
67	Roadside	Diffusion Tube	100.00	100.00	36.20	35.60	**37.20**	**39.8**	32.41
68	Roadside	Diffusion Tube	100.00	100.00	35.72	36.13	34.87	34.99	28.34

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
69	Roadside	Diffusion Tube	100.00	100.00	36.70	**40.30**	35.60	34.9	30.71
70	Roadside	Diffusion Tube	100.00	100.00	24.30	24.80	25.60	24.1	20.20
71 **	Roadside	Diffusion Tube	100.00	100.00	29.00	25.00	24.50	26	17.98
72	Roadside	Diffusion Tube	25.00	25.00	24.91	23.58	22.60	24.03	16.05
73	Roadside	Diffusion Tube	33.33	33.33	28.81	29.60	28.39	27.39	20.18
74	Roadside	Diffusion Tube	33.33	33.33	26.65	28.41	22.39	23.29	15.97
75	Roadside	Diffusion Tube	100.00	100.00	**38.41**	**39.99**	34.02	34.53	30.43
76	Roadside	Diffusion Tube	33.33	33.33	27.76	27.61	25.80	26.58	19.40
78	Roadside	Diffusion Tube	33.33	33.33	27.88	25.69	23.47	25.59	19.04
79	Roadside	Diffusion Tube	33.33	33.33	31.04	30.07	26.82	27.62	20.39
83	Roadside	Diffusion Tube	100.00	100.00	30.33	27.41	25.97	28.07	22.87
84	Roadside	Diffusion Tube	100.00	100.00	32.73	35.13	33.81	33.92	27.53
85	Roadside	Diffusion Tube	100.00	100.00	36.24	35.62	35.28	35.78	29.11
86	Roadside	Diffusion Tube	100.00	100.00	28.18	25.51	23.97	32.27	22.63
87	Roadside	Diffusion Tube	100.00	100.00	22.11	20.80	18.93	20.64	17.10
88	Roadside	Diffusion Tube	100.00	100.00	30.73	28.21	28.37	30.67	26.07
89	Roadside	Diffusion Tube	100.00	100.00	21.26	20.12	20.09	25.23	18.04
90	Roadside	Diffusion Tube	100.00	100.00	33.29	32.61	30.02	31.39	24.54
91	Roadside	Diffusion Tube	100.00	100.00	30.68	29.28	27.46	29.04	25.47
92	Roadside	Diffusion Tube	25.00	25.00	27.10	23.70	23.10	25.6	19.76
93	Roadside	Diffusion Tube	33.33	33.33	29.25	29.21	25.39	26.89	19.11
94	Roadside	Diffusion Tube	91.67	91.67	28.26	28.09	25.66	24.32	22.81
95	Roadside	Diffusion Tube	91.67	91.67	25.85	25.23	21.38	24.12	21.19
96	Roadside	Diffusion Tube	100.00	100.00	27.50	26.20	25.55	27.99	22.27
97	Roadside	Diffusion Tube	91.67	91.67	32.92	31.62	31.44	35.64	28.24
98	Roadside	Diffusion Tube	83.33	83.33	36.67	36.21	33.05	34.33	27.34
99	Roadside	Diffusion Tube	100.00	100.00	31.83	32.73	28.84	31.04	27.03
100	Roadside	Diffusion Tube	33.33	33.33	27.43	24.02	23.09	25.38	18.22
101	Roadside	Diffusion Tube	33.33	33.33	25.34	23.31	23.75	25.79	19.56
102	Roadside	Diffusion Tube	91.67	91.67	28.70	27.96	27.87	29.77	26.60
104	Roadside	Diffusion Tube	100.00	100.00	27.86	27.70	27.13	26.76	22.05
107	Roadside	Diffusion Tube	100.00	100.00	31.01	32.23	29.49	30.83	26.20

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
108	Roadside	Diffusion Tube	33.33	33.33	29.75	28.72	27.33	29.49	19.18
109	Roadside	Diffusion Tube	16.67	16.67	27.14	26.43	25.01	26.07	16.54
110	Roadside	Diffusion Tube	100.00	100.00	26.66	25.75	24.67	23.75	20.51
111	Roadside	Diffusion Tube	100.00	100.00	29.40	27.15	30.15	30.61	24.61
114	Roadside	Diffusion Tube	100.00	100.00	29.70	30.07	27.48	27.47	23.00
115	Roadside	Diffusion Tube	91.67	91.67	**37.57**	**40.40**	35.25	35.09	30.64
116	Roadside	Diffusion Tube	91.67	91.67	**38.43**	**38.73**	35.63	**37.65**	33.13
117	Roadside	Diffusion Tube	100.00	100.00	36.61	35.30	33.91	**37.12**	30.09
⊗118	Roadside	Diffusion Tube	100.00	100.00	29.18	29.33	28.69	28.96	24.84
119	Roadside	Diffusion Tube	100.00	100.00	32.51	34.78	32.05	31.34	27.92
120	Roadside	Diffusion Tube	100.00	100.00	**44.94**	**47.24**	**44.76**	**44.82**	35.72
121	Roadside	Diffusion Tube	100.00	100.00	**50.57**	**52.71**	**47.29**	**48.01**	38.60
122	Roadside	Diffusion Tube	100.00	100.00	32.49	34.83	30.16	32.09	25.90
123	Roadside	Diffusion Tube	100.00	100.00	**46.55**	**47.00**	**39.54**	**46.44**	36.09
⊗124	Roadside	Diffusion Tube	75.00	75.00	36.50	**38.43**	**37.73**	**39.60**	32.41
⊗125	Roadside	Diffusion Tube	100.00	100.00	36.20	**37.90**	**37.10**	**38**	32.04
⊗126	Roadside	Diffusion Tube	100.00	100.00	**40.71**	**40.64**	36.91	34.91	27.61
⊗127	Roadside	Diffusion Tube	100.00	100.00	**45.01**	**44.26**	34.70	34.1	26.42
⊗128	Roadside	Diffusion Tube	100.00	100.00	**40.36**	**38.82**	**37.00**	**38.06**	30.64
⊗129	Roadside	Diffusion Tube	100.00	100.00	36.50	32.56	32.94	**37.11**	30.40
131	Roadside	Diffusion Tube	100.00	100.00	**44.33**	**44.79**	**44.75**	**42.02**	29.77
132	Roadside	Diffusion Tube	100.00	100.00	33.81	27.11	29.66	32.29	26.70
133	Roadside	Diffusion Tube	25.00	25.00	26.57	25.28	23.61	25.17	20.21
⊗134	Roadside	Diffusion Tube	100.00	100.00	**44.54**	**42.65**	**44.25**	**42.10**	33.47
^135	Roadside	Diffusion Tube	100.00	100.00	30.78	-	-	29.66	27.16
^136	Roadside	Diffusion Tube	100.00	100.00	28.71	25.53	27.14	25.18	23.29
^137	Roadside	Diffusion Tube	100.00	100.00	32.17	32.63	29.19	31.16	24.75
140	Roadside	Diffusion Tube	33.33	33.33	33.43	29.12	31.41	29.06	22.87
143	Roadside	Diffusion Tube	33.33	33.33	29.77	30.29	29.65	28.78	20.39
144	Roadside	Diffusion Tube	16.67	16.67	27.71	27.05	24.60	26.78	17.28
145	Roadside	Diffusion Tube	16.67	16.67	28.77	28.27	29.69	27.27	19.47
146	Roadside	Diffusion Tube	33.33	33.33	29.10	32.28	30.27	27.89	21.46

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2013	2014	2015	2016	2017
147	Roadside	Diffusion Tube	33.33	33.33	32.24	33.79	27.35	26.26	16.98
148	Roadside	Diffusion Tube	33.33	33.33	31.46	32.05	29.48	28.76	19.25
149	Roadside	Diffusion Tube	33.33	33.33	26.77	26.66	24.98	25.16	18.72
150	Roadside	Diffusion Tube	33.33	33.33	28.45	27.63	27.85	28.46	20.42
151	Roadside	Diffusion Tube	25.00	25.00	28.18	25.59	26.69	26.74	18.26
180	Roadside	Diffusion Tube	91.67	91.67	30.35	29.67	29.10	30.98	24.43
182	Roadside	Diffusion Tube	91.67	91.67	28.15	28.71	27.04	28.48	24.22
183	Roadside	Diffusion Tube	33.33	33.33	30.34	30.07	28.49	29.79	21.22
197	Roadside	Diffusion Tube	100.00	100.00	32.92	34.22	29.69	33.54	28.10
198	Roadside	Diffusion Tube	100.00	100.00	35.17	35.56	32.13	33.20	28.22
206	Roadside	Diffusion Tube	100.00	100.00	**41.55**	**42.50**	**38.05**	**41.79**	33.98
207	Roadside	Diffusion Tube	100.00	100.00	33.84	32.85	32.16	**37.74**	29.70
208	Roadside	Diffusion Tube	100.00	100.00	36.56	35.06	34.28	**37.23**	29.22
209	Roadside	Diffusion Tube	100.00	100.00	**41.00**	**40.72**	35.21	**39.21**	30.51
210	Roadside	Diffusion Tube	91.67	91.67	33.58	32.69	29.54	33.33	26.57
211	Roadside	Diffusion Tube	100.00	100.00	33.17	33.04	30.98	26.74	26.15
212	Roadside	Diffusion Tube	83.33	83.33	25.63	23.93	24.06	29.00	17.75
213	Roadside	Diffusion Tube	100.00	100.00	33.37	34.86	30.81	34.88	27.13
214	Roadside	Diffusion Tube	33.33	33.33	26.77	25.35	22.78	23.67	16.18
215	Roadside	Diffusion Tube	33.33	33.33	23.55	22.77	22.50	25.61	16.37
216	Roadside	Diffusion Tube	33.33	33.33	26.38	23.80	21.41	24.50	16.46
238	Roadside	Diffusion Tube	33.33	33.33	29.82	28.09	26.66	27.15	19.07
239	Roadside	Diffusion Tube	33.33	33.33	30.10	30.20	27.61	28.86	20.28
240	Roadside	Diffusion Tube	100.00	100.00	32.87	31.37	29.30	31.09	26.16
241	Roadside	Diffusion Tube	100.00	100.00	31.60	30.31	28.76	30.83	25.31
242	Roadside	Diffusion Tube	100.00	100.00	**41.47**	**40.94**	35.68	**43.29**	32.08
243	Roadside	Diffusion Tube	91.67	91.67	35.86	35.75	33.98	**38.88**	32.08
244	Roadside	Diffusion Tube	100.00	100.00	**40.14**	**44.02**	**42.71**	**43.19**	33.95
245	Roadside	Diffusion Tube	100.00	100.00	**39.87**	**42.03**	**39.32**	**42.32**	32.10
247	Roadside	Diffusion Tube	100.00	100.00	32.88	35.00	31.80	32.87	25.49
249	Roadside	Diffusion Tube	100.00	100.00	31.91	34.95	30.54	31.55	25.69
251	Roadside	Diffusion Tube	100.00	100.00	33.95	31.52	30.24	31.56	24.35

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
252	Roadside	Diffusion Tube	33.33	33.33	29.36	29.69	27.79	28.58	22.34
256	Roadside	Diffusion Tube	91.67	91.67	**37.41**	**38.21**	**37.18**	**37.86**	32.51
271	Roadside	Diffusion Tube	25.00	25.00	28.24	31.59	27.44	29.71	21.89
272	Roadside	Diffusion Tube	33.33	33.33	30.54	31.05	28.29	29.97	22.14
275	Roadside	Diffusion Tube	100.00	100.00	24.50	22.60	22.20	22.5	18.20
276	Roadside	Diffusion Tube	100.00	100.00	34.16	34.17	31.91	34.64	30.62
277	Roadside	Diffusion Tube	100.00	100.00	34.23	36.72	34.17	34.73	29.17
278	Roadside	Diffusion Tube	91.67	91.67	35.86	36.15	33.12	35.22	26.61
279	Roadside	Diffusion Tube	100.00	100.00	**47.59**	**49.83**	**43.53**	**47.31**	**41.31**
280	Roadside	Diffusion Tube	100.00	100.00	**39.60**	**41.10**	**37.70**	**38.7**	31.30
281	Roadside	Diffusion Tube	100.00	100.00	36.50	33.40	34.50	34.8	28.49
282	Roadside	Diffusion Tube	100.00	100.00	32.20	32.10	31.00	33.5	28.27
284	Roadside	Diffusion Tube	100.00	100.00	32.49	32.14	29.51	30.51	26.13
285	Roadside	Diffusion Tube	100.00	100.00	34.23	32.57	30.90	31.47	26.74
286	Roadside	Diffusion Tube	100.00	100.00	31.77	34.35	30.40	32.30	26.89
287	Roadside	Diffusion Tube	91.67	91.67	31.87	29.53	28.04	28.84	24.48
288	Roadside	Diffusion Tube	91.67	91.67	32.29	31.48	29.69	30.19	23.55
289	Roadside	Diffusion Tube	100.00	100.00	34.15	32.95	32.08	33.04	27.70
290	Roadside	Diffusion Tube	33.33	33.33	29.08	26.97	26.19	27.24	18.46
291	Roadside	Diffusion Tube	100.00	100.00	**43.73**	**39.73**	**38.54**	**41.05**	35.61
295	Roadside	Diffusion Tube	91.67	91.67	29.80	30.70	28.50	31.7	26.79
296	Roadside	Diffusion Tube	100.00	100.00	35.06	35.59	31.10	36.27	31.25
323	Roadside	Diffusion Tube	100.00	100.00	32.16	33.62	30.33	34.30	29.61
324	Roadside	Diffusion Tube	33.33	33.33	-	28.20	25.75	29.24	19.67
331	Roadside	Diffusion Tube	100.00	100.00	-	-	34.78	36.26	30.62
333	Roadside	Diffusion Tube	100.00	100.00	-	-	33.20	36.5	28.05
334	Roadside	Diffusion Tube	100.00	100.00	-	-	29.74	31.68	25.81
335	Roadside	Diffusion Tube	100.00	100.00	-	-	28.23	29.6	24.12
336	Roadside	Diffusion Tube	100.00	100.00	-	-	33.97	36.64	30.35
337	Roadside	Diffusion Tube	91.67	91.67	-	-	35.90	**37.1**	31.60
338	Roadside	Diffusion Tube	100.00	100.00	-	-	32.80	36.03	29.62
339	Roadside	Diffusion Tube	75.00	75.00	-	-	**40.39**	**37.76**	30.87

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2013	2014	2015	2016	2017
340	Roadside	Diffusion Tube	91.67	91.67	-	-	**46.67**	**49.03**	**40.98**
341	Roadside	Diffusion Tube	100.00	100.00	-	-	36.50	40.3	32.56
342	Roadside	Diffusion Tube	83.33	83.33	-	-	30.00	34.7	27.60
343	Roadside	Diffusion Tube	91.67	91.67	-	-	34.58	35.15	29.22
344	Roadside	Diffusion Tube	100.00	100.00	-	-	26.40	31.1	24.94
345	Roadside	Diffusion Tube	100.00	100.00	-	-	29.50	30.2	24.12
346	Roadside	Diffusion Tube	100.00	100.00	-	-	34.08	34.27	28.29
347	Roadside	Diffusion Tube	91.67	91.67	-	-	31.77	36.32	27.49
348	Roadside	Diffusion Tube	91.67	91.67	-	-	35.90	36.04	28.67
349	Roadside	Diffusion Tube	91.67	91.67	-	-	33.39	35.65	28.77
350	Roadside	Diffusion Tube	100.00	100.00	-	-	**38.06**	**39.52**	33.20
351	Roadside	Diffusion Tube	100.00	100.00	-	-	27.05	27.85	24.26
352	Roadside	Diffusion Tube	91.67	91.67	-	-	30.95	29.46	24.09
353	Roadside	Diffusion Tube	91.67	91.67	-	-	29.10	25.8	21.76
354	Roadside	Diffusion Tube	91.67	91.67	-	-	29.80	28	24.12
355	Roadside	Diffusion Tube	91.67	91.67	-	-	27.90	27.8	23.83
356	Roadside	Diffusion Tube	100.00	100.00	-	-	27.50	31.52	25.04
357	Roadside	Diffusion Tube	100.00	100.00	-	-	28.80	27.6	23.31
358	Roadside	Diffusion Tube	100.00	100.00	-	-	32.50	30.1	24.05
359	Roadside	Diffusion Tube	83.33	83.33	-	-	33.70	33.4	25.53
360	Roadside	Diffusion Tube	50.00	50.00	-	-	30.30	29.57	27.66
361	Roadside	Diffusion Tube	50.00	50.00	-	-	35.47	29.90	26.76
362	Roadside	Diffusion Tube	75.00	75.00	-	-	36.53	**42.23**	35.13
363	Roadside	Diffusion Tube	91.67	91.67	-	-	35.28	35.42	28.44
364	Roadside	Diffusion Tube	83.33	83.33	-	-	34.75	**39.49**	32.55
365	Roadside	Diffusion Tube	91.67	91.67	-	-	30.40	31.85	23.19
366	Roadside	Diffusion Tube	100.00	100.00	-	-	31.04	35.42	27.88
367	Roadside	Diffusion Tube	83.33	83.33	-	-	29.52	32.16	28.77
368	Roadside	Diffusion Tube	100.00	100.00	-	-	25.80	28.1	23.61
373	Roadside	Diffusion Tube	91.67	91.67	-	-	-	34.33	28.49
374	Roadside	Diffusion Tube	100.00	100.00	-	-	-	25.5	19.39
375	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18.24	14.66

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
376	Roadside	Diffusion Tube	100.00	100.00	-	-	-	30.40	25.00
377	Roadside	Diffusion Tube	100.00	100.00	-	-	-	34.98	29.90
378	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18	13.91
379	Roadside	Diffusion Tube	33.33	33.33	-	-	-	16.59	11.11
380	Roadside	Diffusion Tube	33.33	33.33	-	-	-	20.52	11.34
381	Roadside	Diffusion Tube	33.33	33.33	-	-	-	17.80	12.08
382	Roadside	Diffusion Tube	33.33	33.33	-	-	-	23.48	14.83
383	Roadside	Diffusion Tube	33.33	33.33	-	-	-	23.16	15.39
384	Roadside	Diffusion Tube	33.33	33.33	-	-	-	25.02	15.77
385	Roadside	Diffusion Tube	100.00	100.00	-	-	-	25.08	21.82
386	Roadside	Diffusion Tube	100.00	100.00	-	-	-	26.7	22.87
387	Roadside	Diffusion Tube	91.67	91.67	-	-	-	19.79	18.14
388	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18.67	17.16
389	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**46.12**	**38.37**
390	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**37.04**	30.83
391	Roadside	Diffusion Tube	100.00	100.00	-	-	-	27.02	24.32
392	Roadside	Diffusion Tube	33.33	33.33	-	-	-	8.21	6.85
393	Roadside	Diffusion Tube	100.00	100.00	-	-	-	16.7	14.28
394	Roadside	Diffusion Tube	100.00	100.00	-	-	-	16.79	16.17
395	Roadside	Diffusion Tube	100.00	100.00	-	-	-	17.88	15.84
396	Roadside	Diffusion Tube	100.00	100.00	-	-	-	21.00	18.41
397	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	14.28
398	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	11.10
399	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	17.46
400	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	20.79
401	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	22.20
402	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	24.42
403	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	32.12
404	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	19.09
405	Roadside	Diffusion Tube	66.67	66.67	-	-	-	-	10.06
406	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	33.49
407	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	20.79

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2013	2014	2015	2016	2017
408	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**40.4**	35.89
409	Roadside	Diffusion Tube	50.00	50.00	-	-	-	-	**46.55****
410	Roadside	Diffusion Tube	58.33	58.33	-	-	-	-	18.72**
411	Roadside	Diffusion Tube	66.67	66.67	-	-	-	-	19.68**
412	Roadside	Diffusion Tube	41.67	41.67	-	-	-	-	21.79
413	Roadside	Diffusion Tube	41.67	41.67	-	-	-	-	24.36

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m³ are shown in **bold**.

NO_2 annual means exceeding 60µg/m³, 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.

Figure 2.2.1 – Trends in Annual Mean NO_2 Concentrations

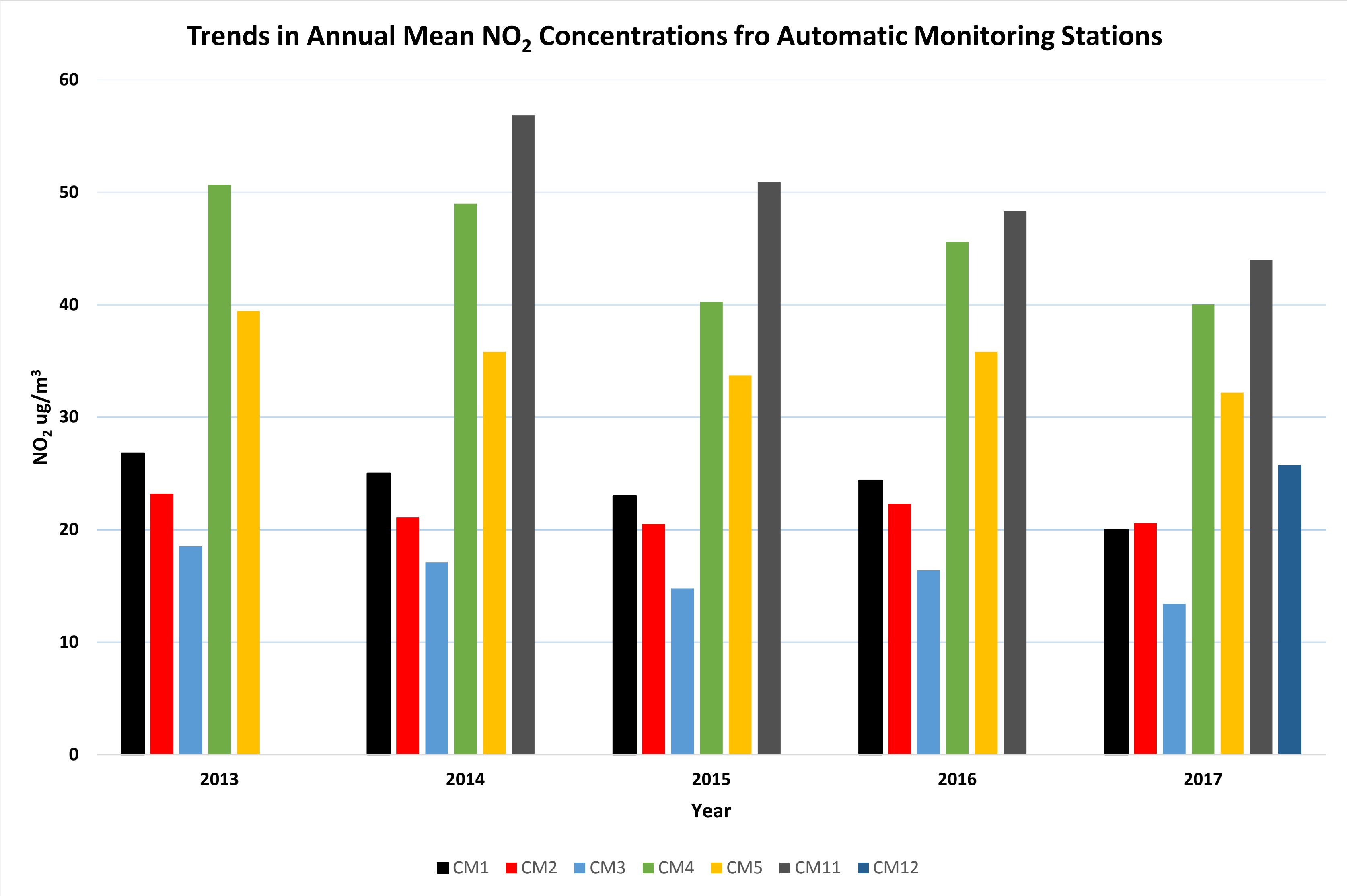


Table 2.2.2 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	NO_2 1-Hour Means > 200µg/m^3 (3)				
				2013	**2014**	**2015**	**2016**	**2017**
CM1	Roadside	Automatic	98.63	0	0	0	0	0
CM2	Roadside	Automatic	91.63	0	0	0	1	0
CM3	Urban Background	Automatic	90.73	0	0	0	0	0
CM4	Roadside	Automatic	95.34	6	1	0	4	1
CM5	Roadside	Automatic	99.94	0	0	0	0	0
CM11	Roadside	Automatic	98.66	-	5 (194.7)	2	1	0
CM12	Roadside	Automatic	31.40*	-	-	-	-	0 (69.69)

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 2.2.3 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2013	2014	2015	2016	2017
CM1	Roadside	94.25	94.25	19.03	20.29	20.20	19.14	18.90
CM2	Roadside			15.30	13.18	-	-	-
CM6	Roadside	90.86	90.86	18.03	19.02	16.25	12.91	10.61
CM7	Roadside	95.25	95.25	18.26	17.18	14.76	13.2	11.13
CM8	Roadside	92.87	92.87	19.74	18.28	18.72	15.28	11.43
CM9	Roadside	92.55	92.55	18.91	17.27	16.62	14.4	9.74
CM10	Roadside	78.33	78.33	17.65	14.49	11.98	11.93	12.11

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.

Figure 2.2.2 – Trends in Annual Mean PM_{10} Concentrations

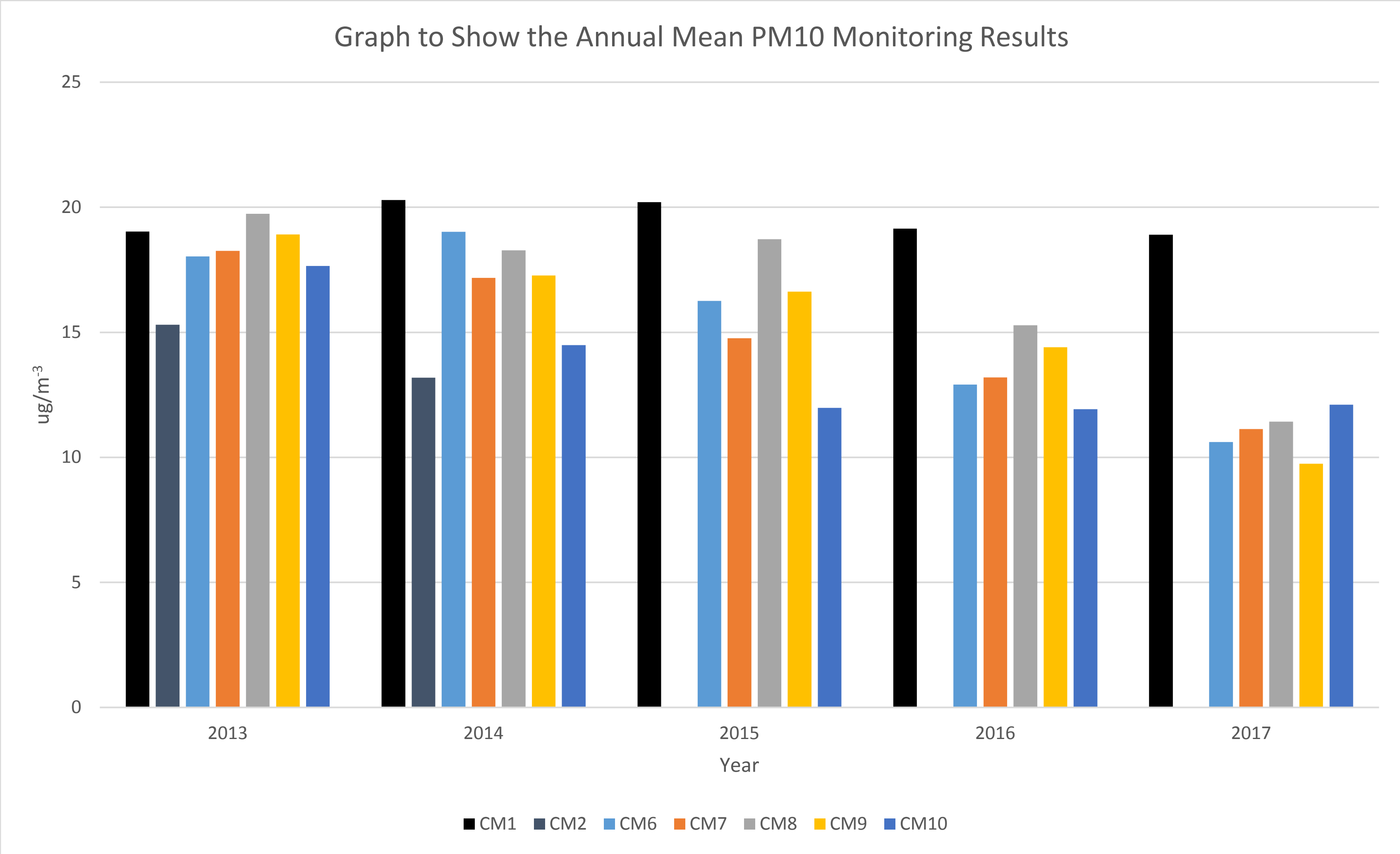


Table 2.2.4 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	PM_{10} 24-Hour Means > 50µg/m³ (3)				
				2013	2014	2015	2016	2017
CM1	Roadside		96.99	2	2	2	0	1
CM2	Roadside		N/A	0	0	1 (19.7)	-	-
CM6	Roadside		90.96	2	5 (27.9)	1	0	0
CM7	Roadside		95.07	2 (28.5)	1 (25.2)	1	0	0
CM8	Roadside		92.88	4 (34.0)	3	1	1	0
CM9	Roadside		91.78	4	4	2	0	0
CM10	Roadside		77.81	4	2	0	1	0 (20.08)

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m³ not to be exceeded more than 35 times/year) are shown in **bold.**

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

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

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

Table 2.2.5 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture 2017 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
			2013	2014	2015	2016	2017
CM1	Roadside	97.26	11.9	12.80	12.80	13.37	14.60
CM2	Roadside	88.23	-	-	-	10.14	9.95

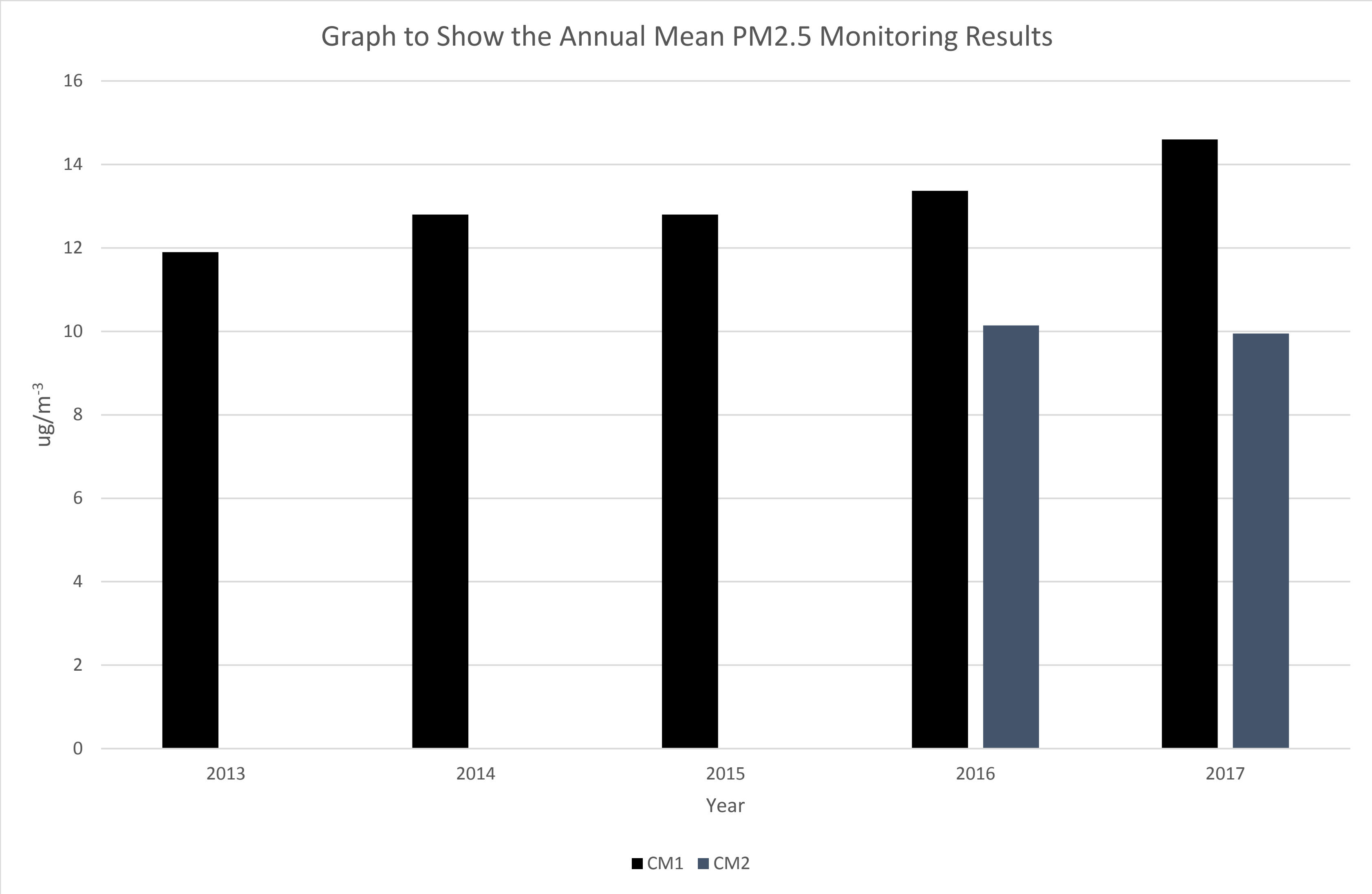
Notes:

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

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

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

Figure 2.2.3 – Trends in Annual Mean $PM_{2.5}$ Concentrations



2.3 Comparison of 2017 Monitoring Results with Previous Years and the Air Quality Objectives

2.3.1 Nitrogen Dioxide (NO_2)

Data from the seven continuous monitoring locations are displayed in table 2.3.1.1 below:

Table 2.3.1.1 - Table to show Annual Mean Concentration for continuous monitoring sites.

Site ID	Site Type	Monitoring Type	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
				2013	2014	2015	2016	2017
CM1**	Roadside	Automatic	98.63	26.8 (31.15)	25 (30.76)	23 (27.43)	24.4 (30.37)	20 (24.41)
CM2**	Roadside	Automatic	91.63	23.2 (28.58)	21.1 (25.89)	20.5 (25.02)	22.3 (29.69)	20.6 (29.14)
CM3	Urban Background	Automatic	90.73	18.54	17.08	14.75	16.39	13.41
CM4	Façade	Automatic	95.34	**50.68**	**48.99**	**40.24**	**45.59**	**40.04**
CM5	Roadside	Automatic	99.14	39.45	35.83	33.71	35.83	32.19
CM11**	Roadside	Automatic	98.66	N/A	**56.85***	**50.9 (54.52)**	**48.3 (51.76)**	**44 (47.20)**
CM12	Roadside	Automatic	25.7	N/A	N/A	N/A	N/A	25.73***

The data reported for the continuous monitoring sites located within Swansea indicate a downward trend-taking place from 2013. However, annual means increased in 2016, which was observed across the UK and is likely due to meteorological conditions (http://www.aqconsultants.co.uk/AQC/media/Reports/NO2-NOx-Trend-Report.pdf) for the year. Figures 2.3.1.1 and 2.3.1.2 shows a greater frequency of Winds coming from the North East which coupled with re-circulatory flows due to the local topography could lead to the elevated concentrations recorded. It is clear from figure 2.3.1.2 that in 2017 the frequency of winds from the North East was reduced and a greater frequency of West/South West winds observed.

Figure 2.3.1.1 – Meteorological Conditions Cwm Level Mast 30m 2016

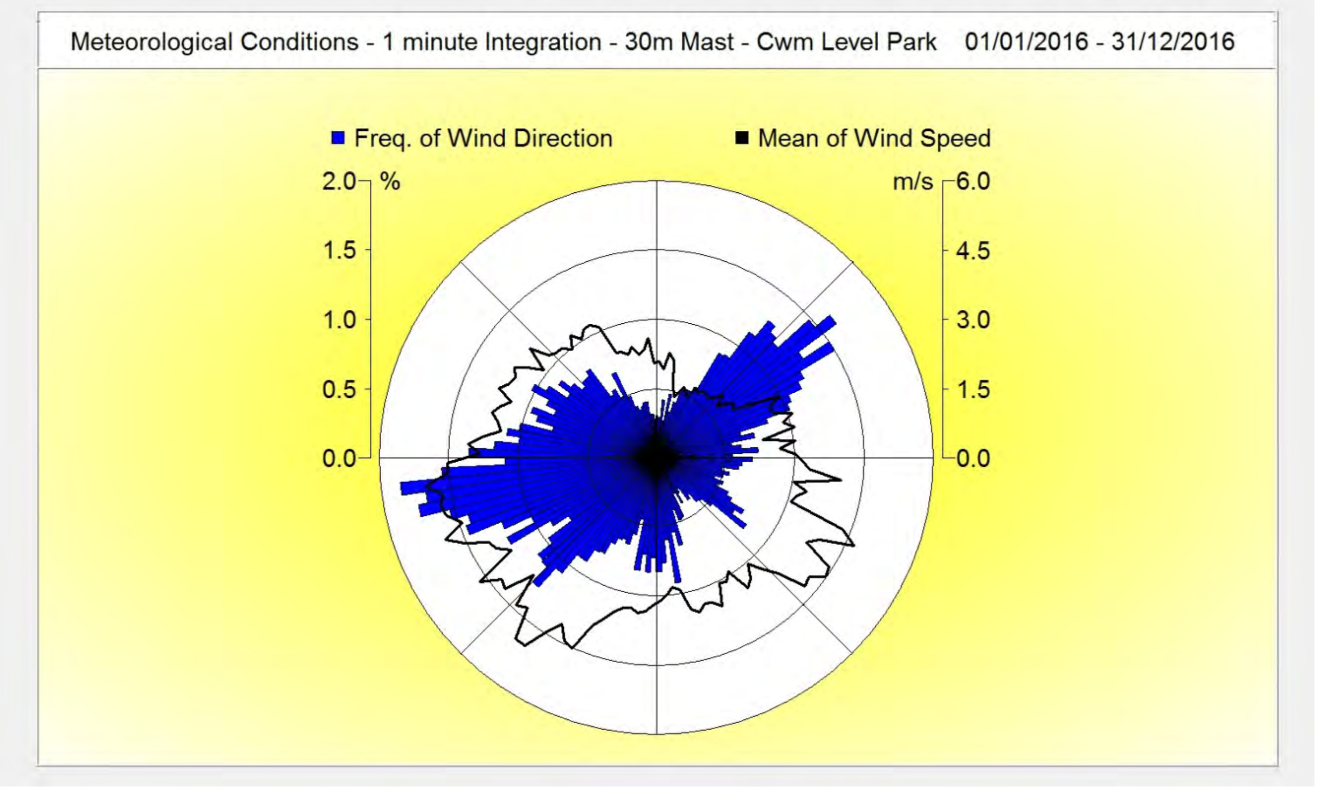
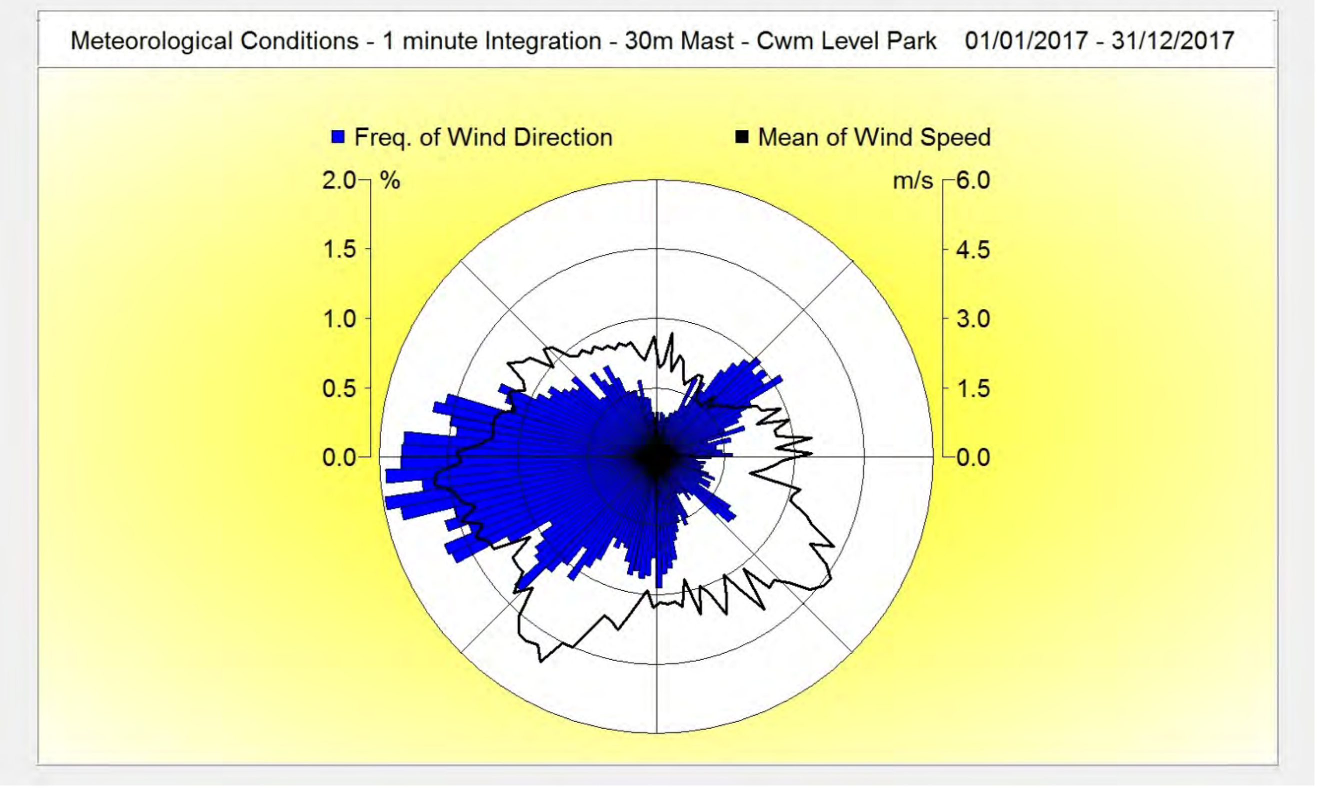


Figure 2.3.1.2 – Meteorological Conditions Cwm Level Mast 30m 2017



CM1 – Swansea Roadside AURN

The AURN site continues to show compliance with the NO_2 Annual Mean Objective Concentration of 40ug/m^3. The downward trend continues however, the increase in concentration was observed in 2016.

Figure 2.3.1.13 displays the typical diurnal pattern during the week at the AURN for 2017. When compared with the diurnal profile for 2016, the reduction in concentration can be clearly seen. Distance correction is applied to this roadside dataset for assessment at the residential exposure.

Furthermore, there have been no exceedences of the hourly NO_2 objective concentration recorded at this site for over the last five years.

Figure 2.3.1.3 - Graph to show NO2 Diurnal Weekly Plot for the Swansea Roadside AURN 2017.

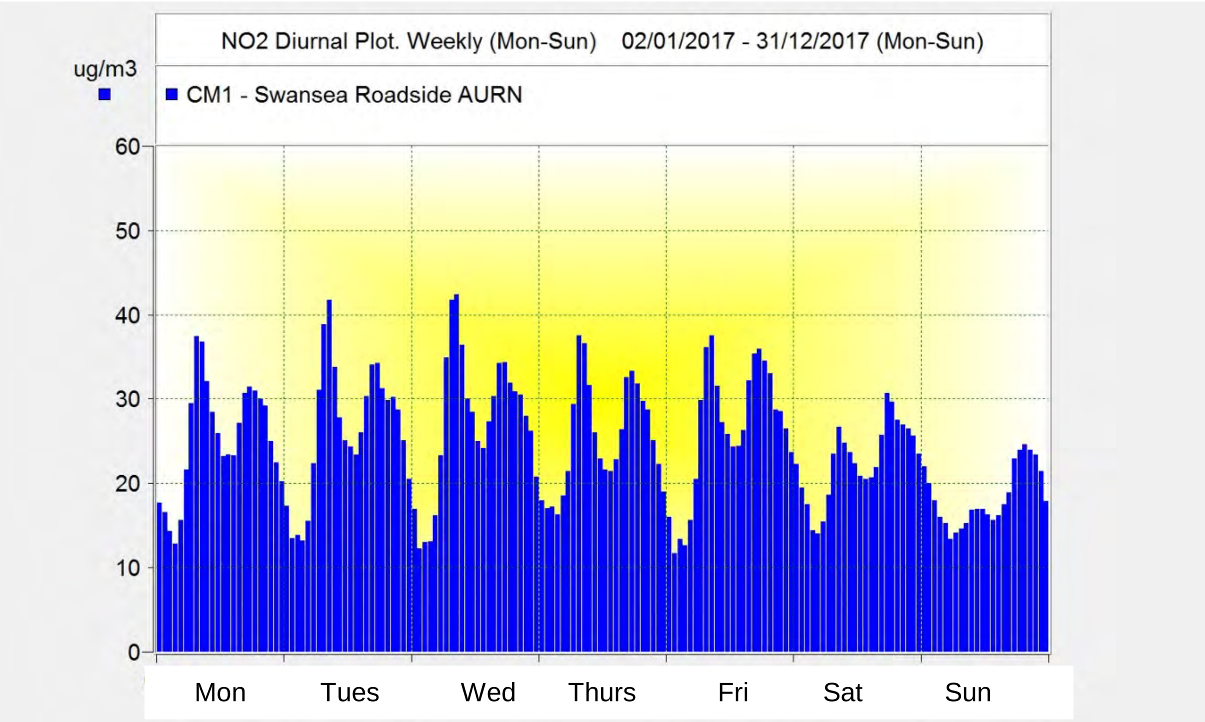
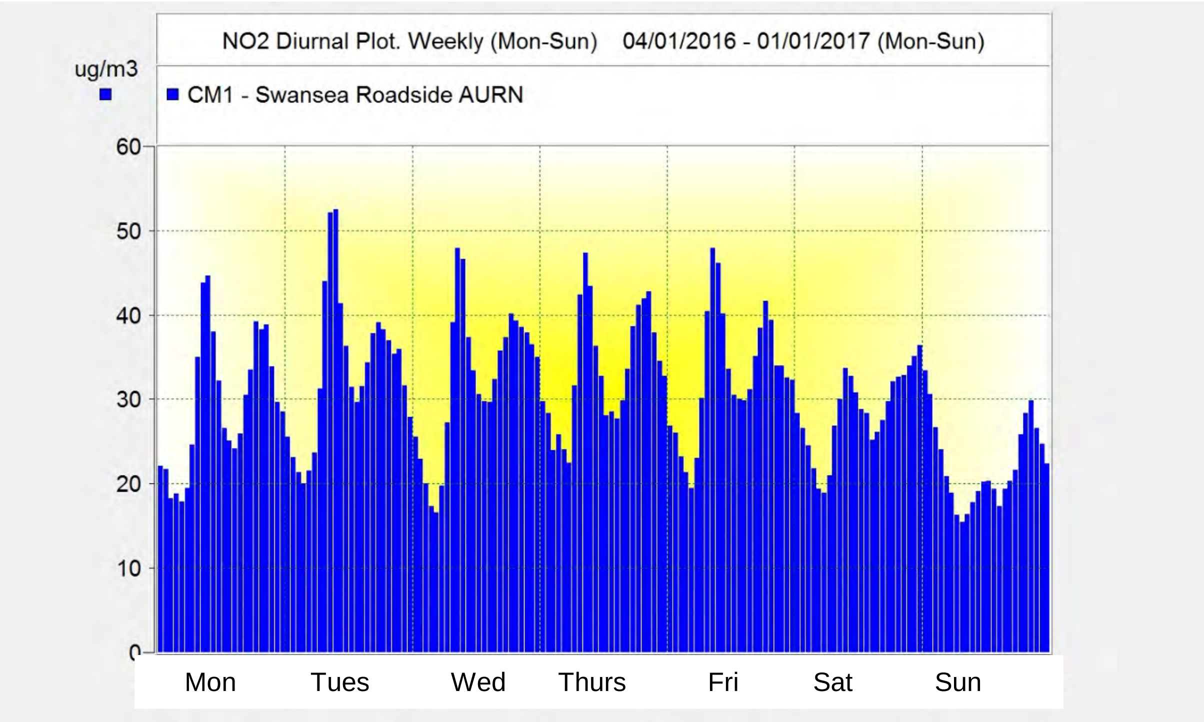


Figure 2.3.1.4 - Graph to show NO2 Diurnal Weekly Plot for the Swansea Roadside AURN 2016.



<u>Morriston Groundhog – CM2</u>

The Morriston Groundhog site continues to show compliance with the NO_2 Annual Mean Objective Concentration of 40ug/m^3. The downward trend continues however, the increase in concentration was observed in 2016. There was a break in data collection from the 9th June 2017 to the 27th June 2017 as the site was temporarily removed for an upgrade leading to the 91.63% data capture for 2017. A new enclosure along with a new NO_2 analyser are now in-place at this site.

Comparison of the weekly diurnal plots for 2017 and 2016 do not show a marked reduction in concentration. The actual roadside annual mean remained stable at 29.14ug/m^3 and 29.69ug/m^3, respectively, whilst the distance corrected residential exposure annual mean reported a reduction in annual mean from 22.3ug/m^3 (2016) to 20.6ug/m^3 (2017); this is likely due the change in background NO_2 concentration data provided by DEFRA.

There were no exceedences of the hourly NO2 Objective Concentration in 2017.

Figure 2.3.1.5 - Graph to show NO2 Diurnal Weekly Plot for the Morriston Groundhog 2017.

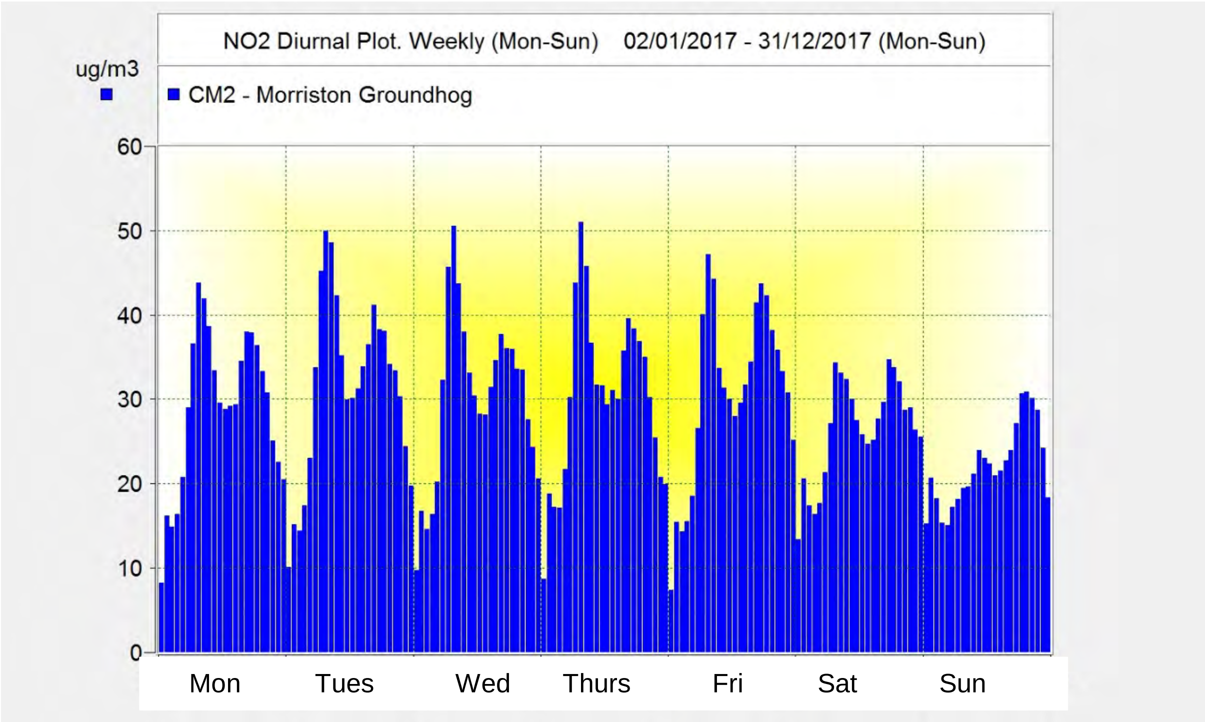
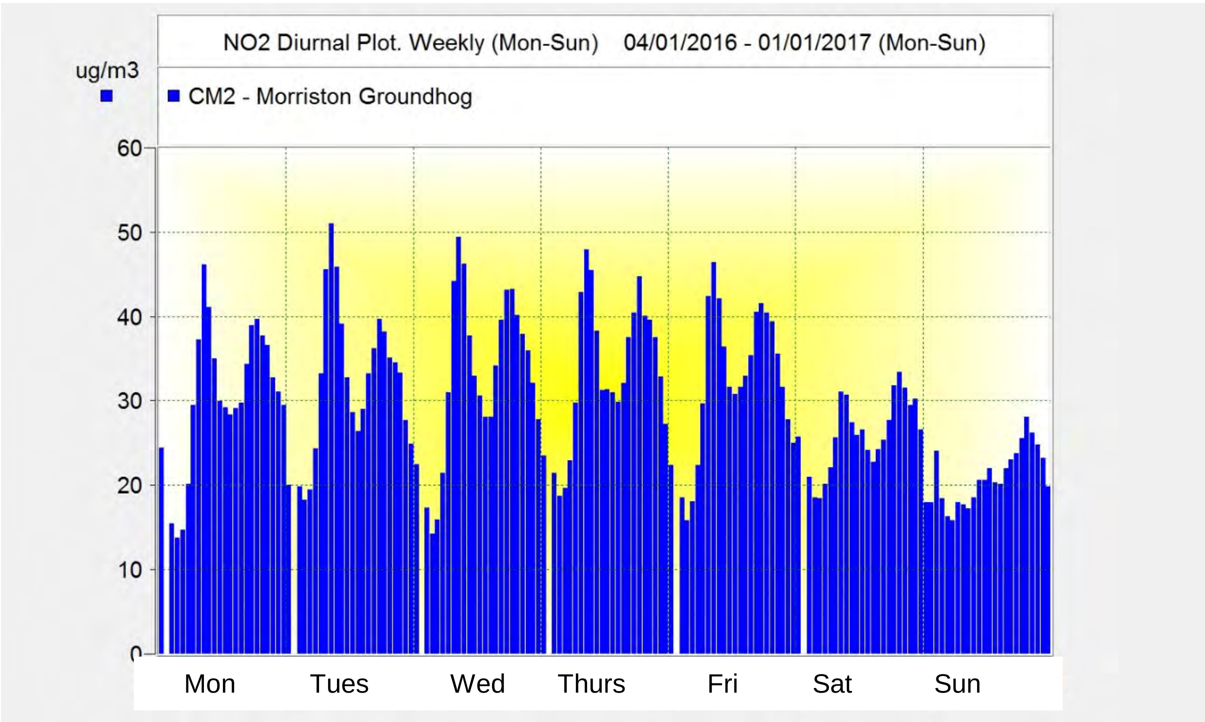


Figure 2.3.1.6 - Graph to show NO2 Diurnal Weekly Plot for the Morriston Groundhog 2016.

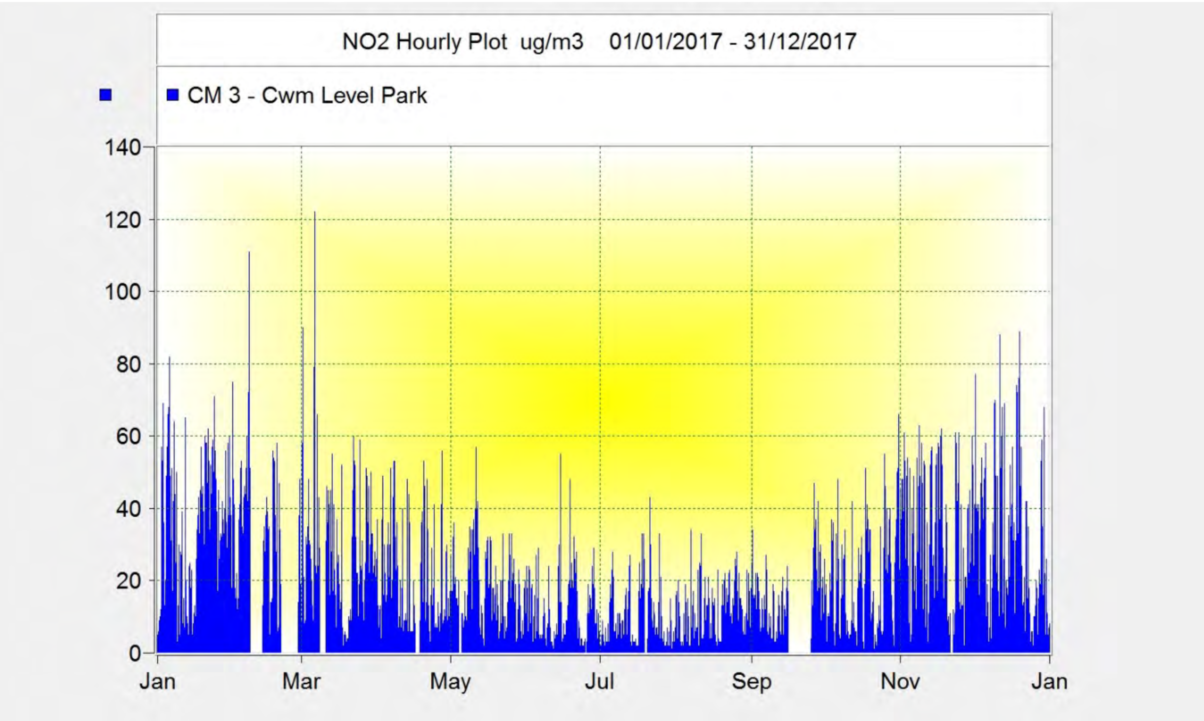


<u>Cwm Level Park – CM3</u>

Cwm Level Park is an urban background site and continues to show compliance with the Annual Mean Objective Concentration. A downward trend is observed at this site, apart from 2016. Unfortunately, data was lost in February 2017 due to an Azero fault, July 2017 due to a pump failure and September 2017 due to logger issues; the valid data capture for 2017 was 90.73%.

Figure 2.3.1.7 displays the hourly means for 2017

Figure 2.3.1.7 - Graph to show hourly NO2 concentrations for Cwm Level Park in 2017.



There have been no exceedences of the hourly Objective Concentration at this site.

<u>Hafod Doas – CM4</u>

The Hafod Doas continues to exceed the NO_2 Annual Mean Objective Concentration of 40ug/m^3. It is positive to note that the Hafod Doas (CM4) has shown a decrease in concentration from 2016 (45.59ug/m^3); whilst previous reports have stated an uncertainty in the confidence of the 2015 (40.24ug/m^3) concentration reported, the 2017 Annual Mean concentration is in line with continued reductions in NO_2 (40.04ug/m^3) in the Hafod as seen across other sites across the Authority. The likelihood for this reduction in annual mean will be due to the opening of the Morfa Distributor Road (August 2017) and the implementation of the Nowcaster System

(October 2017). There are two automatic traffic counters (ATC's) sited on the Neath Road and subsequent analysis indicates a reduction of approximately 20% in Annualised Average Daily Traffic (AADT) at both locations.

Figure 2.3.1.8 – Location of ATC's 6 & 18, Neath Road, Hafod, Swansea.

Table 2.3.1.2 has only included a snapshot comparing traffic flows for the month of October for 2015, 2016 and 2017 but does how a reduction in AADT for Neath Road since the opening of the MDR in August 2017. The Nowcaster System, as highlighted within Swansea Council's Air Quality Action Plan (AQAP), will also play a very important role in further reducing the NO_2 concentration along the Neath Road. The Nowcaster System is currently looking at an hourly threshold concentration of 150ug/m^3 to lead to triggering of the Variable Messaging Signs within Swansea; given the decrease in concentrations observed in 2017 the draft AQAP will look at revising this threshold; the draft AQAP is scheduled to go out for Public Consultation by April 2019.

Table 2.3.1.2 - Table to show AADT for ATC 6 & 18

	AADT 2013	AADT 2014	AADT 2015	AADT 2016	AADT 2017	Difference 2017-2016
ATC 6	15336	16272	16152	16152	14184	12.2%
ATC 18	15504	Site Down	15864	15960	13896	12.9%
	AADT October 2013	AADT October 2014	AADT October 2015	AADT October 2016	AADT October 2017	Difference 2017-2016
ATC 6	15864	16968	16296	15840	12624	20.3%
ATC 18	16727	Site Down	16032	15720	12312	21.7%

Figure 2.3.1.9 shows the diurnal profile recorded by the Hafod DOAS and the morning peak is still greater than the evening commute. As would be expected the weekend displays a different picture as the travel patterns are different to those of the usual working week commute. Figure 2.3.1.9 shows the weekly diurnal plot for 2016 and the graphs show the reduction in concentration difference between the morning and the afternoon peaks. Future assessments will continue to look at this diurnal profile and the reduction in traffic flows and the activation of the Nowcaster System.

During 2017 only one exceedence of the one hour Objective Concentration was observed.

Figure 2.3.1.9 - Graph to show Weekly NO_2 Diurnal Plot 2017

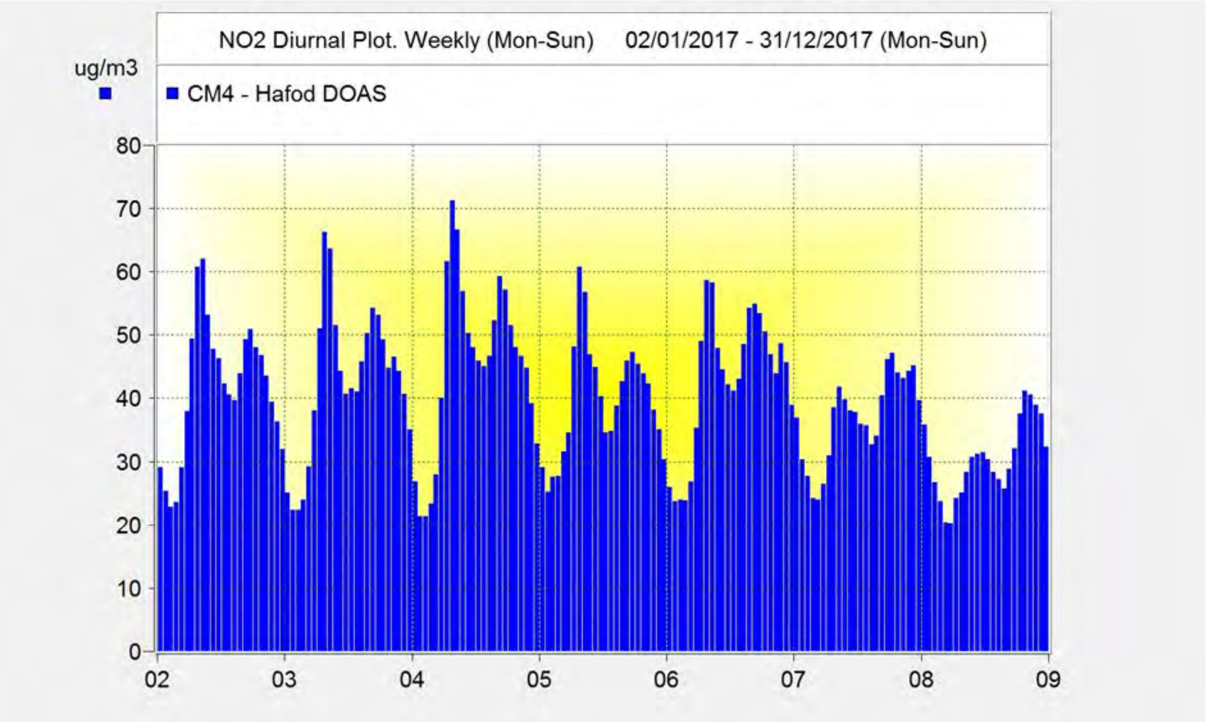
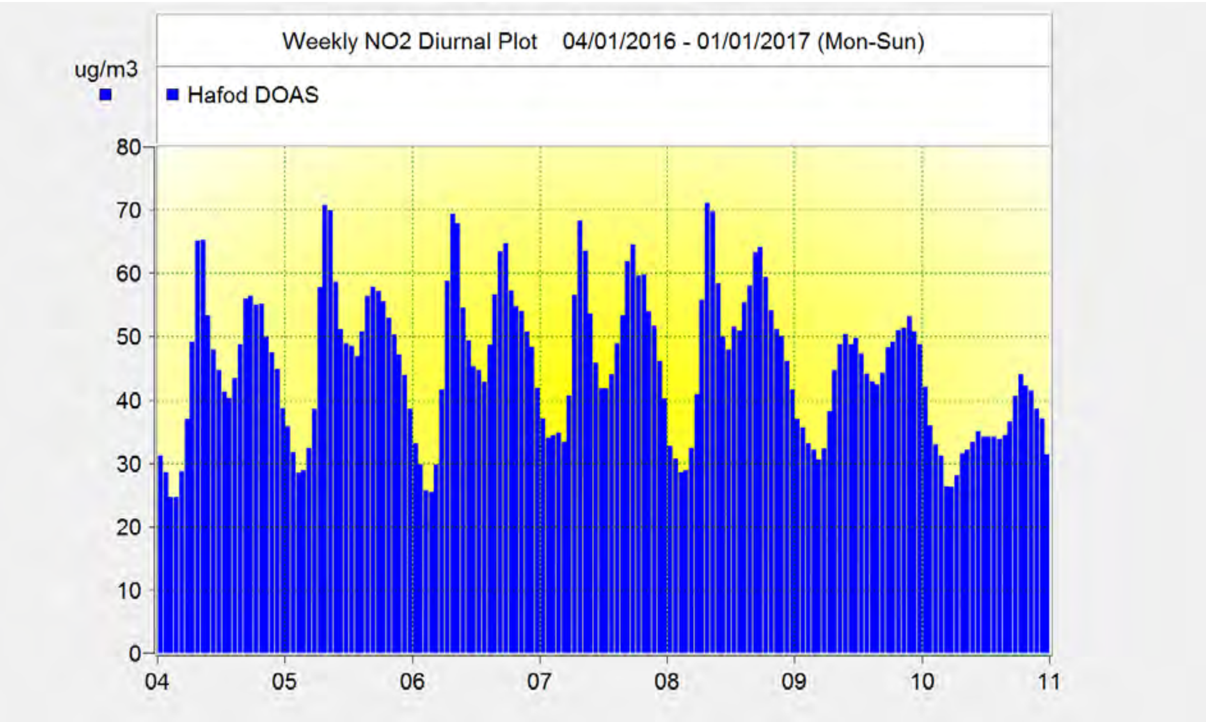


Figure 2.3.1.10 - Graph to show Weekly NO_2 Diurnal Plot 2016



St. Thomas DOAS – CM5

The St Thomas DOAS site continues to show compliance with the NO_2 Annual Mean Objective Concentration of 40ug/m^3. The downward trend continues however, the increase in concentration was observed in 2016. Comparison of the Diurnal Weekly Plots for 2017 and 2016 shows the morning peak to still be higher than the afternoon peak which is seen across the authority. Again, lower concentrations are observed during 2017, as seen across the authority. However, since the opening of the MDR, along with the implementation of the Nowcaster system, Table 2.3.1.3 shows a 6.7% reduction in AADT from 2016 to 2017 and using October 2016 and 2017 as an example (as with the Hafod DOAS) shows an 8.2% reduction in AADT. To see if this reduction in traffic is due to traffic utilising the MDR Table 2.3.1.3 also shows the AADT for ATC site 9 located on the opposite side of the river. Whilst ATC site 9 has shown an increase in AADT over the years the example month of October has shown a 13.1% increase in AADT which could account for the traffic reduction and NO2 concentration reduction observed at the St Thomas DOAS site. Whilst this site continues to show compliance future assessments will continue to look at this diurnal profile and the reduction in traffic flows and the activation of the Nowcaster System.

Table 2.3.1.3 - Table to show AADT for ATC 10

	AADT 2013	AADT 2014	AADT 2015	AADT 2016	AADT 2017	Difference 2017-2016
ATC 10	20376	20184	21192	21360	19920	-6.7%
ATC 9	12552	12288	13320	13824	14616	+5.7%
	AADT October 2013	AADT October 2014	AADT October 2015	AADT October 2016	AADT October 2017	Difference 2017-2016
ATC 10	20592	20688	22080	21768	19992	-8.2%
ATC 9	13080	12600	13800	14256	16128	+13.1%

Figure 2.3.1.11– Location of ATC10, Pentreguinea Road, St Thomas, Swansea.

Figure 2.3.1.12 Graph to show NO2 Diurnal Weekly Plot for the St Thomas DOAS 2017.

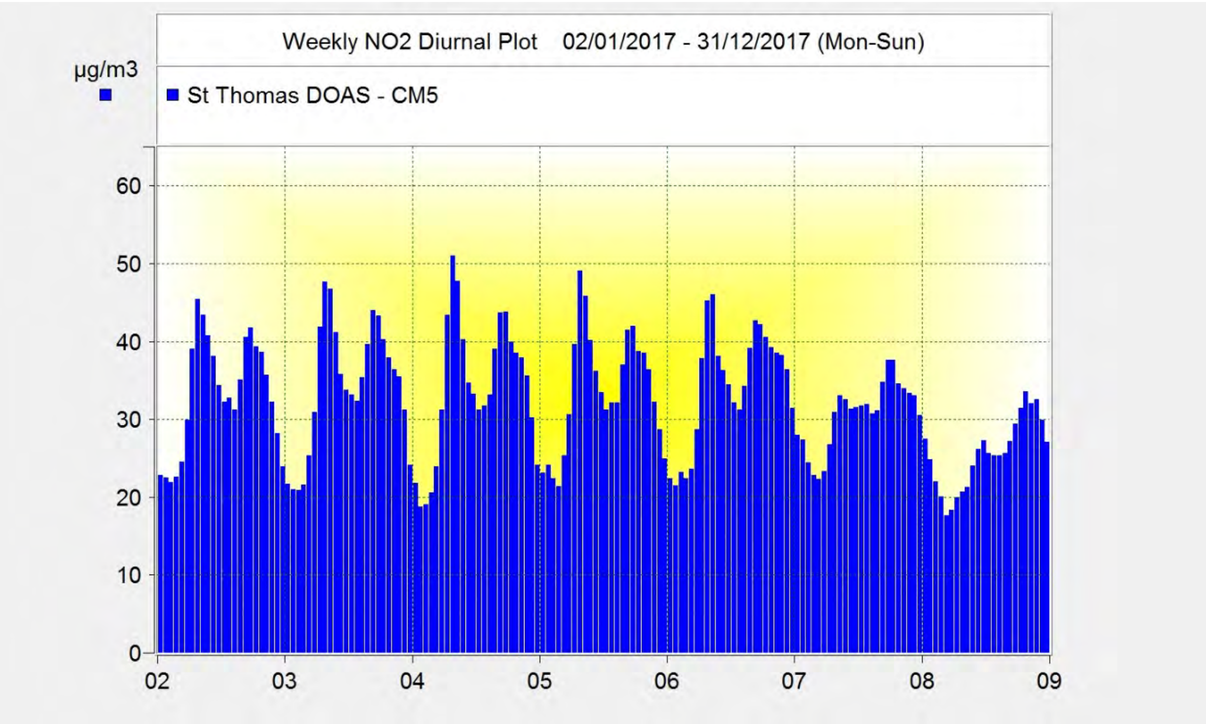
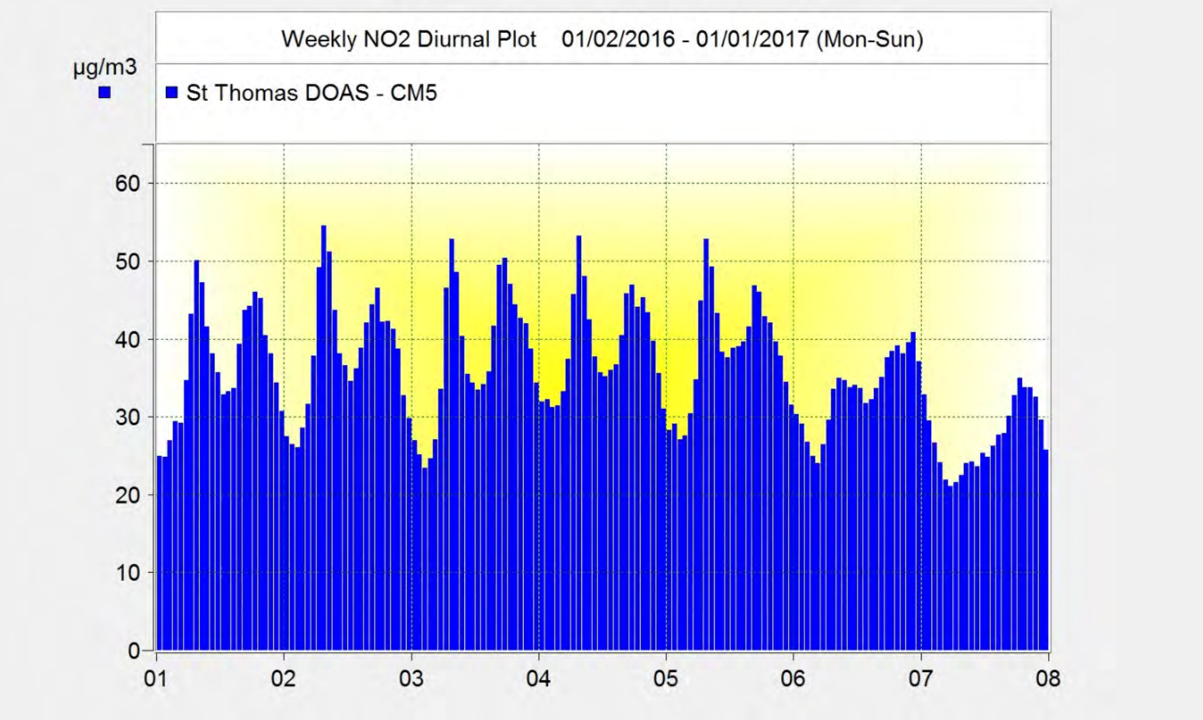


Figure 2.3.1.13 Graph to show NO_2 Diurnal Weekly Plot for the St Thomas DOAS 2016.



<u>Station Court, High Street – CM11</u>

The Station Court, High Street site continues to exceed the NO_2 Annual Mean Objective Concentration of 40ug/m^3. A downward trend continues to be observed at this site since it was commissioned in 2014. Interestingly, the increase in concentration, that was observed at the other continuous monitoring sites, in 2016 was not seen at this site; this could be due to the influence of the direct traffic (HGV) source that the site is recording as indicated in section 2.1.1.

Comparison of the Diurnal Weekly Plots for 2017 and 2016 shows a different picture to the other continuous sites in that the afternoon peak is greater than the morning peak. Whilst the working week profile shows greater concentrations than the weekend there is still a strong signal for the Saturday profile whilst the Sunday is seen to be lower as would be expected with a decrease in HGV flow due to lower number of bus services and delivery vehicles.

There are two ATC's located in close proximity to the monitoring location, Sites 22 & 57.

Figure 2.3.1.14 Graph to show NO_2 Diurnal Weekly Plot for the Station Court, High Street 2017.

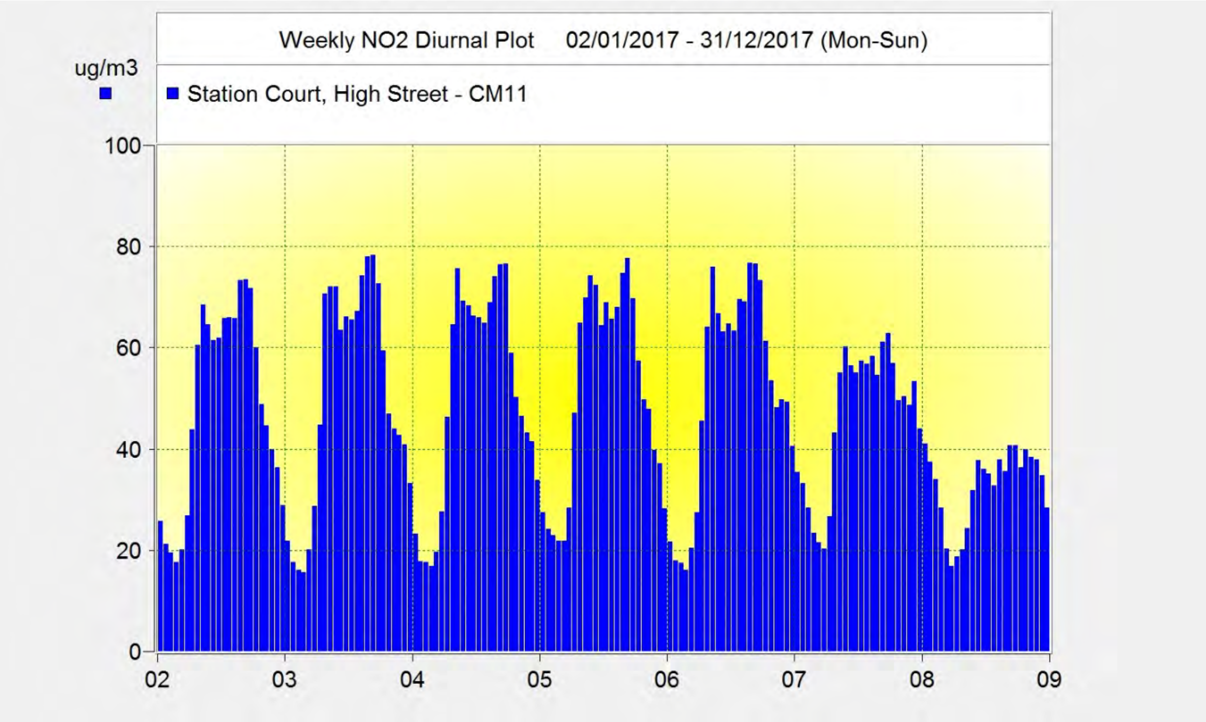


Figure 2.3.1.15 Graph to show NO_2 Diurnal Weekly Plot for the Station Court, High Street 2016.

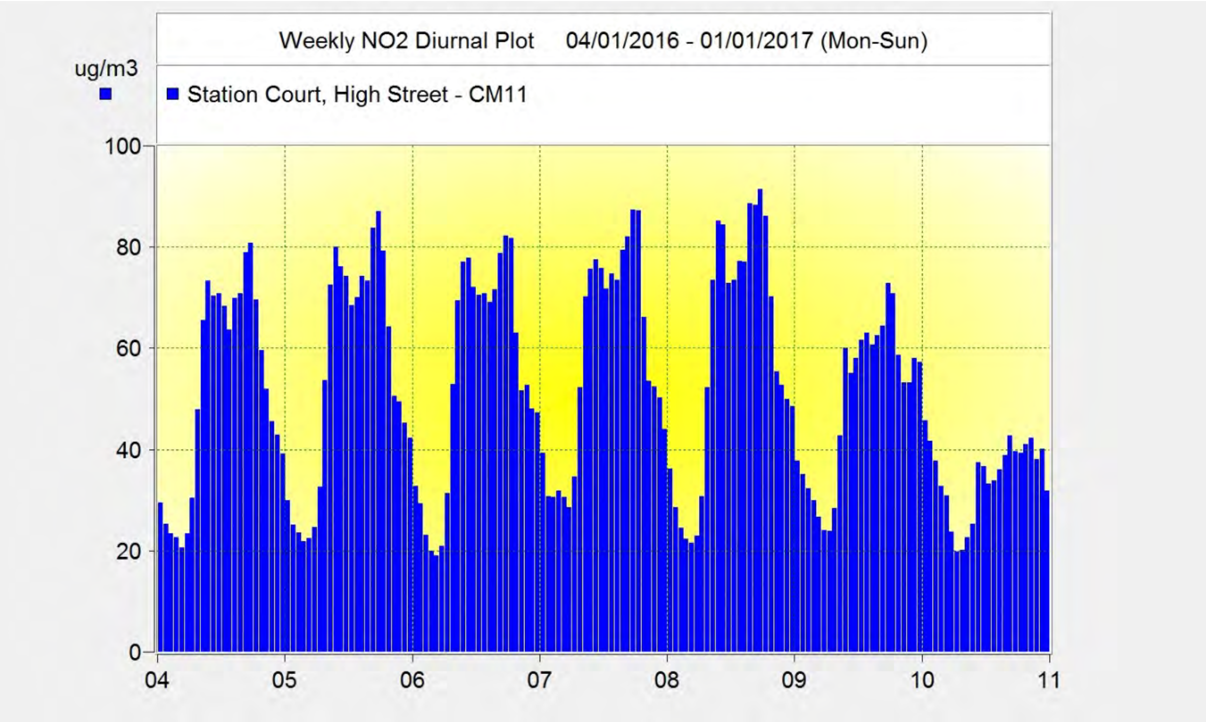
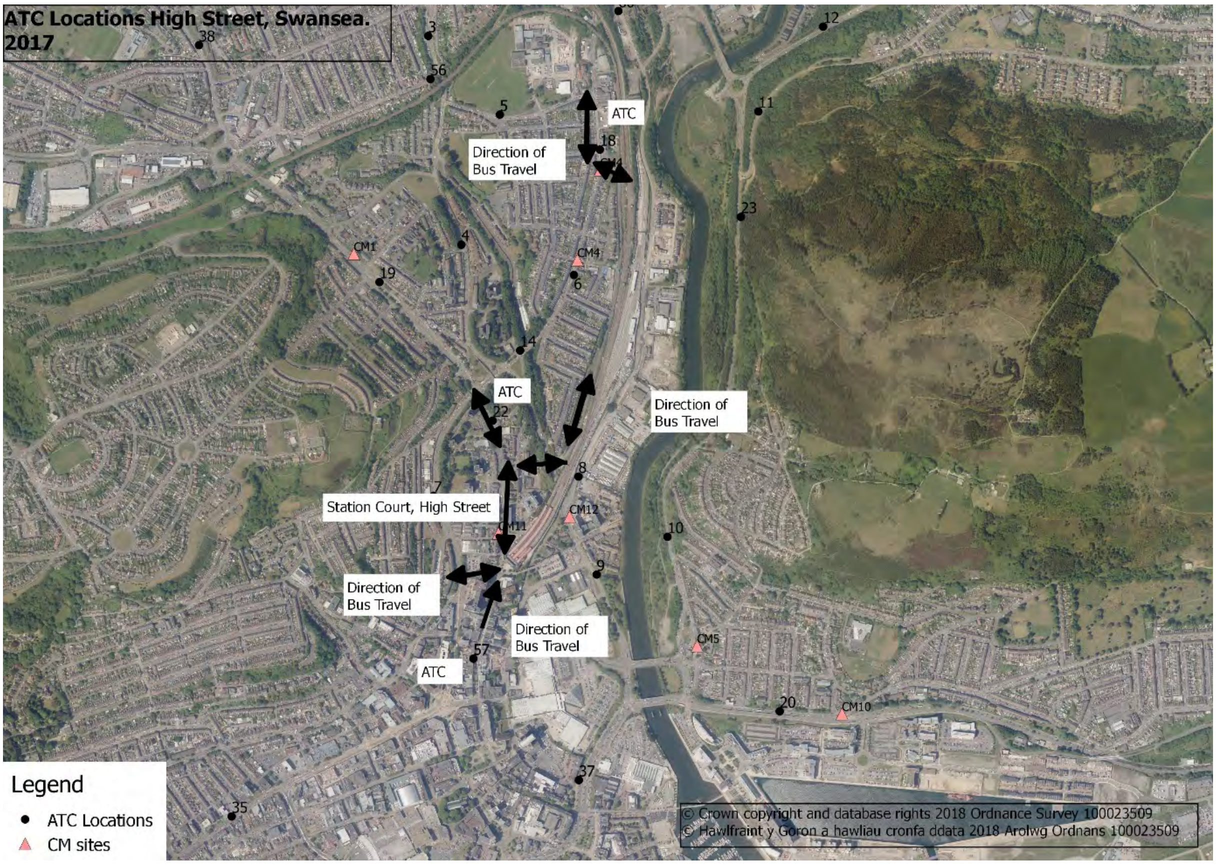


Figure 2.3.1.16 shows the aerial map annotated for the area.



Station court, High Street (CM11) is subject to bus movement in both directions; in order to look at the approximate AADT for buses at the site table 2.3.1.4 displays the AADT from traffic counters in the area. To approximate the AADT for site CM11 it was assumed that all buses passing site CM11 would be counted at ATC 22 and ATC 18 (Access/Egress of the Bus Express Lane).

Table 2.3.1.4 to show the AADT bus flow around site CM11

	AADT 2013	AADT 2014	AADT 2015	AADT 2016	AADT 2017
ATC 18 (BUS)	-	-	-	244	286
ATC 22 (BUS)	578	693	675	674	606
ATC 57 (BUS)	-	-	313*	361	337
Total approx Bus AADT at site CM11 (ATC 18+ATC22)	-	-	-	918	892

*Site installed so incomplete year of data

Unfortunately, due to data issues, it has not been possible to assess the AADT for sites 18 & 57 prior to 2016 effectively and so further assessments will continue to look at this aspect. However, initial investigation could show that there is a reduction in bus flow around site CM11 that along with signalling changes targeting queueing times may well be attributing to a reduction in NO_2 concentration around the site.

The 2017 Progress Report contained information regarding the planning application to redevelop the Mariner Street Car Park, directly to the South West of CM11, for retail and Student Residential Accommodation and so the area will shortly be undergoing infrastructure changes that will be assessed in future air quality reports prepared by Swansea Council.

There were no exceedences of the one hour Objective concentration reported in 2017.

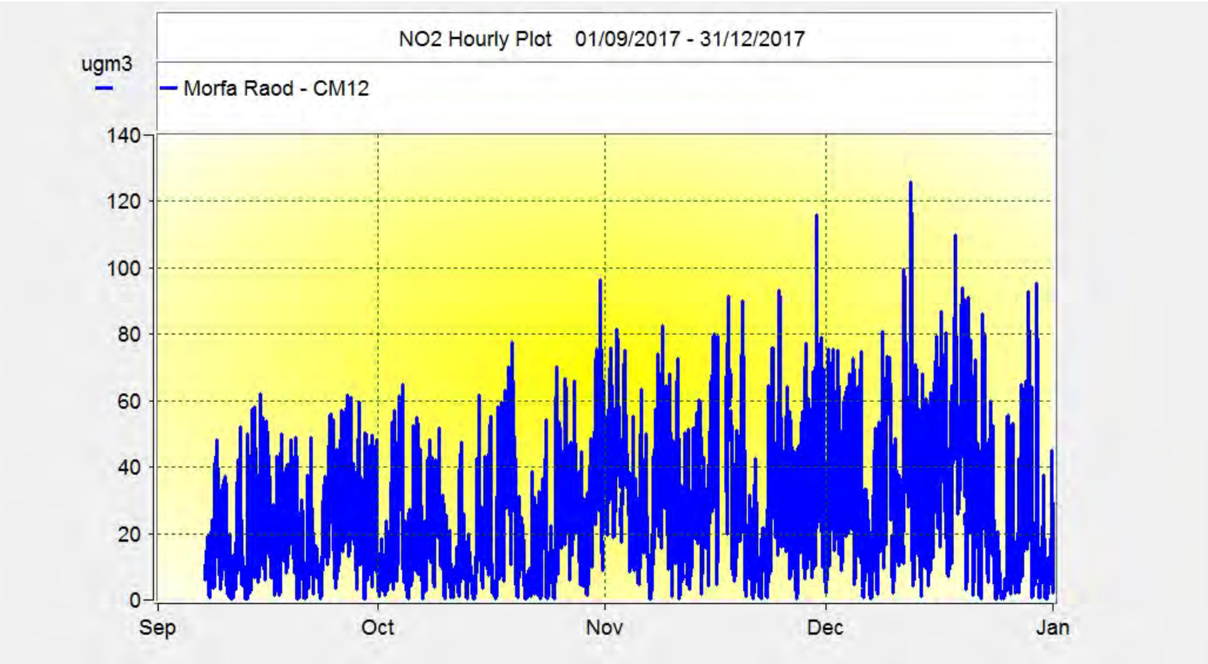
Morfa Road – CM12

Section 2.1.1 contains details the site information for the new real-time continuous NOX analyser installed at site CM12. This site was secured by a section 106 agreement several years ago when the planning application was determined for the construction of the student residential blocks. The site has been operational since the 7th September 2017, although the site was installed in late July 2018 a logger issue meant that data collection started on the 7th September 2017.

Figure 2.3.1.17 shows the hourly data plot for the four months of data for 2017. The mean of the four months of data was 25.73ugm^{-3}. As this site will continue to measure at this locations for several years the data has not be annualised and will be reported within future assessments carried by Swansea Council.

There are no exceedences of the hourly Objective concentration reported for this site.

Figure 2.3.1.17 - NO_2 Hourly plot for Morfa Road (CM12) 2017



Non-Automatic Monitoring:

Data from the Diffusion Tube monitoring locations are displayed in table 2.3.1.5 below along with two maps to show the reduction in the number of Diffusion Tube locations that are exceeding or potentially exceeding the Annual Mean Objective Concentration of 40ug/m^3 for 2017 and 2016.

There were a total of forty one sites exceeding or potentially exceeding in 2016, this has reduced to a total of nine in 2017; of which site 340 is not representative of residential exposure and site 409 had been annualised due to the length of exposure but is no longer an active site as the highway infrastructure is changing due to redevelopment of the Kingsway. The effect upon NO_2 concentration of the redevelopment of the Kingsway Highway infrastructure will be reported upon as part of the 2018 data review.

Due budgetary constraints the acquisition of real-time monitoring equipment for the city centre has been delayed. Equipment has now been acquired and the relevant infrastructure works are yet to be carried out to enable data collection to commence; this will be reported upon in future assessment reports.

Table 2.3.1.5 to show Diffusion Tube Data for Sites from 2013-2017

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
4	Roadside	Diffusion Tube	33.33	33.33	29.92	29.78	27.28	29.49	21.90
5	Roadside	Diffusion Tube	100.00	100.00	34.78	32.46	29.70	31.65	28.35
6	Roadside	Diffusion Tube	100.00	100.00	30.65	28.52	26.57	27.58	23.11
7	Roadside	Diffusion Tube	100.00	100.00	**46.74**	**48.66**	**42.69**	**45.84**	39.05
8	Roadside	Diffusion Tube	100.00	100.00	**44.77**	**41.76**	**40.36**	**46.59**	34.63
9	Roadside	Diffusion Tube	33.33	33.33	30.03	27.89	24.87	26.47	27.49
10	Roadside	Diffusion Tube	100.00	100.00	25.29	24.97	23.94	24.52	20.80
11	Roadside	Diffusion Tube	100.00	100.00	**39.45**	**37.58**	33.81	**37.19**	30.32
12	Roadside	Diffusion Tube	100.00	100.00	**40.22**	**42.78**	**38.39**	**42.72**	34.80
13	Roadside	Diffusion Tube	100.00	100.00	29.30	27.78	25.66	27.40	22.58
14	Roadside	Diffusion Tube	100.00	100.00	28.69	24.30	23.86	24.95	19.54
15	Roadside	Diffusion Tube	100.00	100.00	26.91	24.45	24.30	26.39	22.10
16	Roadside	Diffusion Tube	83.33	83.33	31.63	28.61	26.80	31.35	26.64
18	Roadside	Diffusion Tube	100.00	100.00	**47.01**	**45.85**	**42.07**	**46.38**	37.06
19	Roadside	Diffusion Tube	100.00	100.00	**43.75**	**42.61**	**39.14**	**44.11**	38.29
20	Roadside	Diffusion Tube	100.00	100.00	36.50	**37.74**	35.42	33.73	29.87
21	Roadside	Diffusion Tube	33.33	33.33	30.04	27.96	26.93	29.48	18.79
22	Roadside	Diffusion Tube	100.00	100.00	33.89	31.43	29.91	32.02	26.78
23	Roadside	Diffusion Tube	100.00	100.00	30.93	28.49	28.69	30.29	24.27
25	Roadside	Diffusion Tube	33.33	33.33	27.88	27.06	26.47	26.61	18.64
26	Roadside	Diffusion Tube	100.00	100.00	**39.11**	**38.59**	35.44	38.43	29.54
27	Roadside	Diffusion Tube	100.00	100.00	**38.03**	**39.25**	34.78	36.69	29.33
28	Roadside	Diffusion Tube	33.33	33.33	28.30	28.21	25.67	24.17	17.05
29	Roadside	Diffusion Tube	100.00	100.00	**43.86**	**47.36**	**48.90**	**48.42**	30.14
31	Roadside	Diffusion Tube	100.00	100.00	30.81	31.70	28.42	30.16	25.29
32	Roadside	Diffusion Tube	100.00	100.00	35.24	33.38	30.15	33.88	26.73
33	Roadside	Diffusion Tube	100.00	100.00	31.09	31.33	29.45	31.69	26.64
34	Roadside	Diffusion Tube	33.33	33.33	31.11	29.80	27.33	27.27	19.80
35	Roadside	Diffusion Tube	91.67	91.67	31.27	32.21	31.35	33.53	27.76
36	Roadside	Diffusion Tube	100.00	100.00	30.12	27.49	26.49	29.74	24.85
40	Roadside	Diffusion Tube	83.33	83.33	28.19	27.42	24.83	26.17	22.06
41	Roadside	Diffusion Tube	75.00	75.00	36.54	35.33	31.89	33.05	26.77

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
43	Roadside	Diffusion Tube	91.67	91.67	**38.62**	36.22	32.16	34.75	28.62
44	Roadside	Diffusion Tube	100.00	100.00	25.69	27.35	26.55	26.08	23.86
45	Roadside	Diffusion Tube	100.00	100.00	32.06	30.78	28.19	30.92	23.28
48	Roadside	Diffusion Tube	100.00	100.00	23.43	21.72	19.59	22.15	17.44
50	Roadside	Diffusion Tube	100.00	100.00	32.89	36.43	33.79	38.03	30.77
54	Roadside	Diffusion Tube	100.00	100.00	31.88	33.93	31.38	31.26	26.61
55	Roadside	Diffusion Tube	100.00	100.00	32.39	32.31	31.04	31.21	25.92
56 *	Roadside	Diffusion Tube	100.00	100.00	21.20	22.00	22.20	20.7	15.84
58	Roadside	Diffusion Tube	100.00	100.00	32.50	29.70	28.50	33.8	27.38
59	Roadside	Diffusion Tube	100.00	100.00	**47.99**	**50.28**	**47.78**	**48.41**	**39.60**
60	Roadside	Diffusion Tube	100.00	100.00	35.71	34.21	29.70	30.19	26.39
61	Roadside	Diffusion Tube	91.67	91.67	36.45	**38.16**	33.93	36.75	27.92
63	Roadside	Diffusion Tube	91.67	91.67	22.10	21.00	19.40	22	16.50
64	Roadside	Diffusion Tube	100.00	100.00	**38.90**	**38.30**	36.10	32.8	26.94
65	Roadside	Diffusion Tube	100.00	100.00	22.92	24.77	21.99	25.77	21.45
66	Roadside	Diffusion Tube	100.00	100.00	29.11	26.45	26.53	29.48	24.13
67	Roadside	Diffusion Tube	100.00	100.00	36.20	35.60	**37.20**	**39.8**	32.41
68	Roadside	Diffusion Tube	100.00	100.00	35.72	36.13	34.87	34.99	28.34
69	Roadside	Diffusion Tube	100.00	100.00	36.70	**40.30**	35.60	34.9	30.71
70	Roadside	Diffusion Tube	100.00	100.00	24.30	24.80	25.60	24.1	20.20
71 **	Roadside	Diffusion Tube	100.00	100.00	29.00	25.00	24.50	26	17.98
72	Roadside	Diffusion Tube	25.00	25.00	24.91	23.58	22.60	24.03	16.05
73	Roadside	Diffusion Tube	33.33	33.33	28.81	29.60	28.39	27.39	20.18
74	Roadside	Diffusion Tube	33.33	33.33	26.65	28.41	22.39	23.29	15.97
75	Roadside	Diffusion Tube	100.00	100.00	**38.41**	**39.99**	34.02	34.53	30.43
76	Roadside	Diffusion Tube	33.33	33.33	27.76	27.61	25.80	26.58	19.40
78	Roadside	Diffusion Tube	33.33	33.33	27.88	25.69	23.47	25.59	19.04
79	Roadside	Diffusion Tube	33.33	33.33	31.04	30.07	26.82	27.62	20.39
83	Roadside	Diffusion Tube	100.00	100.00	30.33	27.41	25.97	28.07	22.87
84	Roadside	Diffusion Tube	100.00	100.00	32.73	35.13	33.81	33.92	27.53
85	Roadside	Diffusion Tube	100.00	100.00	36.24	35.62	35.28	35.78	29.11
86	Roadside	Diffusion Tube	100.00	100.00	28.18	25.51	23.97	32.27	22.63

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
87	Roadside	Diffusion Tube	100.00	100.00	22.11	20.80	18.93	20.64	17.10
88	Roadside	Diffusion Tube	100.00	100.00	30.73	28.21	28.37	30.67	26.07
89	Roadside	Diffusion Tube	100.00	100.00	21.26	20.12	20.09	25.23	18.04
90	Roadside	Diffusion Tube	100.00	100.00	33.29	32.61	30.02	31.39	24.54
91	Roadside	Diffusion Tube	100.00	100.00	30.68	29.28	27.46	29.04	25.47
92	Roadside	Diffusion Tube	25.00	25.00	27.10	23.70	23.10	25.6	19.76
93	Roadside	Diffusion Tube	33.33	33.33	29.25	29.21	25.39	26.89	19.11
94	Roadside	Diffusion Tube	91.67	91.67	28.26	28.09	25.66	24.32	22.81
95	Roadside	Diffusion Tube	91.67	91.67	25.85	25.23	21.38	24.12	21.19
96	Roadside	Diffusion Tube	100.00	100.00	27.50	26.20	25.55	27.99	22.27
97	Roadside	Diffusion Tube	91.67	91.67	32.92	31.62	31.44	35.64	28.24
98	Roadside	Diffusion Tube	83.33	83.33	36.67	36.21	33.05	34.33	27.34
99	Roadside	Diffusion Tube	100.00	100.00	31.83	32.73	28.84	31.04	27.03
100	Roadside	Diffusion Tube	33.33	33.33	27.43	24.02	23.09	25.38	18.22
101	Roadside	Diffusion Tube	33.33	33.33	25.34	23.31	23.75	25.79	19.56
102	Roadside	Diffusion Tube	91.67	91.67	28.70	27.96	27.87	29.77	26.60
104	Roadside	Diffusion Tube	100.00	100.00	27.86	27.70	27.13	26.76	22.05
107	Roadside	Diffusion Tube	100.00	100.00	31.01	32.23	29.49	30.83	26.20
108	Roadside	Diffusion Tube	33.33	33.33	29.75	28.72	27.33	29.49	19.18
109	Roadside	Diffusion Tube	16.67	16.67	27.14	26.43	25.01	26.07	16.54
110	Roadside	Diffusion Tube	100.00	100.00	26.66	25.75	24.67	23.75	20.51
111	Roadside	Diffusion Tube	100.00	100.00	29.40	27.15	30.15	30.61	24.61
114	Roadside	Diffusion Tube	100.00	100.00	29.70	30.07	27.48	27.47	23.00
115	Roadside	Diffusion Tube	91.67	91.67	**37.57**	**40.40**	35.25	35.09	30.64
116	Roadside	Diffusion Tube	91.67	91.67	**38.43**	**38.73**	35.63	**37.65**	33.13
117	Roadside	Diffusion Tube	100.00	100.00	36.61	35.30	33.91	**37.12**	30.09
⊗118	Roadside	Diffusion Tube	100.00	100.00	29.18	29.33	28.69	28.96	24.84
119	Roadside	Diffusion Tube	100.00	100.00	32.51	34.78	32.05	31.34	27.92
120	Roadside	Diffusion Tube	100.00	100.00	**44.94**	**47.24**	**44.76**	**44.82**	35.72
121	Roadside	Diffusion Tube	100.00	100.00	**50.57**	**52.71**	**47.29**	**48.01**	38.60
122	Roadside	Diffusion Tube	100.00	100.00	32.49	34.83	30.16	32.09	25.90
123	Roadside	Diffusion Tube	100.00	100.00	**46.55**	**47.00**	**39.54**	**46.44**	36.09

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
⊗124	Roadside	Diffusion Tube	75.00	75.00	36.50	**38.43**	**37.73**	**39.60**	32.41
⊗125	Roadside	Diffusion Tube	100.00	100.00	36.20	**37.90**	**37.10**	**38**	32.04
⊗126	Roadside	Diffusion Tube	100.00	100.00	**40.71**	**40.64**	36.91	34.91	27.61
⊗127	Roadside	Diffusion Tube	100.00	100.00	**45.01**	**44.26**	34.70	34.1	26.42
⊗128	Roadside	Diffusion Tube	100.00	100.00	**40.36**	**38.82**	**37.00**	**38.06**	30.64
⊗129	Roadside	Diffusion Tube	100.00	100.00	36.50	32.56	32.94	**37.11**	30.40
131	Roadside	Diffusion Tube	100.00	100.00	**44.33**	**44.79**	**44.75**	**42.02**	29.77
132	Roadside	Diffusion Tube	100.00	100.00	33.81	27.11	29.66	32.29	26.70
133	Roadside	Diffusion Tube	25.00	25.00	26.57	25.28	23.61	25.17	20.21
⊗134	Roadside	Diffusion Tube	100.00	100.00	**44.54**	**42.65**	**44.25**	**42.10**	33.47
^135	Roadside	Diffusion Tube	100.00	100.00	30.78	-	-	29.66	27.16
^136	Roadside	Diffusion Tube	100.00	100.00	28.71	25.53	27.14	25.18	23.29
^137	Roadside	Diffusion Tube	100.00	100.00	32.17	32.63	29.19	31.16	24.75
140	Roadside	Diffusion Tube	33.33	33.33	33.43	29.12	31.41	29.06	22.87
143	Roadside	Diffusion Tube	33.33	33.33	29.77	30.29	29.65	28.78	20.39
144	Roadside	Diffusion Tube	16.67	16.67	27.71	27.05	24.60	26.78	17.28
145	Roadside	Diffusion Tube	16.67	16.67	28.77	28.27	29.69	27.27	19.47
146	Roadside	Diffusion Tube	33.33	33.33	29.10	32.28	30.27	27.89	21.46
147	Roadside	Diffusion Tube	33.33	33.33	32.24	33.79	27.35	26.26	16.98
148	Roadside	Diffusion Tube	33.33	33.33	31.46	32.05	29.48	28.76	19.25
149	Roadside	Diffusion Tube	33.33	33.33	26.77	26.66	24.98	25.16	18.72
150	Roadside	Diffusion Tube	33.33	33.33	28.45	27.63	27.85	28.46	20.42
151	Roadside	Diffusion Tube	25.00	25.00	28.18	25.59	26.69	26.74	18.26
180	Roadside	Diffusion Tube	91.67	91.67	30.35	29.67	29.10	30.98	24.43
182	Roadside	Diffusion Tube	91.67	91.67	28.15	28.71	27.04	28.48	24.22
183	Roadside	Diffusion Tube	33.33	33.33	30.34	30.07	28.49	29.79	21.22
197	Roadside	Diffusion Tube	100.00	100.00	32.92	34.22	29.69	33.54	28.10
198	Roadside	Diffusion Tube	100.00	100.00	35.17	35.56	32.13	33.20	28.22
206	Roadside	Diffusion Tube	100.00	100.00	**41.55**	**42.50**	**38.05**	**41.79**	33.98
207	Roadside	Diffusion Tube	100.00	100.00	33.84	32.85	32.16	**37.74**	29.70
208	Roadside	Diffusion Tube	100.00	100.00	36.56	35.06	34.28	**37.23**	29.22
209	Roadside	Diffusion Tube	100.00	100.00	**41.00**	**40.72**	35.21	**39.21**	30.51

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
210	Roadside	Diffusion Tube	91.67	91.67	33.58	32.69	29.54	33.33	26.57
211	Roadside	Diffusion Tube	100.00	100.00	33.17	33.04	30.98	26.74	26.15
212	Roadside	Diffusion Tube	83.33	83.33	25.63	23.93	24.06	29.00	17.75
213	Roadside	Diffusion Tube	100.00	100.00	33.37	34.86	30.81	34.88	27.13
214	Roadside	Diffusion Tube	33.33	33.33	26.77	25.35	22.78	23.67	16.18
215	Roadside	Diffusion Tube	33.33	33.33	23.55	22.77	22.50	25.61	16.37
216	Roadside	Diffusion Tube	33.33	33.33	26.38	23.80	21.41	24.50	16.46
238	Roadside	Diffusion Tube	33.33	33.33	29.82	28.09	26.66	27.15	19.07
239	Roadside	Diffusion Tube	33.33	33.33	30.10	30.20	27.61	28.86	20.28
240	Roadside	Diffusion Tube	100.00	100.00	32.87	31.37	29.30	31.09	26.16
241	Roadside	Diffusion Tube	100.00	100.00	31.60	30.31	28.76	30.83	25.31
242	Roadside	Diffusion Tube	100.00	100.00	**41.47**	**40.94**	35.68	**43.29**	32.08
243	Roadside	Diffusion Tube	91.67	91.67	35.86	35.75	33.98	**38.88**	32.08
244	Roadside	Diffusion Tube	100.00	100.00	**40.14**	**44.02**	**42.71**	**43.19**	33.95
245	Roadside	Diffusion Tube	100.00	100.00	**39.87**	**42.03**	**39.32**	**42.32**	32.10
247	Roadside	Diffusion Tube	100.00	100.00	32.88	35.00	31.80	32.87	25.49
249	Roadside	Diffusion Tube	100.00	100.00	31.91	34.95	30.54	31.55	25.69
251	Roadside	Diffusion Tube	100.00	100.00	33.95	31.52	30.24	31.56	24.35
252	Roadside	Diffusion Tube	33.33	33.33	29.36	29.69	27.79	28.58	22.34
256	Roadside	Diffusion Tube	91.67	91.67	**37.41**	**38.21**	**37.18**	**37.86**	32.51
271	Roadside	Diffusion Tube	25.00	25.00	28.24	31.59	27.44	29.71	21.89
272	Roadside	Diffusion Tube	33.33	33.33	30.54	31.05	28.29	29.97	22.14
275	Roadside	Diffusion Tube	100.00	100.00	24.50	22.60	22.20	22.5	18.20
276	Roadside	Diffusion Tube	100.00	100.00	34.16	34.17	31.91	34.64	30.62
277	Roadside	Diffusion Tube	100.00	100.00	34.23	36.72	34.17	34.73	29.17
278	Roadside	Diffusion Tube	91.67	91.67	35.86	36.15	33.12	35.22	26.61
279	Roadside	Diffusion Tube	100.00	100.00	**47.59**	**49.83**	**43.53**	**47.31**	**41.31**
280	Roadside	Diffusion Tube	100.00	100.00	**39.60**	**41.10**	**37.70**	**38.7**	31.30
281	Roadside	Diffusion Tube	100.00	100.00	36.50	33.40	34.50	34.8	28.49
282	Roadside	Diffusion Tube	100.00	100.00	32.20	32.10	31.00	33.5	28.27
284	Roadside	Diffusion Tube	100.00	100.00	32.49	32.14	29.51	30.51	26.13
285	Roadside	Diffusion Tube	100.00	100.00	34.23	32.57	30.90	31.47	26.74

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
286	Roadside	Diffusion Tube	100.00	100.00	31.77	34.35	30.40	32.30	26.89
287	Roadside	Diffusion Tube	91.67	91.67	31.87	29.53	28.04	28.84	24.48
288	Roadside	Diffusion Tube	91.67	91.67	32.29	31.48	29.69	30.19	23.55
289	Roadside	Diffusion Tube	100.00	100.00	34.15	32.95	32.08	33.04	27.70
290	Roadside	Diffusion Tube	33.33	33.33	29.08	26.97	26.19	27.24	18.46
291	Roadside	Diffusion Tube	100.00	100.00	**43.73**	**39.73**	**38.54**	**41.05**	35.61
295	Roadside	Diffusion Tube	91.67	91.67	29.80	30.70	28.50	31.7	26.79
296	Roadside	Diffusion Tube	100.00	100.00	35.06	35.59	31.10	36.27	31.25
323	Roadside	Diffusion Tube	100.00	100.00	32.16	33.62	30.33	34.30	29.61
324	Roadside	Diffusion Tube	33.33	33.33	-	28.20	25.75	29.24	19.67
331	Roadside	Diffusion Tube	100.00	100.00	-	-	34.78	36.26	30.62
333	Roadside	Diffusion Tube	100.00	100.00	-	-	33.20	36.5	28.05
334	Roadside	Diffusion Tube	100.00	100.00	-	-	29.74	31.68	25.81
335	Roadside	Diffusion Tube	100.00	100.00	-	-	28.23	29.6	24.12
336	Roadside	Diffusion Tube	100.00	100.00	-	-	33.97	36.64	30.35
337	Roadside	Diffusion Tube	91.67	91.67	-	-	35.90	**37.1**	31.60
338	Roadside	Diffusion Tube	100.00	100.00	-	-	32.80	36.03	29.62
339	Roadside	Diffusion Tube	75.00	75.00	-	-	**40.39**	**37.76**	30.87
340	Roadside	Diffusion Tube	91.67	91.67	-	-	**46.67**	**49.03**	**40.98**
341	Roadside	Diffusion Tube	100.00	100.00	-	-	36.50	40.3	32.56
342	Roadside	Diffusion Tube	83.33	83.33	-	-	30.00	34.7	27.60
343	Roadside	Diffusion Tube	91.67	91.67	-	-	34.58	35.15	29.22
344	Roadside	Diffusion Tube	100.00	100.00	-	-	26.40	31.1	24.94
345	Roadside	Diffusion Tube	100.00	100.00	-	-	29.50	30.2	24.12
346	Roadside	Diffusion Tube	100.00	100.00	-	-	34.08	34.27	28.29
347	Roadside	Diffusion Tube	91.67	91.67	-	-	31.77	36.32	27.49
348	Roadside	Diffusion Tube	91.67	91.67	-	-	35.90	36.04	28.67
349	Roadside	Diffusion Tube	91.67	91.67	-	-	33.39	35.65	28.77
350	Roadside	Diffusion Tube	100.00	100.00	-	-	**38.06**	**39.52**	33.20
351	Roadside	Diffusion Tube	100.00	100.00	-	-	27.05	27.85	24.26
352	Roadside	Diffusion Tube	91.67	91.67	-	-	30.95	29.46	24.09
353	Roadside	Diffusion Tube	91.67	91.67	-	-	29.10	25.8	21.76

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
354	Roadside	Diffusion Tube	91.67	91.67	-	-	29.80	28	24.12
355	Roadside	Diffusion Tube	91.67	91.67	-	-	27.90	27.8	23.83
356	Roadside	Diffusion Tube	100.00	100.00	-	-	27.50	31.52	25.04
357	Roadside	Diffusion Tube	100.00	100.00	-	-	28.80	27.6	23.31
358	Roadside	Diffusion Tube	100.00	100.00	-	-	32.50	30.1	24.05
359	Roadside	Diffusion Tube	83.33	83.33	-	-	33.70	33.4	25.53
360	Roadside	Diffusion Tube	50.00	50.00	-	-	30.30	29.57	27.66
361	Roadside	Diffusion Tube	50.00	50.00	-	-	35.47	29.90	26.76
362	Roadside	Diffusion Tube	75.00	75.00	-	-	36.53	**42.23**	35.13
363	Roadside	Diffusion Tube	91.67	91.67	-	-	35.28	35.42	28.44
364	Roadside	Diffusion Tube	83.33	83.33	-	-	34.75	**39.49**	32.55
365	Roadside	Diffusion Tube	91.67	91.67	-	-	30.40	31.85	23.19
366	Roadside	Diffusion Tube	100.00	100.00	-	-	31.04	35.42	27.88
367	Roadside	Diffusion Tube	83.33	83.33	-	-	29.52	32.16	28.77
368	Roadside	Diffusion Tube	100.00	100.00	-	-	25.80	28.1	23.61
373	Roadside	Diffusion Tube	91.67	91.67	-	-	-	34.33	28.49
374	Roadside	Diffusion Tube	100.00	100.00	-	-	-	25.5	19.39
375	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18.24	14.66
376	Roadside	Diffusion Tube	100.00	100.00	-	-	-	30.40	25.00
377	Roadside	Diffusion Tube	100.00	100.00	-	-	-	34.98	29.90
378	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18	13.91
379	Roadside	Diffusion Tube	33.33	33.33	-	-	-	16.59	11.11
380	Roadside	Diffusion Tube	33.33	33.33	-	-	-	20.52	11.34
381	Roadside	Diffusion Tube	33.33	33.33	-	-	-	17.80	12.08
382	Roadside	Diffusion Tube	33.33	33.33	-	-	-	23.48	14.83
383	Roadside	Diffusion Tube	33.33	33.33	-	-	-	23.16	15.39
384	Roadside	Diffusion Tube	33.33	33.33	-	-	-	25.02	15.77
385	Roadside	Diffusion Tube	100.00	100.00	-	-	-	25.08	21.82
386	Roadside	Diffusion Tube	100.00	100.00	-	-	-	26.7	22.87
387	Roadside	Diffusion Tube	91.67	91.67	-	-	-	19.79	18.14
388	Roadside	Diffusion Tube	100.00	100.00	-	-	-	18.67	17.16
389	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**46.12**	38.37

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 Annual Mean Concentration (µg/m^3) (3)				
					2013	2014	2015	2016	2017
390	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**37.04**	30.83
391	Roadside	Diffusion Tube	100.00	100.00	-	-	-	27.02	24.32
392	Roadside	Diffusion Tube	33.33	33.33	-	-	-	8.21	6.85
393	Roadside	Diffusion Tube	100.00	100.00	-	-	-	16.7	14.28
394	Roadside	Diffusion Tube	100.00	100.00	-	-	-	16.79	16.17
395	Roadside	Diffusion Tube	100.00	100.00	-	-	-	17.88	15.84
396	Roadside	Diffusion Tube	100.00	100.00	-	-	-	21.00	18.41
397	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	14.28
398	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	11.10
399	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	17.46
400	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	20.79
401	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	22.20
402	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	24.42
403	Roadside	Diffusion Tube	100.00	100.00	-	-	-	-	32.12
404	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	19.09
405	Roadside	Diffusion Tube	66.67	66.67	-	-	-	-	10.06
406	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	33.49
407	Roadside	Diffusion Tube	75.00	75.00	-	-	-	-	20.79
408	Roadside	Diffusion Tube	100.00	100.00	-	-	-	**40.4**	35.89
409	Roadside	Diffusion Tube	50.00	50.00	-	-	-	-	**46.55****
410	Roadside	Diffusion Tube	58.33	58.33	-	-	-	-	18.72**
411	Roadside	Diffusion Tube	66.67	66.67	-	-	-	-	19.68**
412	Roadside	Diffusion Tube	41.67	41.67	-	-	-	-	21.79
413	Roadside	Diffusion Tube	41.67	41.67	-	-	-	-	24.36

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 **<u>bold and underlined.</u>**

(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.

Figure 2.3.1.18 Map to show the NO_2 Diffusion Tube Sites Exceeding or Potentially Exceeding the Annual Mean Objective concentration of 40ug/m^3 for 2017.

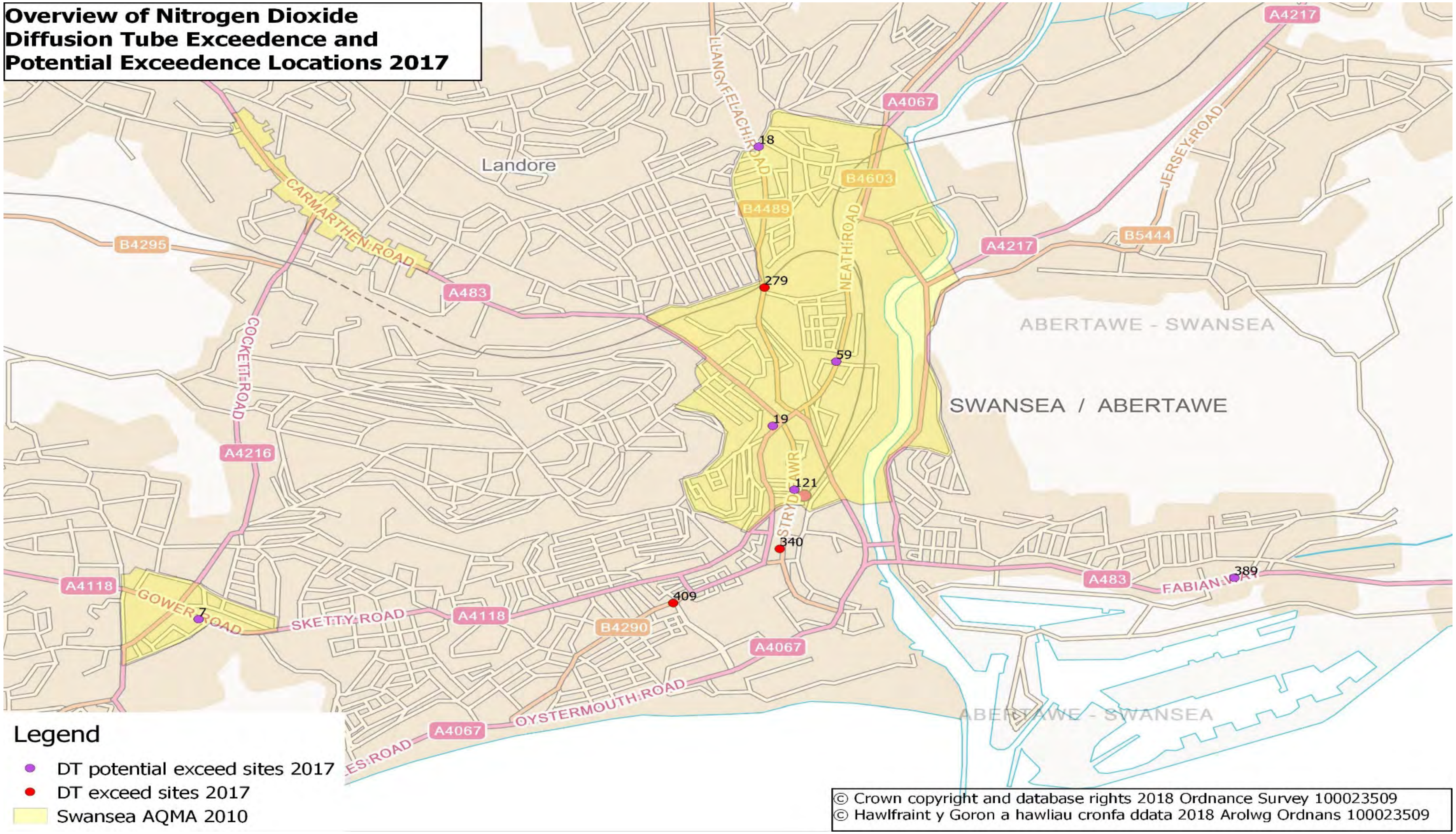
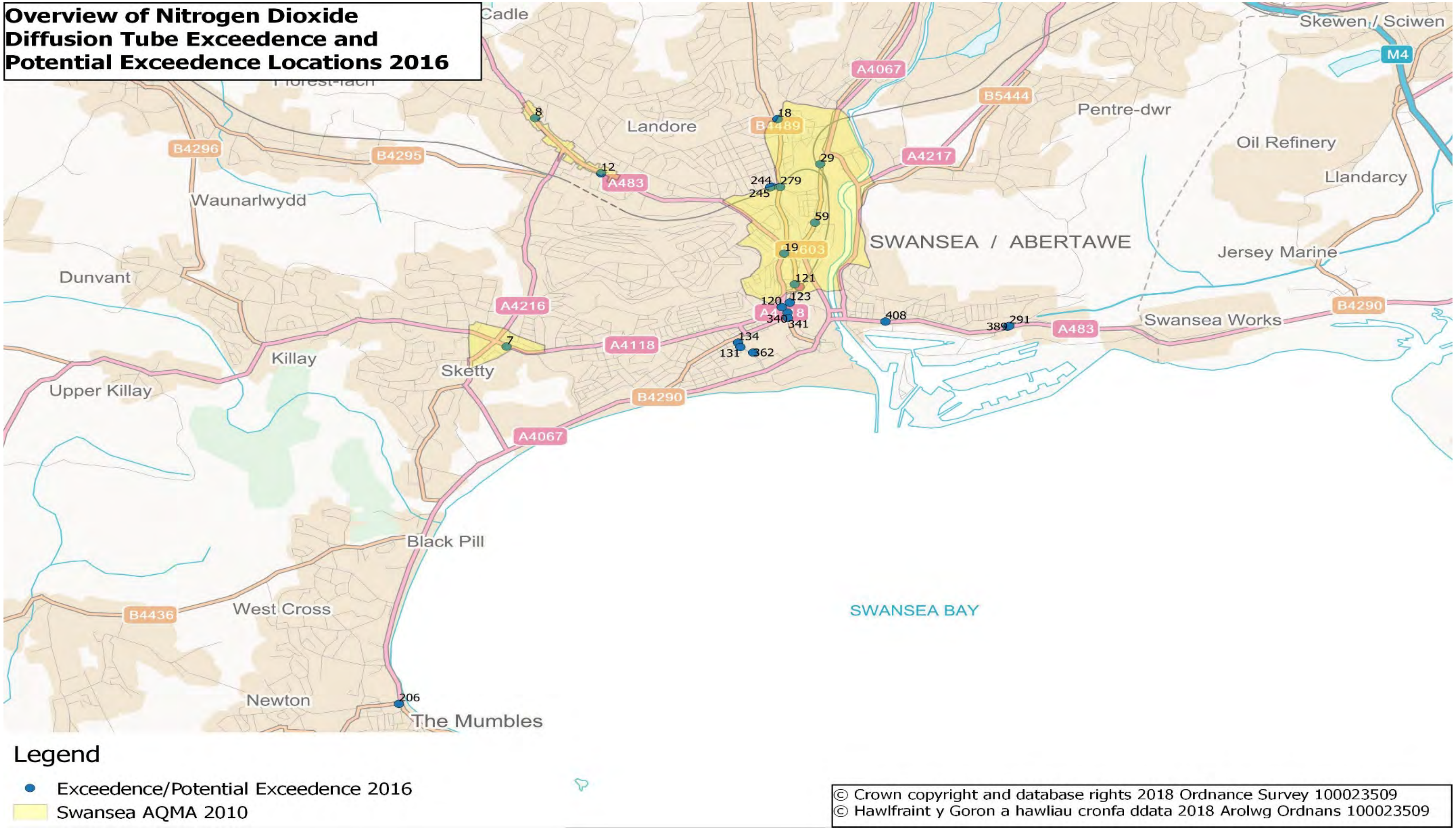


Figure 2.3.1.19 Map to show the NO_2 Diffusion Tube Sites Exceeding or Potentially Exceeding the Annual Mean Objective concentration of 40ug/m^3 for 2016.



In order to look at the 2017 data set for NO_2 diffusion tubes an area approach has been taken in order to show trends in the data sets and theories for results obtained.

Hafod:

Figure 2.3.1.20 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trends in the Hafod.

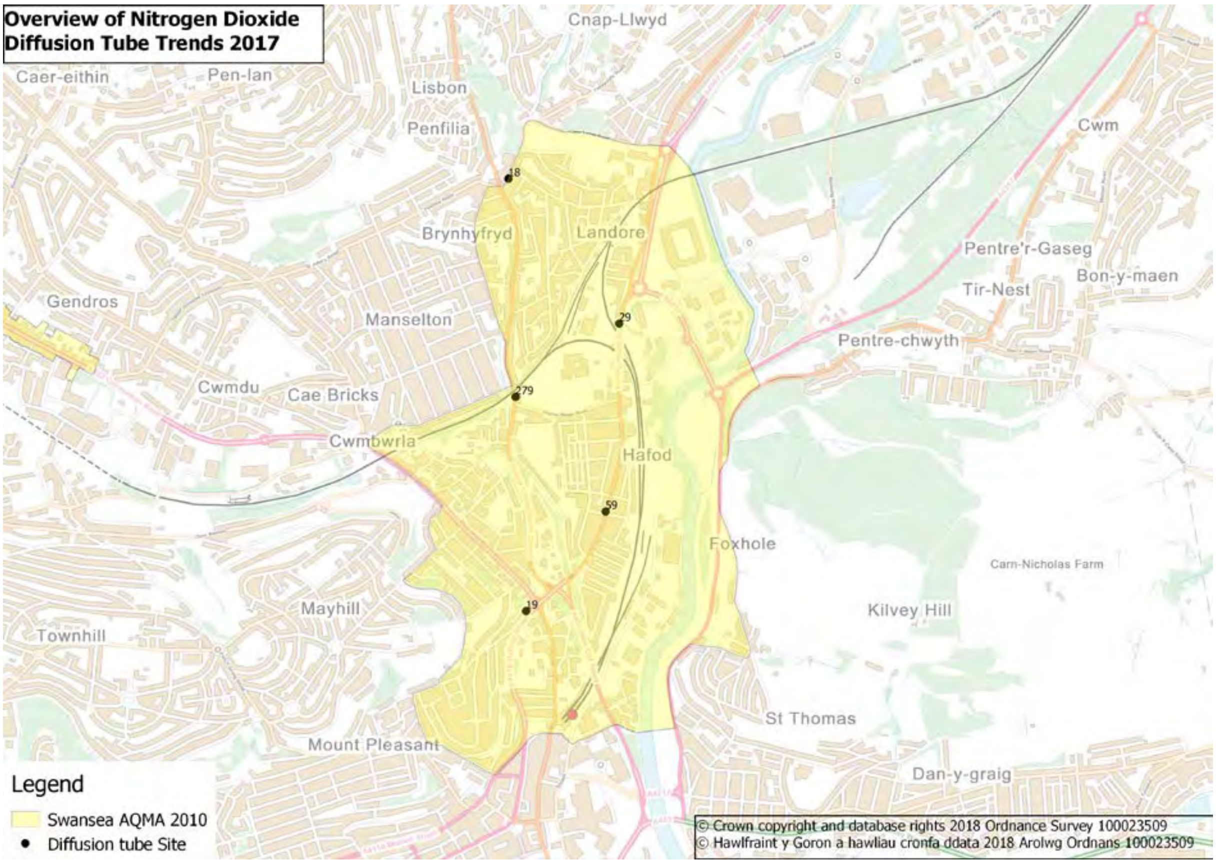


Figure 2.3.1.21 shows an overall downward trend for the selection of diffusion tubes highlighted since 2013. As with the continuous monitoring stations, an increase was observed in Annual Mean concentrations for 2016. For the highlighted sites, only one remains in exceedance of the Annual Mean Objective Concentration of 40ug/m3. This is site 279, located on Llangyfelach road; the location is on an incline adjacent to the junction with Pentremawr Road. The site still lies within the Swansea AQMA and will be subject to the draft Air Quality Action Plan due to go out to public Consultation by April 2019.

Site 29 shows a marked reduction in concentration from previous years, this is due to the highway infrastructure changes as part of the Morfa Distributor Road. Figures 2.3.1.22 highlight the change in road layout due to the new junction in close proximity to site 29. Site 406 is highlighted also but the site has only been active for a year and the annual mean is below 36ug/m^3.

Figure 2.3.1.20 – Trends in Annual Mean NO_2 Concentrations in the Hafod

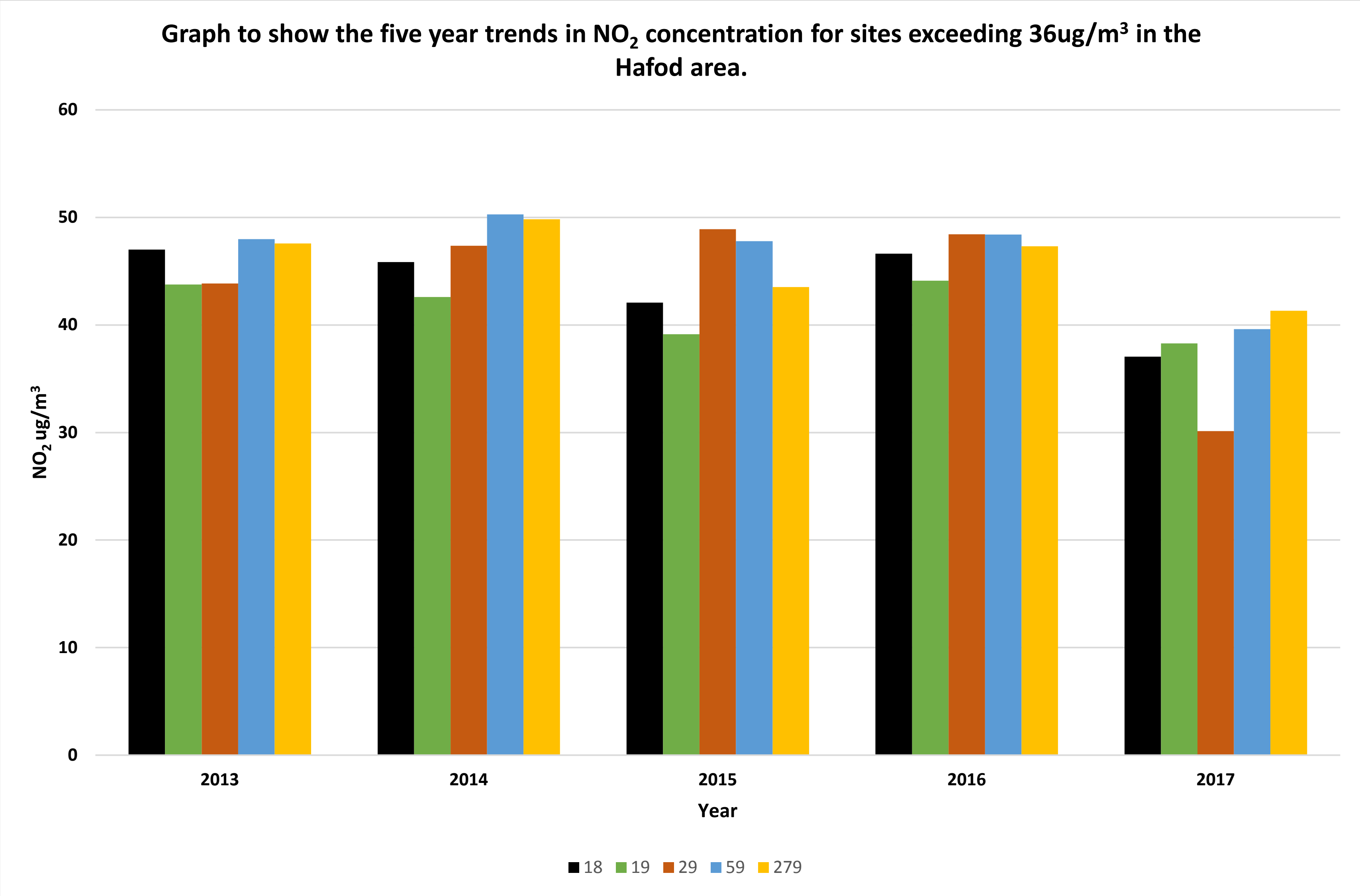


Figure 2.3.1.21 - Map to show Road Layout at Site 29 2016.

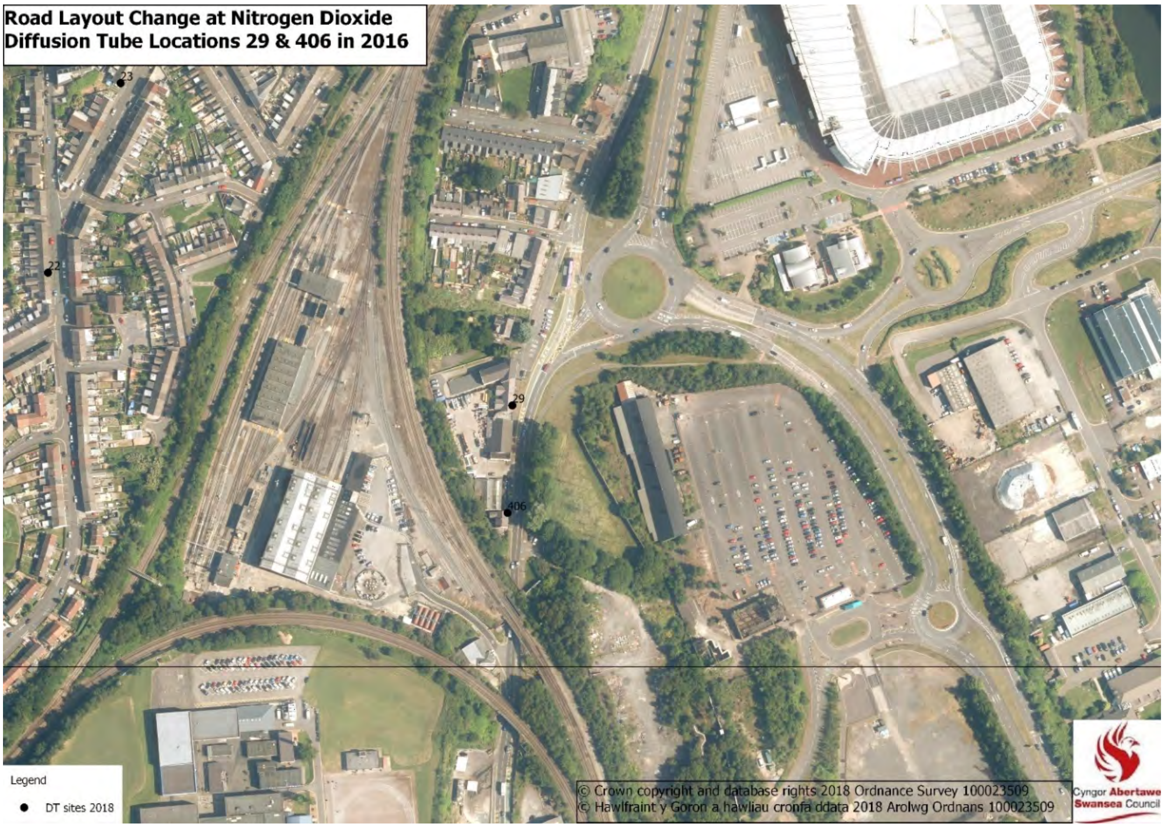
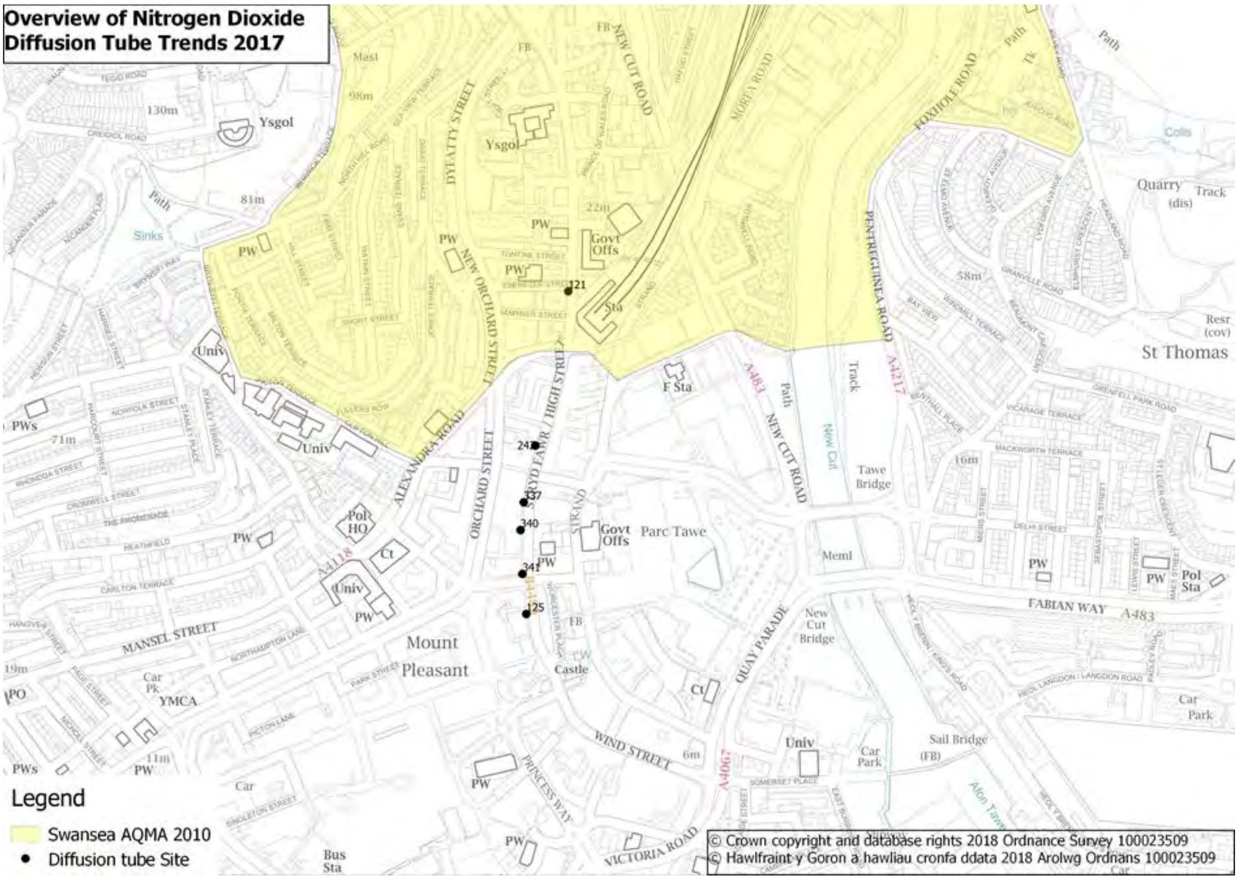


Figure 2.3.1.22 - Map to show Road Layout at Site 29 2017.

High Street:

Figure 2.3.1.23 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend High Street Locations 2017



Site 123 and site 242 are located on the same downpipe; Site 123 is at 2.5 metres and 242 is at 5metres

Data for the highlighted sites in figure 2.3.1.24 indicates an overall downward trend, with the exception of the observed climb in data seen across the Authority in 2016. Of the sites presented within figure 2.3.1.24 only sites 121& 242 are relevant residential exposures. Site 121 is located on the façade of the residential block behind the continuous monitor, CM11 – Station Court, High Street. The annual mean indicates compliance at the residential façade in 2017.

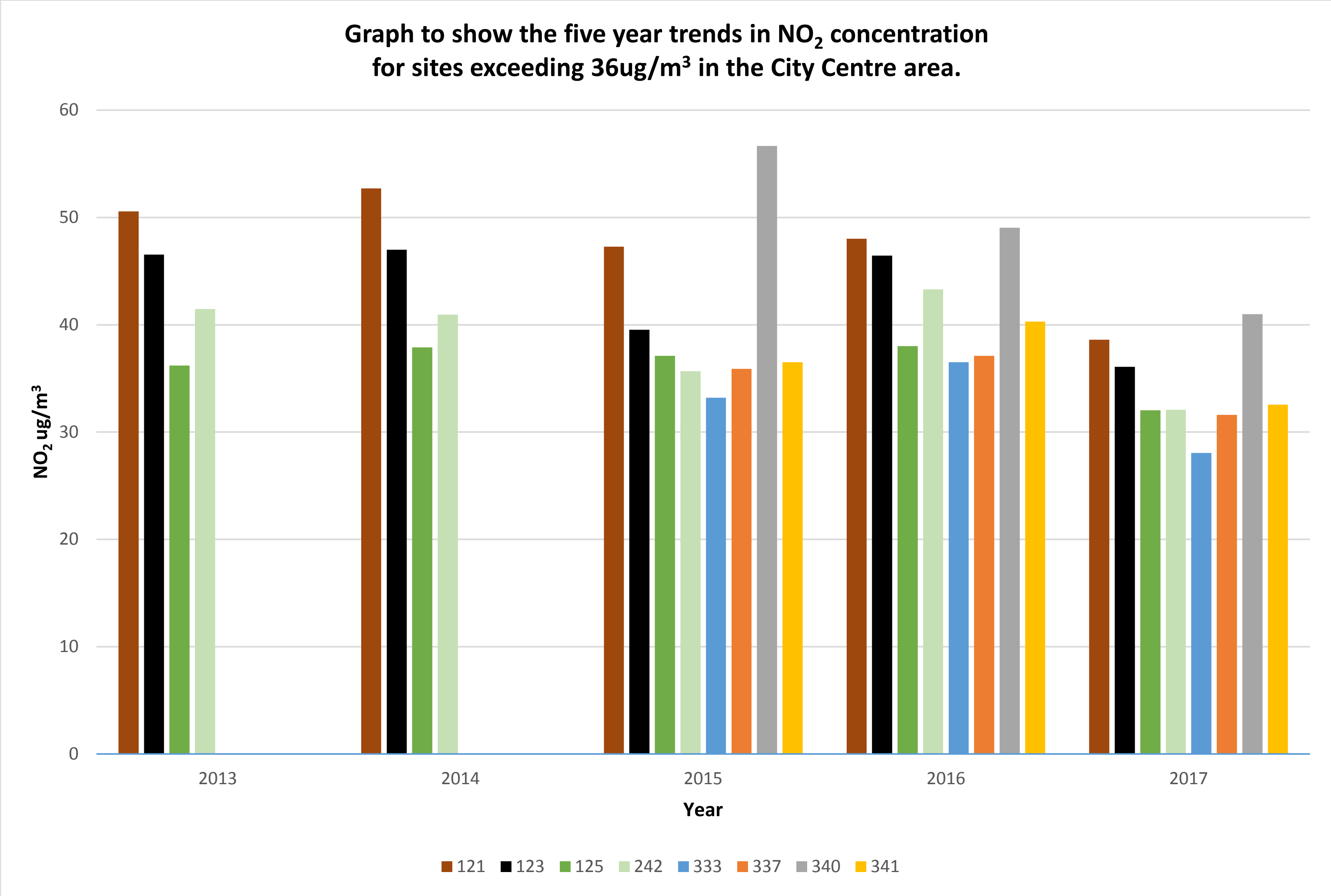
Site 242 is a first floor residential location that has been fluctuating around the Annual Mean Objective concentration for several years. The marked increase observed in 2016 led to logical step of a detailed assessment in the area however, budgetary constraints has led to a delay in acquisition of real-time monitoring equipment. The equipment has now been acquired and infrastructure works are being carried out to enable the site to commence monitoring as soon as possible in the location. The decrease in the 2017 dataset has reported a large reduction at site

242, the area will be continue to be assessed in-line with the annual report requirements with a view to working towards Welsh Government Policy Objectives to achieve compliance and further reduce exposure. ATC 57 is located in close proximity to the site and in 2016 returned an AADT of 8400; in 2017 an AADT of 8016 was returned which may also be a contributing factor as a reduction in primary emissions from vehicles.

Furthermore, the reduction in concentration at these sites could also be attributed to a return to a more 'normal' year of meteorological data as opposed to 2016, along with signalling timing changes at junctions along High Street. This will continue to be assessed within subsequent reports prepared by the Authority.

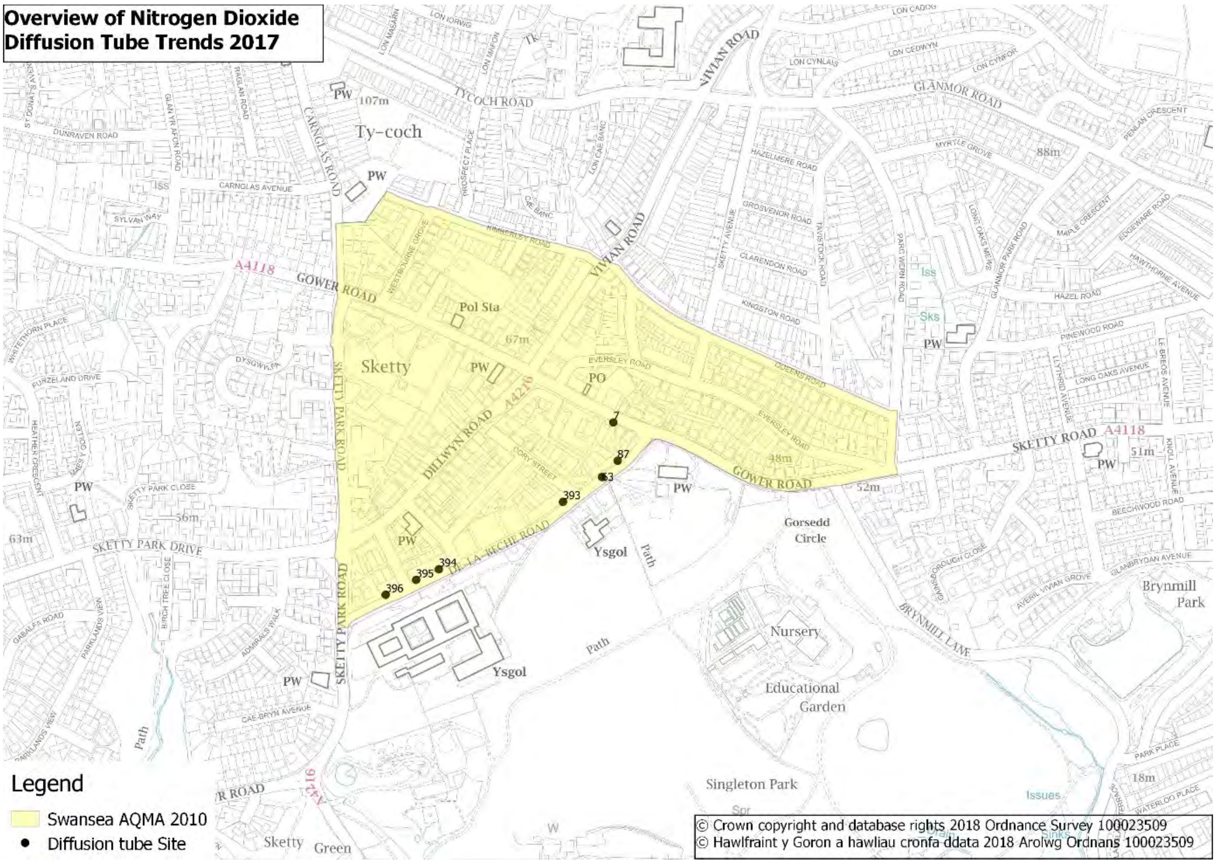
Sites 123, 125, 333, 347, 340 & 341 are representative of 1 hour exposures and so are below the $60ug/m^3$ annual mean guidance value that might indicate a relevant exposure risk and so are deemed compliant.

Figure 2.3.1.24 – Trends in Annual Mean NO_2 Concentrations



<u>Sketty:</u>

Figure 2.3.1.25 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend Sketty Locations 2017



Site 7 has been in exceedance of the Annual Mean Objective concentration for several years. Whilst a downward trend is observed is figure 2.3.1.26, again an increase was observed in 2016. However, in April 2017 junction improvement works were carried out in close proximity to site 7. The mini-roundabout was replaced with a light controlled junction aimed to reduce congestion in the area (figures 2.31.27 and 2.3.1.28), to reduce NO_2 concentrations observed and reduce the use of De La Beche Road as a 'Rat Run'.

The site 7 data for 2017, figure 2.3.1.26, indicates compliance for the first time whilst the spread of diffusion tubes along De La Beche Road also continue to show compliance with the Annual Mean Objective Concentration for the residential exposure.

The monitoring sites in Sketty will remain along with the sites on De La Beche Road in order to create a long-term dataset to assess the effects of the new junction upon the surrounding environment.

Figure 2.3.1.26 – Trends in Annual Mean NO_2 Concentrations

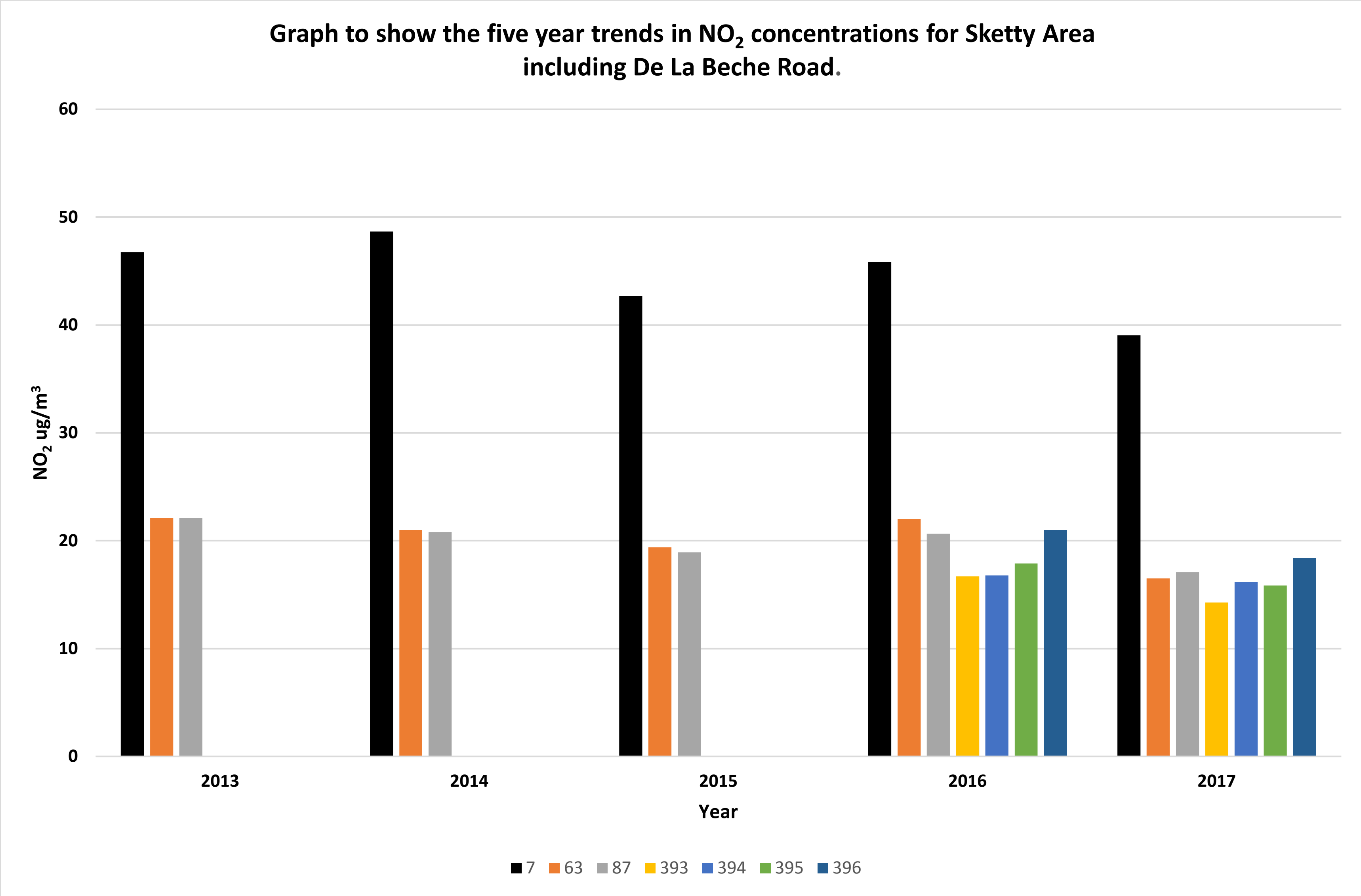
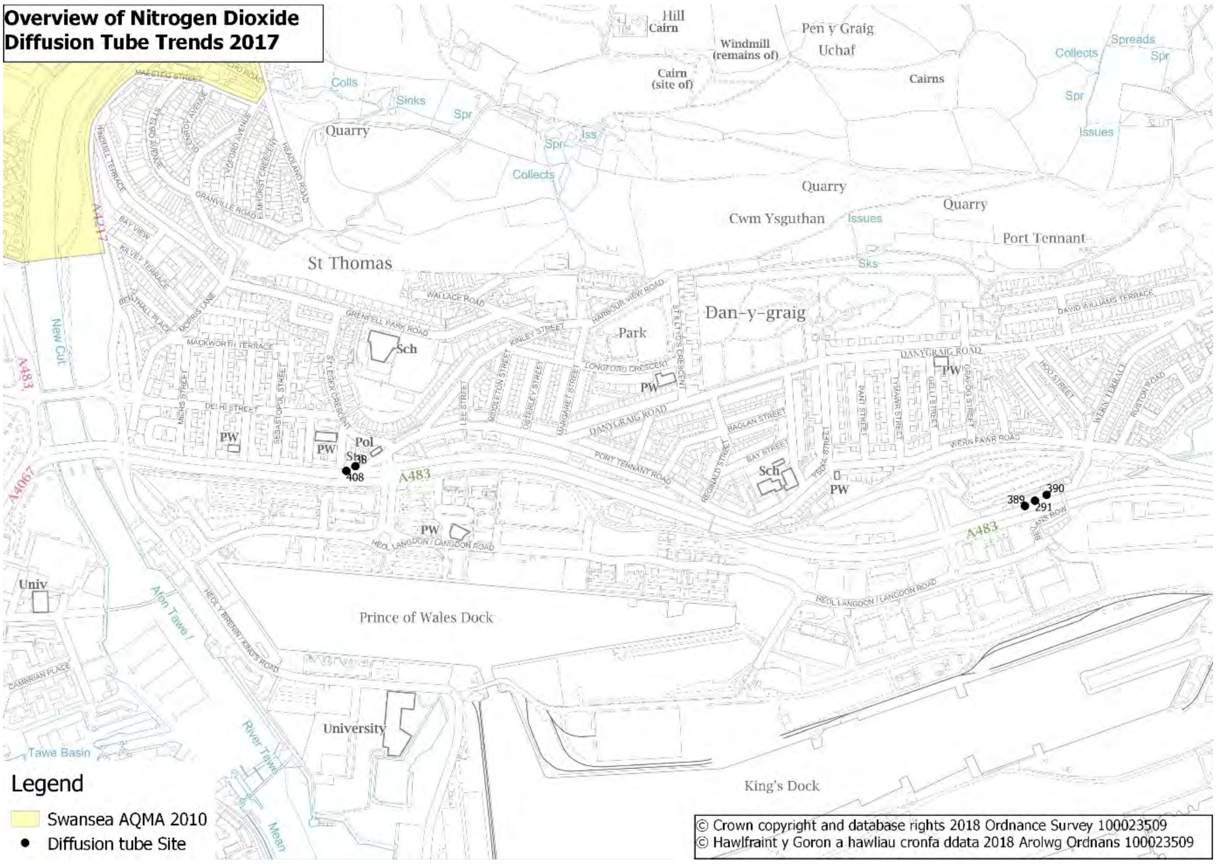


Figure 2.3.1.27 - Map to show Road Layout at Site 7 2017.

Figure 2.3.1.28 - Map to show Road Layout at Site 7 2016.

St. Thomas:

Figure 2.3.1.29 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend St. Thomas Locations 2017



Site 38 was discontinued in 2016 due to the request of the owner, the site had continued to show compliance with the Annual Mean Objective concentration. The decision was taken to create site 408, figure 2.3.1.30 shows the position of both sites. The results for 2016 indicated a marginal exceedence at site 408, this is located on a Lighting Column approximately 50cm from the façade of the dwelling and so is subject to back correction as set out within the Technical Guidance (TG16) The conclusion within the 2017 Progress Report was to proceed to a detailed assessment for this location however, given the fact that 2016 has been reported as an anomalous year for meteorological conditions, the reduction in concentration observed in 2017 has led to compliance with the Annual Mean Objective. The AADT for the location in 2017 was 34,704 and 34,776 in 2016; this would indicate that whilst traffic flow is similar was both years the meteorological conditions are likely to have played an important role in the concentration recorded.

Figure 2.3.1.30 Picture to show the location of Diffusion Tube sites 38 and 408

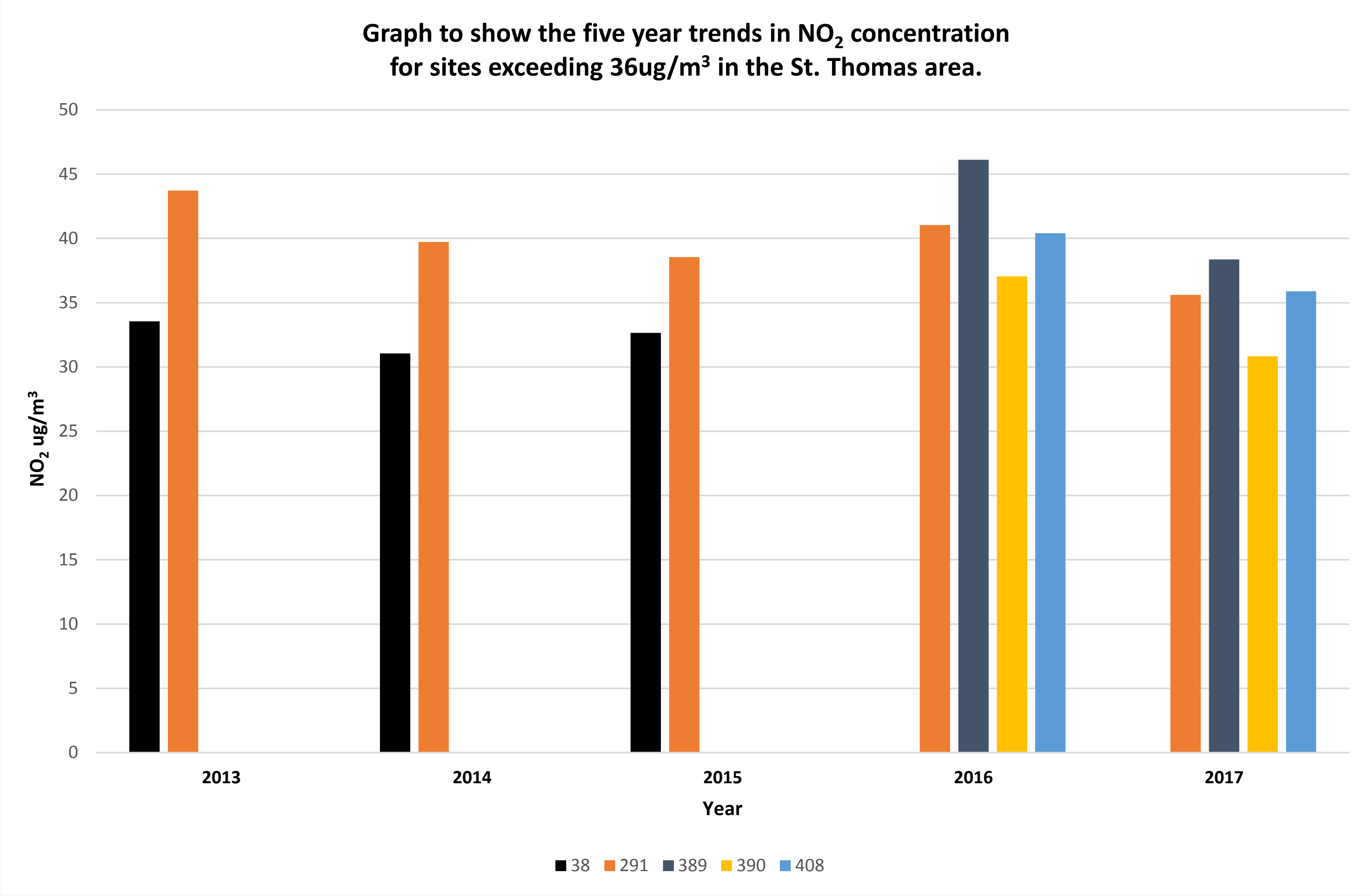
There are plans to replace the E-Bam monitoring station (CM10), due to unit failure, with a real-time NOX analyser and a Bam1020 PM2.5 unit; this will be scheduled for 2018.

Sites 291, 389 and 390 are located on terrace properties further east along Fabian Way, the last premises on Fabian Way on the outbound A483 towards junction 42 of the M4. The location of the sites are shown in Figure 2.3.1.29 and Figure 2.3.1.31, site 291 was commissioned in 2011 and has been reported upon in previous reports. Sites 389 and 390 were commissioned in 2016 and an annualised annual mean was reported for 2016. Sites 291 and 389 both reported exceedences of the Annual Mean Objective concentration in 2016. However, as with the site 38 and 408, the similar AADT recorded for 2016 and 2017 and the anomalous year of meteorological conditions in 2016 would suggest that meteorological conditions have played a role in the compliance concentrations returned for 2017. Given the ongoing work with the Air Quality Action Plan and other collaborative work streams that the Local Authority are undertaking the requirement for a detailed assessment, within the 2017 Progress Report, will not be carried out at this time.

Figure 2.3.1.31 Picture to show the location of Diffusion Tube sites 291 and 389

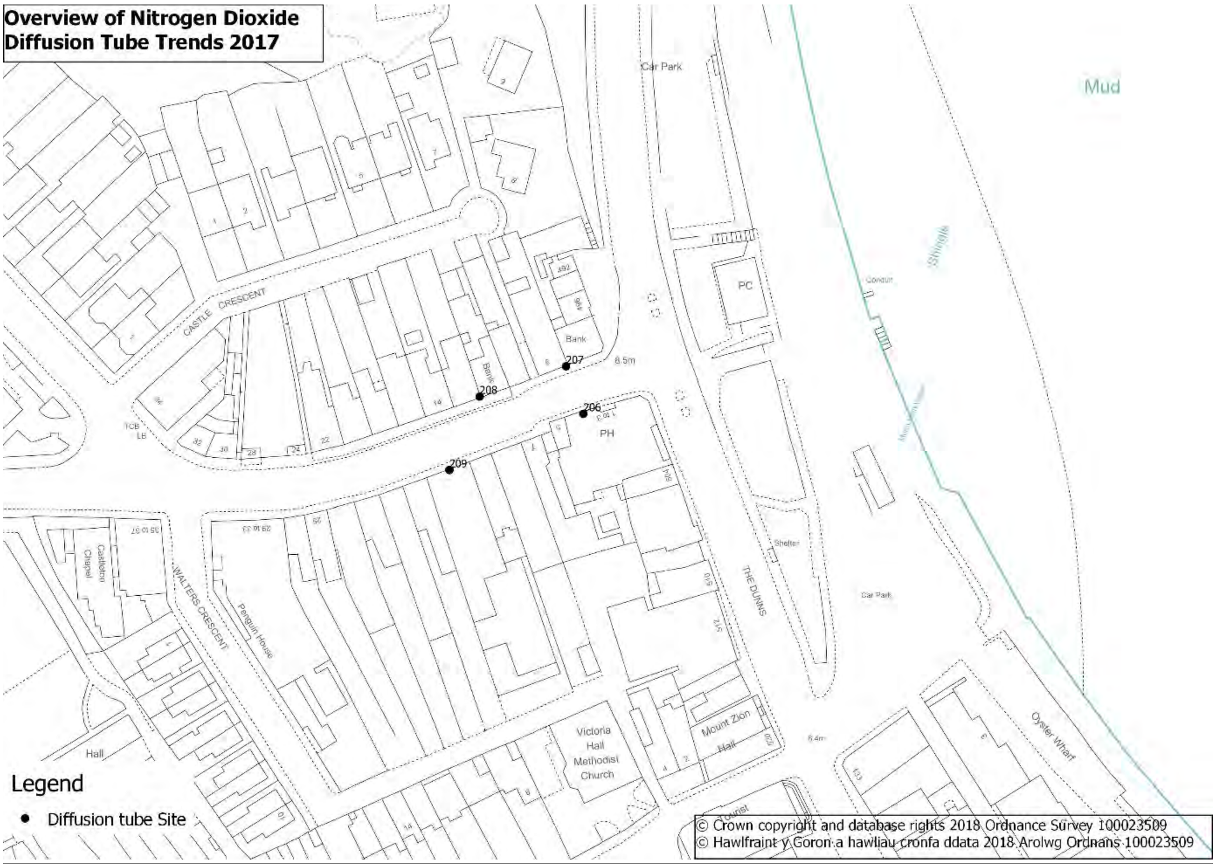
The data for 2017, figure 2.3.1.32, indicates compliance for the four sites with the Annual Mean Objective Concentration for the residential exposure with site 291 indicating a downward trend in concentration (apart from 2016).

Figure 2.3.1.32 – Trends in Annual Mean NO_2 Concentrations



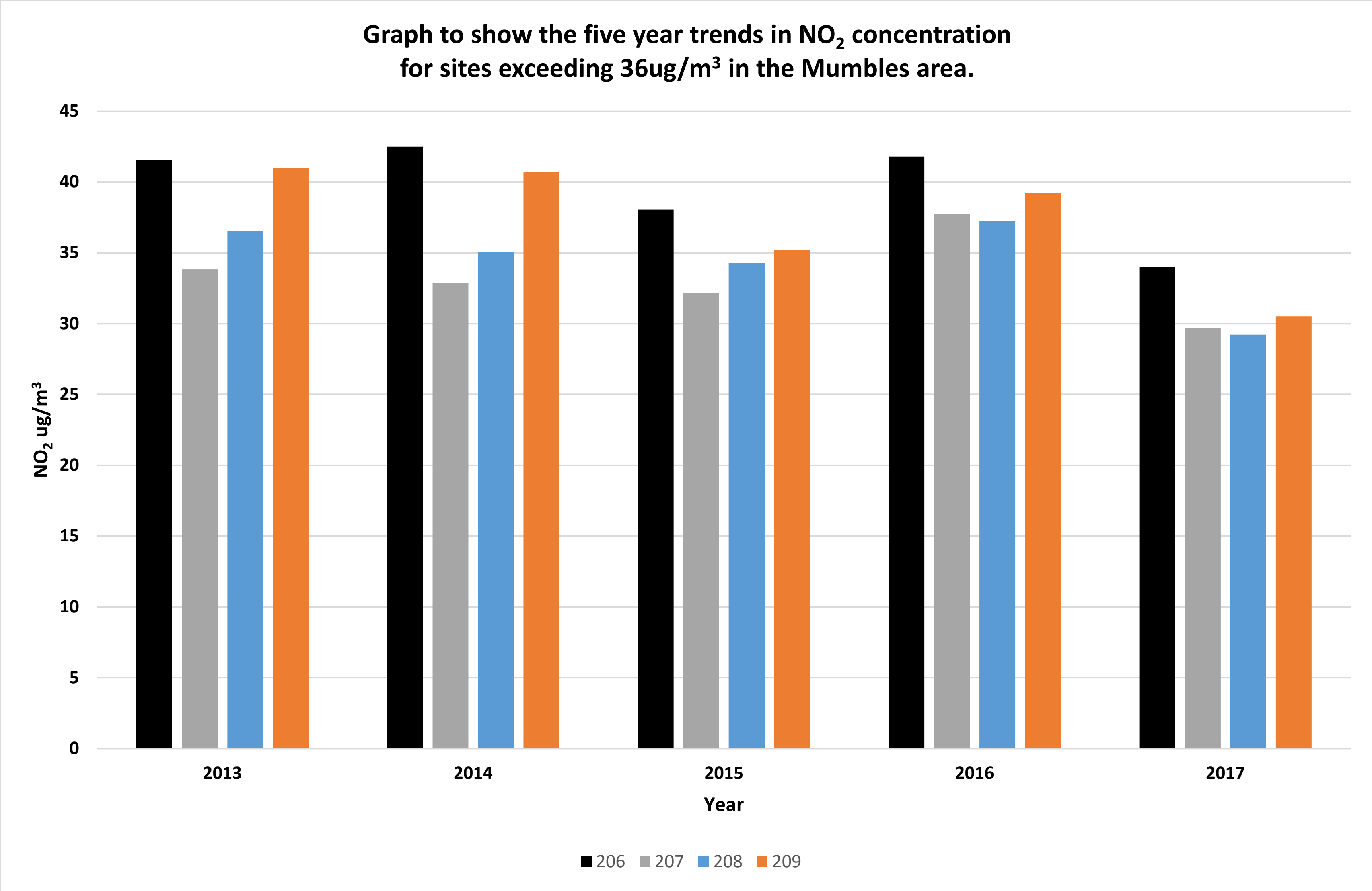
<u>Mumbles:</u>

Figure 2.3.1.33 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend Mumbles Locations 2017



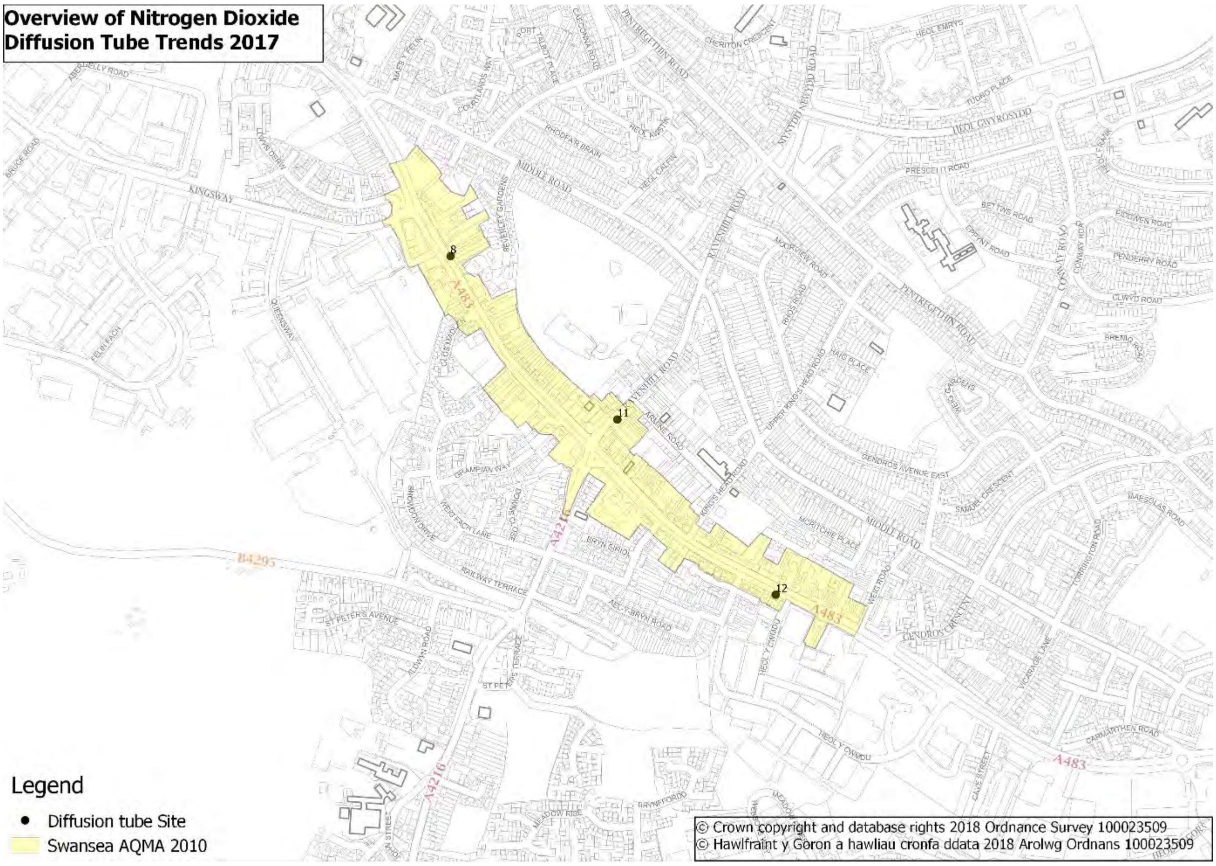
As discussed in previous reports, the situation within Newton Road, Mumbles has continued to improve, figure 2.3.1.34. However, an increase in concentration has been observed for 2016 for the sites being monitored. Site 206 exhibited an exceedence of the annual mean objective however, 2017 data has indicated a large reduction in concentration across the sites. Site 206 is located on the drainpipe, approximately 2.5m high, on a local pub with residential at the first floor. It is likely that at the first floor height the annual objective would have been met; however, the major redevelopment on the sea front (Oyster Wharf) has now been completed and the envisaged improvements are being observed. The detailed assessment required by the 2017 Progress Report will not be submitted; the Local Authority will continue to monitor in the area to assess the long-term trends.

Figure 2.3.1.34 – Trends in Annual Mean NO_2 Concentrations



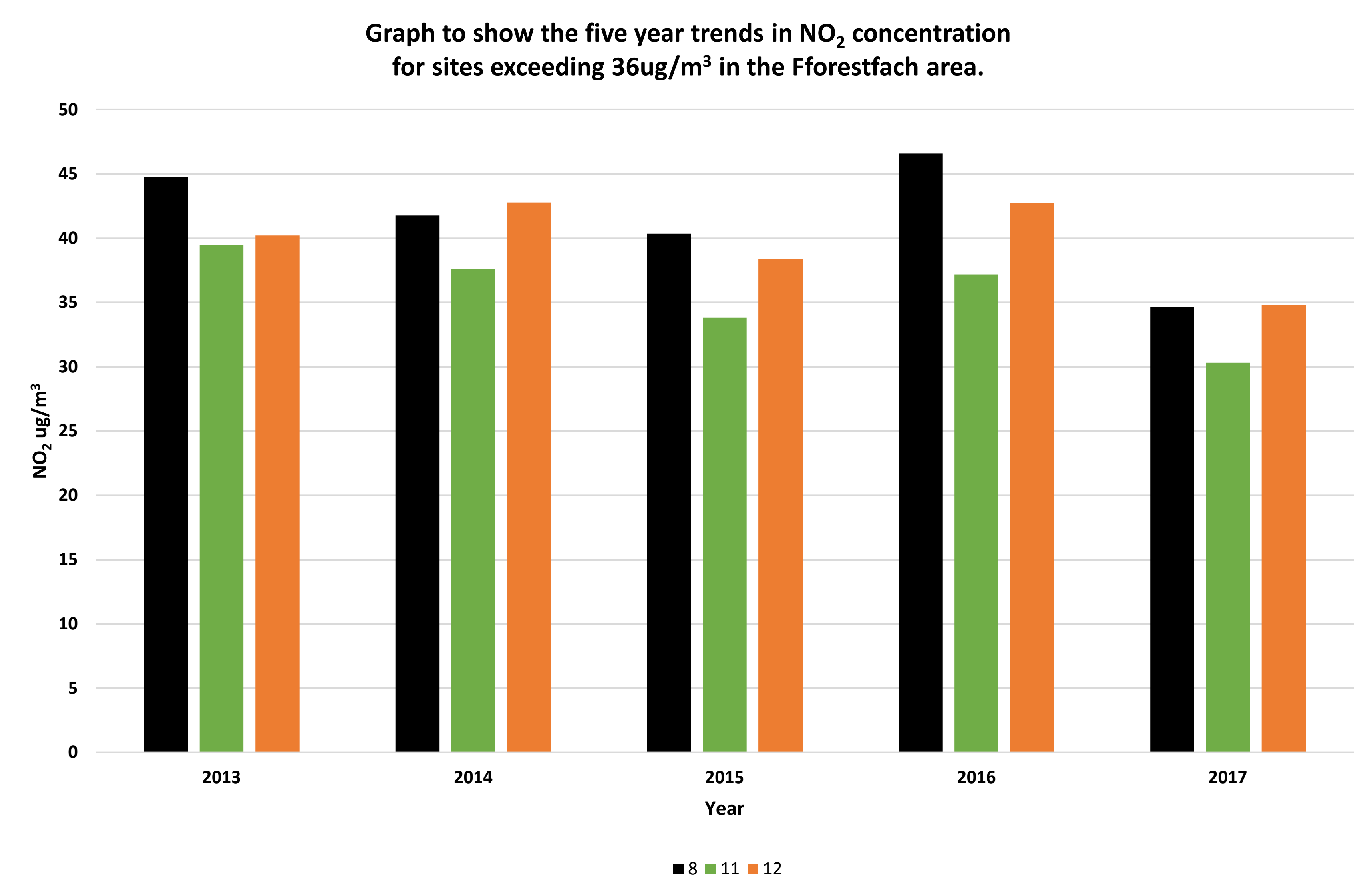
Fforestfach:

Figure 2.3.1.35 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend Fforestfach Locations 2017



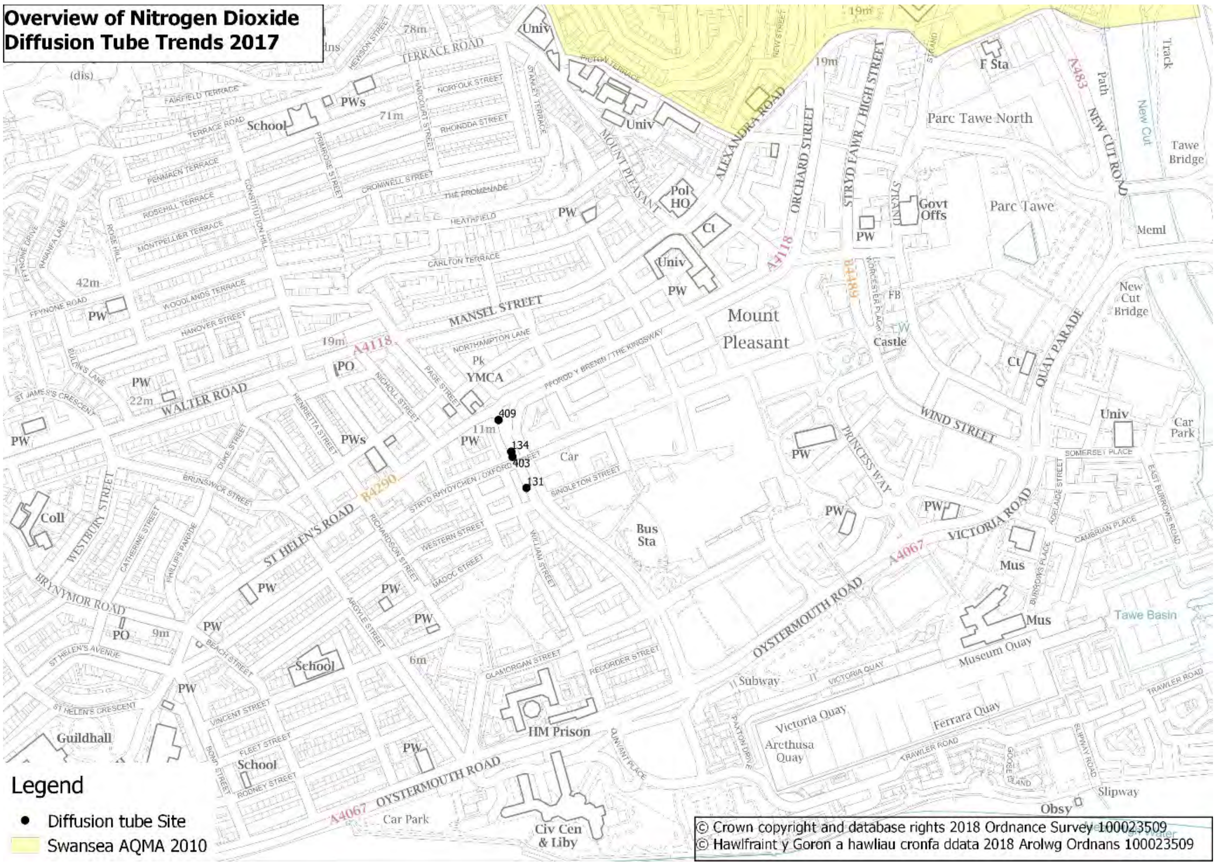
The three sites displayed in figure 2.3.1.35 are currently located within the Swansea AQMA 2010. Figure 2.3.1.36 shows a downward trend occurring over the last five years, with the exception of 2016 and the anomalous meteorological conditions. Sites 8 and 12 are subject to analysis within the AQAP scheduled to go out for consultation by April 2019. The AADT for 2017 is 13,128 and 13,056 for 2016, given the close proximity to the traffic source, this would concur with previous comments regarding the effects of meteorological conditions have upon NO_2 concentrations recorded. All sites reported no exceedences of the Annual Mean Objective concentration in 2017.

Figure 2.3.1.36 – Trends in Annual Mean NO_2 Concentrations



<u>City Centre:</u>

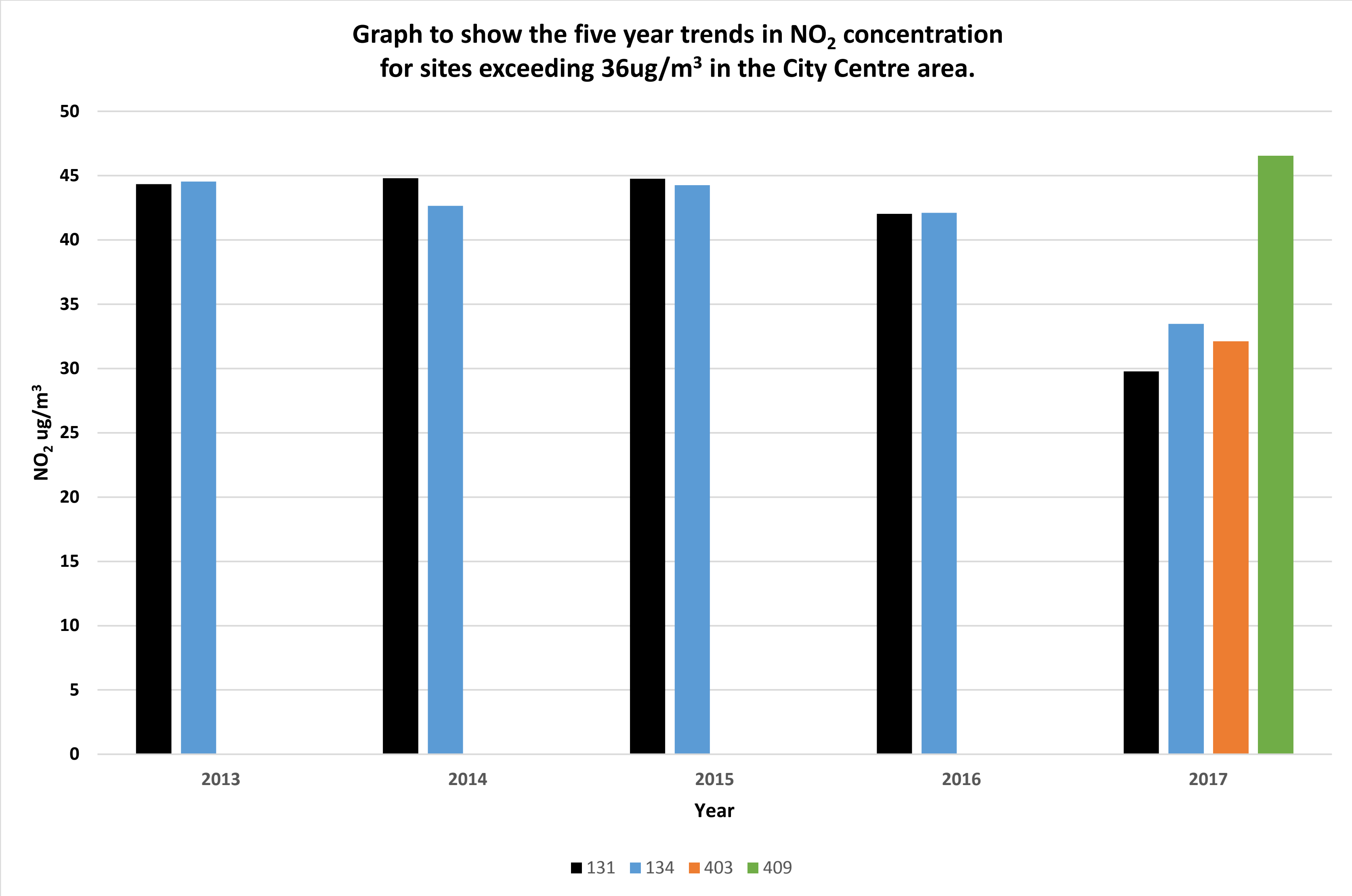
Figure 2.3.1.37 - Map to show Overview of Nitrogen Dioxide Diffusion Tube Trend City Centre Locations 2017



Sites 131 and 134 are located on facades of business premises in order to assess for the one hour exposure Objective Concentration; both sites continue to return results below the indicative threshold of 60ug/m^{-3}. As reported in the 2017 Progress Report, first floor accommodation was discovered above site 134 and so site 403 was commissioned. A different trend can be observed in figure 2.3.1.38 for the dataset in that concentrations have remained relatively stable, over the years reported. However, a decrease was observed in 2016 ; unlike other locations. It has been previously reported that this area of the City has undergone major highway infrastructure works over the years including the new Bus Station and Kingsway works. Ongoing development works in the area due to continue in into 2018 and light phasing for queueing times amendments will take place in 2018.

Site 403 has returned a compliant annual mean for 2017, the site is located at first floor height for the residential exposure above the ground floor commercial use. Site 409 was commissioned part way through 2017 to assess the one hour Objective Concentration and has been annualised and back corrected for 2017. Whilst this site is currently showing an exceedence of the Annual Mean Objective, given that residential accommodation exists further monitoring is intended to be carried out at the location as only five months of data was returned for 2017. It is worth mentioning at this point that the road layout is subject to substantial change in 2018 as part of the Kingsway Project and so the site is likely to be lost and a potential real-time monitoring location added.

Figure 2.3.1.3 – Trends in Annual Mean NO_2 Concentrations



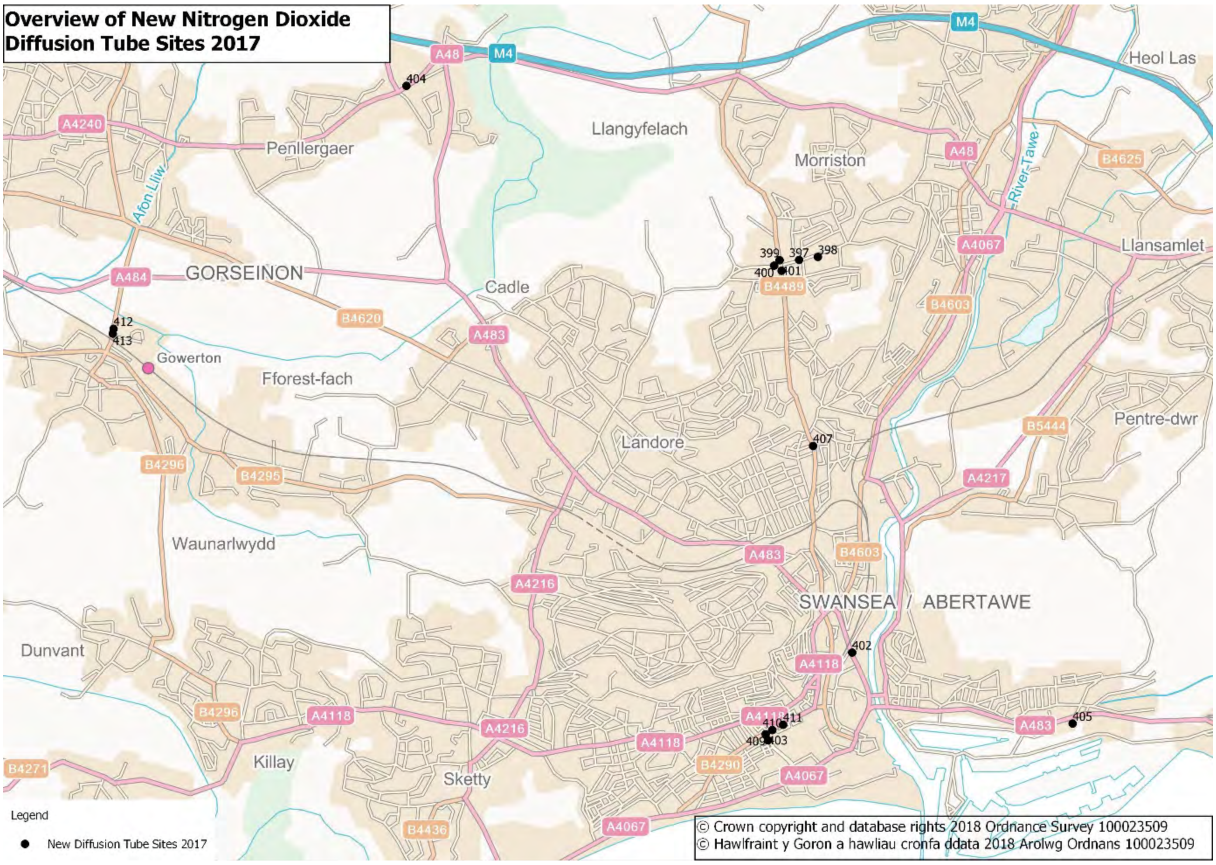
New NO_2 Diffusion Tube Sites:

During 2017 the Pollution Control was approached by Local Ward Members, Environmental Groups and Members of the Public and asked whether we could carry out any diffusion tube monitoring in the following areas:

- Llangyfelach
- Penllergaer Primary School
- Gowerton
- Rear of Bevans Row
- Brynhyfryd Primary School

Along with these locations, additional sites were set up in the City Centre to assess the effects of infrastructure changes planned.

Figure 2.3.1.39 shows the locations across the Local Authority



Llangyfelach:

Figure 2.3.1.40 shows sites 397 – 401 that commenced monitoring on the 4th January 2017. These sites were selected in order to answer local resident's queries regarding pollutant concentration at the busy junction of Llangyfelach Road and Mynydd Garnlwydd Road and the potential exposure of school children at peak periods.

Figure 2.3.1.40 - Map to show Diffusion Tube site 397-401.

Table 2.3.1.6 to show the NO_2 ugm^{-3} data for sites 397 – 401 for 2017

	397	398	399	400	401
2017 (Uncorrected)	19.8	16.3	24.3	22	27.1
2017 (Corrected)	14.3	11.1	17.5	20.8	22.2

The data for these sites is displayed as the uncorrected annual mean to assess against the hourly NO_2 objective concentration and as the distance corrected façade annual mean. As the table shows, all sites are in compliance with the objective concentrations.

Penllergaer Primary School:

Figure 2.3.1.41 shows site 404 that commenced monitoring on the 3rd March 2017. This site was selected in order to answer a local Ward Member's query regarding pollutant concentration at the Primary School on Gorseinon Road and the potential exposure of school children at peak periods.

Figure 2.3.1.41 - Map to show Diffusion Tube site 404.

Table 2.3.1.7 to show the NO_2 ugm^{-3} data for site 404 for 2017

	404
2017 (Uncorrected)	24.6
2017 (Corrected)	19.1

The data for this site is displayed as the uncorrected annual mean to assess against the hourly NO_2 objective concentration and as the distance corrected façade annual mean. As the table shows the site is in compliance with the objective concentrations, monitoring will continue at this location.

Gowerton:

Figure 2.3.1.42 shows sites 373 - 378 & the two new sites 412 - 413. The new sites commenced monitoring on the 14th August 2017. This site was selected in order to answer a local Ward Member's query regarding pollutant concentration due to the traffic flow along the B4296.

Figure 2.3.1.42 - Map to show Diffusion Tube sites 373-378 & the two new sites 412-413.

Table 2.3.1.8 to show the NO_2 ugm^{-3} data for Gowerton Sites for 2017

	373	374	375	376	377	378	412	413
2016	34.33	25.5	18.24	30.4	34.98	18	-	-
2017	28.49	19.39	14.66	25	29.90	13.91	21.79	24.36

The data returned for these sites indicates compliance with both the annual and the hourly objective concentrations. The data for sites 412 & 413 only began in August and so the data has been annualised in accordance with the requirements within the Technical Guidance; these new sites will continue to be assessed in 2018.

Bevans Row:

Figure 2.3.1.43 shows sites located along Bevans Row, Port Tennant, Swansea. The new site (405) commenced monitoring on the 30th March 2017. This site was selected in order to answer local resident's queries regarding pollutant concentrations due to the traffic flow along the A483 , Fabian Way, the access to the industrial Estate at the rear and the concern regarding a diesel generator in use at a mobile food vendor behind the properties.

Figure 2.3.1.43 - Map to show Diffusion Tube sites 48, 387 388 & 405

Table 2.3.1.9 to show the NO_2 ugm^{-3} data for Bevans Row Sites for 2017

	48	291	387	388	389	390	405
2013	23.43	43.73	-	-	-	-	-
2014	21.72	39.73	-	-	-	-	-
2015	19.59	38.54	-	-	-	-	-
2016	22.18	41.05	19.79	18.67	46.12	37.04	-
2017	17.44	35.61	18.14	17.16	38.37	30.83	15.83

Whilst the data for sites 291, 389 & 390 have been displayed in the table above they have been commented upon in an earlier section regarding the St. Thomas area; the paragraph below has been repeated here for completeness.

Sites 291, 389 and 390 are located on terrace properties further east along Fabian Way, the last premises on Fabian Way on the outbound A483 towards junction 42 of the M4. The location of the sites are shown in Figure 2.3.1.29 and Figure 2.3.1.31, site 291 was commissioned in 2011 and has been reported upon in previous reports. Sites 389 and 390 were commissioned in 2016 and an annualised annual mean was reported for 2016. Sites 291 and 389 both reported exceedences of the Annual Mean Objective concentration in 2016. However, as with the site 38 and 408, the similar AADT recorded for 2016 and 2017 and the anomalous year of meteorological conditions in 2016 would suggest that meteorological conditions have played a role in the compliance concentrations returned for 2017. Given the ongoing work with the Air Quality Action Plan and other collaborative work streams that the Local Authority are undertaking the requirement for a detailed assessment, within the 2017 Progress Report, will not be carried out at this time and further work will be assessed in the next 18 months.

The data returned for the sites along Bevans Row continue to indicate compliance with both the annual and the hourly objective concentrations. The data for site 405 has been annualised in accordance with the requirements within the Technical Guidance; these sites will continue to be assessed in 2018.

Brynhyfryd Primary School:

Figure 2.3.1.44 shows the new site located outside Brynhyfryd Infants School, Llangyfelach Road, Swansea. The B4489 is a busy section of road with an AADT of 13,152 in 2017; this data is obtained from the ATC located on Llangyfelach Road approximately 600m to the south. Brynhyfryd Junior School is located opposite the site as well but is set further back from the highway and so the monitoring location chosen was felt to be representative of both the annual mean and hourly Objective concentration. This site was set up in order to respond to queries raised by Friends of the Earth regarding pollutant concentrations due to a short survey they carried to in the area.

Figure 2.3.1.44 - Map to show Diffusion Tube Site 407

Monitoring at the site commenced in April 2017 and achieved 75% exposure for 2017; the annual mean returned was 20.79ugm^{-3} and so compliant with both the annual mean and hourly mean objective concentration. Data will continue to be collected here and further monitoring studies are looking at being developed with collaborative partners to further assess the exposure in this area.

2.3.2 Particulate Matter (PM_{10})

The Met One Bam 1020 PM_{10} has taken part in UK equivalency trials and has been deemed to be compliant with the EU reference gravimetric method subject to correction for slope by dividing the data by 1.2 or multiplying the data by 0.833 as set out in section 7.151 in the Technical Guidance (TG16).
Each hour, a small 14C (carbon-14) element emits a constant source of high-energy electrons (known as beta rays) through a spot of clean filter tape. These beta rays are detected and counted by a sensitive scintillation detector to determine a zero reading. The BAM-1020 automatically advances this spot of tape to the sample nozzle, where a vacuum pump then pulls a measured and controlled amount of dust-laden air (16.7l/min) through the filter tape, loading it with ambient dust. At the end of the hour this dirty spot is placed back between the beta source and the detector thereby causing an attenuation of the beta ray signal which is used to determine the mass of the particulate matter on the filter tape and the volumetric concentration of particulate matter in ambient air.

Data collected from the BAM 1020 PM_{10} unit has an integration period of 1-hour. Hourly ratified Particulate Matter PM_{10} data for 2017 has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector for the Swansea AURN.

These hourly data have then been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation. The calculated hourly mean mass concentration data have then been further processed by the software package Opsis Enviman Reporter. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the calculated hourly means were specified to be present.

For several years, the authority has indicated that it would undertake a basic PM_{10} screening exercise at some of the busier traffic junctions. However, this had previously proved impossible to undertake due to the unreliability of the instruments originally deployed on site. As mentioned in chapter 2.1 above, MetOne EBams have now been deployed at five sites during late 2012. Data for 2013-2017 are reported here. It is important to again highlight, that the MetOne EBam has not demonstrated equivalency with the EU reference gravimetric method. However, as the intention is only to provide an ongoing screening assessment, their use is judged to be appropriate.

The 90.4th percentile's of the daily means of measurements made during 2013-2017 are presented in bold within brackets in table 2.2.4 where appropriate, as the data capture rates fall below the required 90% at the Morriston Groundhog (FDMS) site and for completeness, the same approach has been taken with the low data capture rates at the Fforestfach Cross and Uplands EBam sites. Data capture from the Uplands Crescent site was compromised due to yet another external sensor problem and pump flow issues with the main circuit/logic board failing at the Fforestfach Cross EBam site during 2014. **However, LAQM.TG(16) amends this required data capture rate to 85% with the requirement that the 90.4th percentile be presented should data capture for the year fall below the required 85%.**
All data for sites measuring PM10 concentrations can be seen in tables 2.2.3 and 2.2.4.
There are no exceedences of the PM10 objective concentrations for 2017.

2.3.3 Particulate Matter ($PM_{2.5}$)

The Met One Bam $PM_{2.5}$ (smart Bam) is heated and has been determined to show equivalency to the EU reference method during recent trials without the need for the application of a correction factor.
Each hour, a small 14C (carbon-14) element emits a constant source of high-energy electrons (known as beta rays) through a spot of clean filter tape. These beta rays are detected and counted by a sensitive scintillation detector to determine a zero reading. The BAM-1020 automatically advances this spot of tape to the sample nozzle, where a vacuum pump then pulls a measured and controlled amount of dust-laden air through the filter tape, loading it with ambient dust. At the end of the hour this dirty spot is placed back between the beta source and the detector thereby causing an attenuation of the beta ray signal which is used to determine the mass of the particulate matter on the filter tape and the volumetric concentration of particulate matter in ambient air.
Data collected from the BAM 1020 $PM_{2.5}$ unit has an integration period of 1-hour. Hourly ratified Particulate Matter $PM_{2.5}$ data for 2017 has been downloaded from the

Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector for the Swansea AURN.

The data collected from the Morriston Groundhog BAM 1020 $PM_{2.5}$ unit has been downloaded from the Welsh Air Quality Forum https://airquality.gov.wales/maps-data/measurements/downloadsubmit-data for the Morriston Groundhog site.

The data is displayed is table 2.2.5.

2.3.4 Other Pollutants Monitored

Benzene:

Benzene is measured in real-time at two roadside sites in Swansea with Opsis DOAS instruments. Section 2.1 above outline the systems in operation at the Hafod (along Neath Road) and at St. Thomas (Pentreguinea Road) sites.

Annual means for benzene and the underlying data capture for 2013-2017 are provided below within table 2.3.4.1

Table 2.3.4.1 to show Benzene Concentrations 2013-2017

Site ID	Location	Within AQMA	Data Capt. 2013 %	Data Capt. 2014 %	Data Capt. 2015 %	Data Capt. 2016 %	Data Capt. 2017 %	Annual mean concentrations (μg/m^3)				
								2013	2014	2015	2016	2017
CM4	Hafod DOAS	Y	73%	70%	73%	63%	95%	2.23	2.01	2.33	2.63	1.58
CM5	St.Thomas DOAS	N	73%	74%	70%	93%	98%	2.30	2.56	2.20	2.75	1.48

Significant data has been lost at these sites in previous years due to operational issues and also building renovation works in the case of the Hafod site. Analysis of the data for 2017 has produced data capture rates above the assumed / recommended 85% required for other pollutants within LAQM.TG(16). No mention is made within LAQM.TG(16) of a specific required annual data capture rate for benzene. However, previous poor data capture rate can partly be explained by the validation rules outlined within section 2.1 together with some periods of measurement cycles being close to the “limit of detection” resulting in a high standard deviation of the measurement and thus rejection if the standard deviation is more than the concentration measured. Discussions with Opsis have led to amendment of the validation rules previously applied in that data is no now longer required to be greater than twice the standard deviation of the measurement; data capture for both sites would be less than 50%. Given the low concentrations being recorded and that concentrations are close to the limit of detection data provided for 2017, in Table 2.3.4.1, has had the light limit threshold applied.

Sulphur Dioxide (SO_2):

SO_2 is now only monitored at one location within Swansea - the St. Thomas DOAS. St. Thomas is ideally placed for this monitoring, being in close proximity to Swansea Docks with the Tata Steelworks to the south-east across Swansea Bay. This has been the traditional dominant source of SO_2 seen within Swansea since measurement of SO_2 commenced during the late 1970's.

The derived 5-minute means have been compiled into 15-minute averages by the software package OPSIS Enviman Reporter. In order to compile a valid hourly mean, a minimum of 3, 15-minute means were specified. Data capture of less than 75% for the hour therefore excludes that hour from any analysis. The derived hourly means have then been used to calculate both the hourly and 24-hour objectives. In order to calculate the 24-hour mean a minimum of 75% (i.e. 18 out of 24) of the ratified hourly means were specified to be present[3]

The data capture rates are presented within table 2.3.4.2 and, where applicable, the percentile value corresponding to the objective exceedance value is given should the data capture rate fall below 85%[4]. Under LAQM.TG(16) data capture requirement was 85%

Table 2.3.4.2 – Results of Automatic Monitoring for SO_2: Comparison with Objectives

Site ID	Site Type	Within AQMA?	Valid Data Capture 2017 % [b]	Number of: [c]		
				15-minute Means > 266µg/m³	1-hour Means > 350µg/m³	24-hour Means > 125µg/m³
CM5	Roadside	N	88.05	0	0	0

There are no exceedences of the Objective Concentrations at this site.

Ozone (O_3):

Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2015. The long term objective for ozone mentioned within the Air Quality Strategy 2007 (vol 2) (chapter 1 section 1.3.5 page 62) was for the 8-hour means not to exceed 100$\mu g/m^3$ on more than 10 occasions with a compliance date of 31st December 2005. LAQM.TG(16) makes no reference to ozone monitoring so the approach adopted within previous reporting cycles is adopted within this report. In addition the LAQM Policy Guidance for Wales (June 2017) also makes no specific reference to ozone monitoring.

Measurements are undertaken with Advanced Pollution Instrumentation (API) real-time O_3 analysers at the Cwm Level Park and Morriston Groundhog sites with the DOAS technique providing the measurements from the St Thomas and Hafod sites. The O_3 analyser from the Swansea AURN was decommissioned on the 27th November 2008 and relocated at Cwm Level Park.

Ratified datasets have been downloaded from http://www.welshairquality.co.uk/data_and_statistics.php in relation to the ozone monitoring undertaken at the Morriston Groundhog and Cwm Level Park sites. Data ratification procedures undertaken at the Hafod and St Thomas DOAS sites are described in more detail within section 2.1

Hourly means have been used to calculate the 8-hour means. In order to form a valid 8-hour mean 75% of the hourly means were required to be present i.e. 6 out of every 8.

Table 2.3.4.3 To show Max 8-Hour Mean (ugm^{-3}) at Morriston Groundhog

Morriston Groundhog	Max 8-hour Mean ($\mu g/m^3$)	Data capture (at 8 hour integration)	Exceedances of 8-hour objective 100$\mu g/m^3$ (10 permitted)
2002	109.50	83.3%	3
2003	169.25	95.71%	28
2004	142.75	98%	23
2005	113.00	97.6%	1
2006	152.20	98.8 %	15
2007	114	98%	4
2008	120.75	88.43%	3
2009	103.25	89.04%	2
2010	103.5	94.34%	1
2011	104.25	90.78%	2
2012	126.50	97.63%	5
2013	111.00	93.42%	1
2014	103.25	95.71%	1
2015	105	91.51%	2
2016	110.63	98.72%	2
2017	100.88	90.05	1

Table 2.3.4.4 To show Max 8-Hour Mean (ugm^{-3}) at Cwm Level Park

Cwm Level Park	Max 8-hour Mean ($\mu g/m^3$)	Data capture	Exceedances of 8-hour objective 100$\mu g/m^3$ (10 permitted)
2009	100.75	92.6%	1
2010	106.5	98.26%	1
2011	112.0	98.63	5
2012	130.25	96.17%	5
2013	124.75	98.54%	23
2014	115.25	98.54%	5
2015	108.50	97.81%	1
2016	116.75	92.62%	2
2017	115.13	95.98	2

Table 2.3.4.5 To show Max 8-Hour Mean (ugm^{-3}) at Hafod DOAS

Hafod DOAS	Max 8-hour Mean (μg/m^3)	Data capture %	Exceedances of 8-hour objective 100μg/m^3 (10 permitted)
2006	95.95	53.7%	0
2007	87.36	82.3%	0
2008	98.96	38.5%	0
2009	118.49	94.70%	50
2010	115.53	95.98%	6
2011	102.19	99.91%	2
2012	141.71	99.6%	13
2013	112.60	99.1%	9
2014	124.70	85.57%	12
2015	127.46	98.71%	4
2016	85.58	99.27%	0
2017	106.24	95.62	1

Table 2.3.4.6 To show Max 8-Hour Mean (ugm^{-3}) at St Thomas DOAS

St Thomas DOAS	Max 8-hour Mean (μg/m^3)	Data capture	Exceedances of 8-hour objective 100μg/m^3 (10 permitted)
2006	150.6	94.9%	47
2007	106.4	98.7%	10
2008	127.9	99.9%	91
2009	118.93	99.4%	48
2010	120.45	99.36%	37
2011	108.90	99.54%	9
2012	116.42	98.63%	4
2013	113.76	99.7%	22
2014	115.38	98.45%	4
2015	102.49	99%	2
2016	101.50	98.91%	1
2017	111.94	100%	14

Compliance during 2017 has been achieved at all monitoring locations except for St Thomas which exceeded the 10 permitted 8-hour exceedances with a total of 14 recorded.

Heavy Metals Monitoring

The Department of Environment, Food and Rural Affairs (DEFRA) is funding a monitoring study to determine ambient concentrations of lead, cadmium, arsenic, mercury and nickel in the vicinity of a wide-variety of industrial processes.

The City and County of Swansea were requested to participate in this study from its inception during 1999/2000 due to the nickel refinery at Vale (Formerly Vale INCO/ INCO Europe) being located within the authority's area at Clydach. Full details on this monitoring program can be found within section 2 above which outlines the overall monitoring program and sites chosen.

Several years of monitoring data are available and can be viewed within previous LAQM Reporting undertaken online at http://www.swansea.gov.uk/article/2850/Local-air-quality-management-reports

During August 2007, Vale INCO Europe commenced an abatement improvement program with the installation of particulate bag filters on the main high stack discharge point. Data is presented below from 2008-2013 representing the last 6 years of monitoring. Additional factors should be taken into account when viewing the monitoring data. Due to the economic downturn, Vale have operated in previous years or so at a reduced capacity primarily operating on one kiln. Whilst both the improved abatement techniques and reduced capacity are clearly seen within the data from the four monitoring stations within the City & County of Swansea's area, colleagues from Neath Port Talbot Borough Council have identified previously unrecognised local, and now deemed significant sources of nickel within Pontardawe. These sources within Pontardawe were previously being masked and have only now come to light due to the increased monitoring and analysis undertaken within the Swansea valley into ambient levels of nickel. This additional work is in part being driven by the Nickel in South Wales Review Group whose membership includes the Welsh Assembly Government (Policy and Technical Services Division), DEFRA, Environment Agency Wales, Ricardo AEA, National Physics Laboratory together with the relevant operators and local authorities.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and benzo (a) pyrene and, for ease of reference these are repeated below as table 2.3.4.7**.**

Pollutant	Target value ng/m^{-3}
Arsenic	6
Cadmium	5
Nickel	20
Benzo(a)pyrene	1

Table 2.3.4.7 - Target Values 4th Daughter Directive - Heavy Metals Monitoring

Significant changes have occurred to the heavy metals monitoring network within Swansea during 2013 and the early part of 2014. Due to recurring issues with the equipment deployed at the Glais School site and the imposed budget restrictions the authority is operating under, monitoring ceased at Glais School on the 1st April 2013. In addition, whilst the equipment remains operational at YGG Gellionnen, a decision has been taken that due to the costs of the heavy metals analysis previously funded by the authority that monitoring would cease in January 2014. Whilst regrettable, this decision at least enabled a full year of monitoring to be completed at YGG Gellionnen.

As previously mentioned, the full monthly datasets from each of the four heavy metal monitoring locations within the authority's area have been fully reported within previous reporting.

Nickel annual mean data for the **Coed-Gwilym Cemetery site** and the **Morriston Groundhog** site during 2015 is presented below within table 2.3.4.8 which, for completeness also details the nickel annual mean results from Glais and YGG Gellionnen stations during 2002 – 2013/14. All results are expressed in ng/m^{-3}

Table 2.3.4.8 to show Nickel Concentration

Year	* Glais Primary School	Coed-Gwilym Cemetery	** YGG Gellionnen	Morriston Groundhog
2002	**28.91**	-	-	-
2003	18.14	-	-	-
2004	**33.83**	-	-	-
2005	19.62	-	-	-
2006	**26.13**	-	-	-
2007	**28.04**	**37.31**	-	18.3
2008	10.34	19.61	10.99	7.6
2009	4.64	16.0	19.22	9.34
2010	7.0	10.48	15.0	15.28
2011	6.34	10.91	10.0	9.75
2012	6.79	8.51	6.04	5.64
2013	* 4.15	7.78	** 7.53	6.51
2014	-	12.39	-	9.38
2015	-	12.94	-	7.35
2016	-	10	-	5.9
2017	-	8.5	-	5.8

** Site ceased monitoring April 2013*

*** Site ceased monitoring January 2014*

From the data available within table 2.3.4.8 it is clear that nickel compliance has been achieved at all UK Network monitoring sites during 2017 and at all sites since 2008.

Annual mean data between 2008 and 2016 for **arsenic (As) and cadmium (Cd)** are presented below within table 2.3.4.9. All results are expressed in ng/m^{-3}

Table 2.3.4.9 to show Arsenic and Cadmium Concentration

Year	Glais Primary School		Coed-Gwilym Cemetery		YGG Gellionnen		Morriston Groundhog	
	As	Cd	As	Cd	As	Cd	As	Cd
2008	0.64	0.22	0.49	0.17	0.34	0.21	0.51	0.30
2009	0.52	0.15	0.61	0.20	0.59	0.16	0.87	0.30
2010	0.58	0.19	0.76	0.19	0.60	0.18	0.88	0.30
2011	0.50	0.23	0.50	0.17	0.44	0.19	0.78	0.33
2012	0.57	0.21	0.44	0.18	0.34	0.16	0.61	0.37
2013	*0.60	*0.19	0.62	0.22	0.52	0.24	0.83	0.51
2014	-	-	0.64	0.26	-	-	0.78	0.47
2015	-	-	0.53	0.14	-	-	0.65	0.27
2016	-	-	0.57	0.21	-	-	0.74	0.32
2017	-	-	0.56	0.28	-	-	0.81	0.43

*** Data capture 19%**

From table 2.3.4.9 above, it is clear that annual mean concentrations for arsenic and cadmium at all monitoring locations fall well below the 4th Daughter Directive Target Values.

Annual mean data from all monitoring stations between 2008 and 2017 for **lead** is presented within table 2.3.4.10 below**. All results are expressed in ng/m-3**

Table 2.3.4.10 to show Lead Concentration

Year	Glais Primary School ❷	Coed-Gwilym Cemetery ❸	YGG Gellionnen ❹	Morriston Groundhog ❺
2008	10.21	8.0	9.04	20.5
2009	7.27	10.2	10.06	17.4
2010	9.1	8.4	8.4	18.1
2011	9.95	7.88	8.38	21.40
2012	10.0	6.20	6.0	11.6
2013	* 14.09	10.47	8.15	15.38
2014	-	9.2	-	16.71
2015	-	6.0	-	13.86
2016	-	5.9	-	11
2017	-	5.3	-	9.4

***** Data capture 19%

From the data available within table 2.3.4.10, it is clear that annual mean concentrations for lead at all monitoring locations fall well below the 0.25ug/m3 required under the Air Quality (Amendment) (Wales) Regulations 2002 to be achieved by the 31st December 2008

PAH data analysis/ratification from the monitoring site within the compound of the 30m meteorological mast at Cwm Level Park, Landore has continued throughout 2017. Results of all compounds measured from 2007 to December 2017 can be found by following link at:

https://uk-air.defra.gov.uk/data/exceedence?f_group_id=19&action=exceedence&go=Step+1 - select the year i.e. 2017 and the pollutant of interest from the drop down list – each pollutant is displayed individually. The ability to download the monthly data exists via the “Download this data as CSV” link at the bottom right of the data table on display.

2.4 Summary of Compliance with AQS Objectives as of 2017

Swansea Council has examined the results from monitoring in the City and County of Swansea. Concentrations of PM10, SO_2 and Benzene are all below the Objectives, therefore no further action is required.

Swansea Council has examined the results from monitoring in the City and County of Swansea. Concentrations of Nitrogen Dioxide in some areas have been found to be close to the Objectives, therefore further investigation is required before deciding on whether action is necessary.

Swansea Council has examined the results from monitoring in the City and County of Swansea. Concentrations within the Swansea 2010 AQMA still exceed the Annual Mean for Nitrogen Dioxide. Therefore these AQMA should remain.

3. New Local Developments

3.1 Road Traffic Sources (& other transport)

The authority operates 52 GPRS traffic counters that have been configured to produce a vehicle classification split into the EUR 6 basic categories as detailed below within table 3.1.1. These tend to be within the lower Swansea Valley area in and around the Swansea AQMA 2010 but the last deployment has seen this provision expand into other areas, mainly around some of the busier major traffic junctions. Funding is being sought to once again expand this monitoring program but within the current financial climate, significant, rapid expansion is unlikely with any expansion more likely to reflect that seen during recent years with just the addition of two or three sites.

Table 3.1.1 – Table to show EUR 6 Basic Categories

Vehicle class:	Description
0	Unclassified vehicles
1	Motorcycles
2	Cars or light Vans
3	Cars or light Vans with Trailer
4	Heavy Van, Mini bus, L/M/HGV
5	Articulated lorry, HGV+Trailer
6	Bus

Figure 3.1.1 shows the locations for the traffic counters in Swansea.

Data from the ATC network has been analysed for the years 2006 – 2017 for the EUR6 classification employed that are required to produce the composition of flow; tables 3.1.2-3.1.6 below set out the basic statistics for the last four years and compares the percentage increase or decrease with 2017.

Table 3.1.2 to Show EUR6 Classification, AADT & AWDT for 2014

2014	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	1	94	0.2	4.4	0.2	0.2	**11496**	**12216**
Site 2	0	0.8	92.2	0.2	6.4	0.2	0.2	**14208**	**15240**
Site 3	0	0.6	93.9	0	5.4	0	0.2	**12984**	**13800**
Site 4	0	0.7	94.5	0	4.8	0	0	**9984**	**10608**
Site 5	0	1	92.8	0	5.9	0.3	0	**7344**	**7896**
Site 6	0	1.5	90.3	0.1	7.5	0.4	0.1	**16272**	**17208**
Site 7	2.5	0.8	91.3	0.1	4.9	0.1	0.2	**20400**	**21840**
Site 8	0	0	68.8	0	31.3	0	0		
Site 9	0	0.8	91.6	0.2	6.8	0.4	0.2	**12288**	**13032**
Site 10	0	0.6	93.2	0.8	4.5	0.2	0.6	**20184**	**21408**
Site 11	0	0.6	88.8	0	7.1	0	3.5	**4104**	**4296**
Site 12	0	0.7	93.8	0.1	5	0.1	0.2	**19392**	**20856**
Site 13	0	0.8	93.8	0.2	4.6	0.2	0.4	**12024**	**13560**
Site 14	0	1	91.9	0.3	5.9	0.3	0.6	**16656**	**17568**
Site 15	0	0.9	92.1	0.1	6	0.4	0.4	**22008**	**23400**
Site 16	0	0.7	93.7	0.1	5	0.2	0.3	**26256**	**27720**
Site 17	0	0.7	93.1	0.2	5.7	0.2	0.2	**29256**	**30936**
Site 18	0	1.4	90.4	0.4	6.4	0.4	1.1		
Site 19	0	0.8	90.2	0.1	5.7	0.2	3	**21120**	**22008**
Site 20	0	1.1	93.1	0.2	4.3	0.4	1	**31824**	**33600**
Site 21	0	0.7	91.8	0.2	6.9	0.2	0.2	**30288**	**32424**
Site 22	0	0.4	87.8	0	5.1	0.2	6.4	**10824**	**10920**
Site 23	0	0.6	92.8	0.1	5	0.2	1.3	**20904**	**22200**
Site 24	0	2.1	90.8	0	6	0.3	0.8	**9144**	**9792**
Site 25	0	0.9	91.5	0.2	6.2	0.4	0.9	**13512**	**14280**
Site 26	0	0.4	92.5	0.2	6.2	0.2	0.4	**22248**	**23616**
Site 27	0	0.4	93.5	0.7	4.7	0.2	0.4	**21528**	**22968**
Site 28	0	0.4	93.4	0.6	4.9	0.4	0.4	**12696**	**13488**
Site 29	0	0.7	92.4	0.2	5.2	0.2	1.2	**10080**	**10728**
Site 30	0	1	93.5	0.2	4.3	0.2	0.7	**20592**	**22032**
Site 31	0	0.8	93.8	0.2	4.7	0.2	0.3	**14424**	**14904**
Site 32	0	0.5	94.4	0.2	4.1	0	0.9	**15984**	**16920**
Site 33	0	0.7	93.4	0.1	4.6	0.2	1	**21408**	**22416**
Site 34	0	0.4	93.8	1.1	4.1	0.1	0.4	**17472**	**18576**
Site 35	0	1.5	91.4	0.2	5.7	0.4	0.9	**13104**	**13728**
Site 36	-	-	-	-	-	-	-		
Site 37	0	1.4	90.3	1.1	5.2	0.8	1.2		
Site 38	0	0.5	90.6	1.3	6.4	0.3	0.8	**8952**	**9600**
Site 39	4	1.2	89	0.1	4.5	0.3	0.9	**21840**	**22872**
Site 40	0	0.8	94.6	0	4.1	0	0.5	**9408**	**10008**
Site 41	0	0.6	95	0.3	3.2	0.3	0.6	**26160**	**27576**
Site 42	0	0.8	92.8	0.2	5.3	0.2	0.8	**15288**	**16392**
Site 43	0	1.2	91	0.4	5.9	1	0.4	**27600**	**30072**
Site 44	0	0.9	91.4	0.2	6.1	0.4	0.9	**12888**	**13704**
Site 50	0	1.4	93.9	0.7	3.6	0	0.4		
Site 51	0	0.9	93.5	0.2	4.3	0.4	0.8	**6696**	**6696**
Site 52	0	0.6	93.3	0.2	4.4	0.2	1.3	**31008**	**33048**
Site 53	0	0.7	93.9	0.4	4.5	0.1	0.3	**11520**	**12240**
Site 54	0	2.8	89.6	0.2	6.2	0.2	0.9	**21840**	**23040**
Site 55	0	0.5	90.7	0.3	7.1	1.1	0.3	**10392**	**10776**

Table 3.1.3 to Show EUR6 Classification, AADT & AWDT for 2015

2015	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	0.8	94.1	0.2	4.4	0.2	0.2	**11424**	**12144**
Site 2	0	0.7	92.3	0.2	6.6	0	0.2	**14112**	**15144**
Site 3	0	1.6	92.4	0	6	0	0	**13296**	**14160**
Site 4	0	0.7	94.4	0	4.9	0	0	**10368**	**11064**
Site 5	0	1	92.7	0	6	0.3	0	**7224**	**7704**
Site 6	0	1.3	90.3	0.1	7.6	0.4	0.1	**16152**	**17040**
Site 7	0	0.8	93.8	0.1	4.8	0.1	0.4	**20520**	**22008**
Site 8	0	2.2	67.4	1.1	27.2	1.1	1.1	**2208**	**2832**
Site 9	0	0.7	91.9	0.2	6.5	0.4	0.4	**13320**	**14184**
Site 10	0	0.6	93.2	0.3	4.5	0.2	1.1	**21192**	**22536**
Site 11	0	0.6	88.4	0	7.5	0	3.5	**4152**	**4368**
Site 12	4.8	0.7	89.1	0.1	4.7	0.1	0.4	**19872**	**21384**
Site 13	0	0.6	93.9	0.2	4.7	0.2	0.4	**11832**	**13320**
Site 14	0	1	92	0.1	6	0.1	0.7	**16416**	**17280**
Site 15	0	0.8	92	0.1	6.1	0.3	0.7	**21312**	**22752**
Site 16	0	0.7	93.4	0.1	5.3	0.2	0.4	**26424**	**27936**
Site 17	0	0.7	92.9	0.2	5.9	0.2	0.2	**29424**	**31152**
Site 18	0	1.1	90.9	0.8	6.1	0.5	0.8	**15864**	**16752**
Site 19	0	0.9	90.1	0.1	5.7	0.2	3	**20328**	**21144**
Site 20	0	1	93.2	0.2	4.2	0.4	1	**32640**	**34512**
Site 21	0	0.7	91.6	0.2	7.1	0.2	0.3	**30840**	**33000**
Site 22	0	0.5	87.5	0	5.5	0.2	6.4	**10560**	**10632**
Site 23	0	0.5	92.8	0.1	5	0.2	1.3	**22104**	**23520**
Site 24	0	2.3	90.3	0	6.3	0.3	0.8	**9192**	**9816**
Site 25	0	0.9	91.2	0.2	6.5	0.4	0.9	**13320**	**14088**
Site 26	0	0.4	92.3	0.2	6.4	0.2	0.4	**22248**	**23616**
Site 27	0	0.3	93.5	0.7	4.8	0.2	0.4	**21528**	**23016**
Site 28	0	0.4	93.5	0.6	5	0.2	0.4	**12552**	**13344**
*Site 29	0	0.6	92.4	0	5.2	0.3	1.5	**7920**	**8472**
Site 30	0	0.9	93.3	0.2	4.5	0.2	0.8	**20328**	**21768**
Site 31	0	0.7	93.6	0.2	5	0.2	0.3	**13968**	**14496**
Site 32	0	0.5	94	0.2	4.4	0	0.9	**15264**	**16176**
Site 33	0	0.6	93.3	0.1	4.7	0.2	1	**20736**	**21744**
Site 34	0	0.4	93.6	1.2	4.2	0.1	0.4	**16392**	**17448**
Site 35	0	1.2	91.7	0	5.4	0.4	1.2	**11928**	**12480**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0	2	86.8	0.8	7.5	1.3	1.6	**42888**	**44880**
Site 38	0	0.5	90.9	1.1	6.1	0.3	1.1	**8952**	**9600**
Site 39	0	1.2	92.9	0.1	4.7	0.3	0.9	**22536**	**23640**
Site 40	0	0.8	94.3	0	4.4	0	0.5	**9312**	**9912**
Site 41	0	0.4	96.5	0.3	3.1	0.2	0.4	**26808**	**28608**
Site 42	0	0.8	92.8	0.2	5.2	0.2	0.9	**15624**	**16728**
Site 43	0	1.2	90.7	0.5	6	1.1	0.5	**30216**	**32856**
Site 44	0	0.9	91.1	0.2	6.5	0.4	0.9	**12912**	**13728**
Site 50	0	1.4	94	0.7	3.6	0	0.4	**6720**	**6768**
Site 51	0	0.7	93.4	0.1	4.5	0.3	1	**32544**	**34872**
Site 52	0	0.6	93.5	0.2	4.2	0.2	1.3	**11424**	**12144**
Site 53	0	0.6	93.8	0.4	4.7	0.1	0.3	**22152**	**23424**
Site 54	0	2.8	89.7	0.2	6.4	0.2	0.7	**10440**	**10872**
Site 55	0	0.6	90.3	0.2	7.1	1.2	0.6	**20616**	**22104**
Site 56	0	0.5	93.5	0	6.1	0	0	**5136**	**5520**
Site 57	0	1.6	87.4	0	6.6	0.3	4.1	**7632**	**7392**

Table 3.1.4 to Show EUR6 Classification, AADT & AWDT for 2016

2016	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	1.7	93.4	0.2	4.4	0.2	0.2	**11544**	**12312**
Site 2	0	0.7	92	0.2	7	0	0.2	**14088**	**15168**
Site 3	0	1.1	92.8	0	6.1	0	0	**13440**	**14328**
Site 4	0	0.7	94.3	0	5	0	0	**10488**	**11160**
Site 5	0	1	92.5	0	6.2	0.3	0	**7392**	**7896**
Site 6	0	1.5	89.6	0.1	7.9	0.4	0.1	**16152**	**17016**
Site 7	4.1	0.7	89.6	0.1	5	0.1	0.4	**20040**	**21504**
Site 8	0	2.2	68.1	0	27.5	1.1	1.1	**2208**	**2832**
Site 9	0	0.7	91.8	0.2	6.4	0.3	0.5	**13824**	**14668**
Site 10	0	0.3	93.5	0.3	4.6	0.2	1	**21360**	**22752**
Site 11	0	0.6	88.1	0	7.9	0	3.4	**4248**	**4464**
Site 12	0	0.7	93.3	0.1	5.2	0.2	0.4	**20112**	**21696**
Site 13	0	0.6	93.8	0.2	4.8	0.2	0.4	**11952**	**13440**
Site 14	0	1	91.4	0.3	6.2	0.3	0.7	**16536**	**17400**
Site 15	0	0.8	92.1	0.1	6	0.1	0.8	**22224**	**23688**
Site 16	0	0.6	93.4	0.1	5.5	0.2	0.2	**26592**	**28248**
Site 17	0	0.6	92.8	0.2	6.1	0.2	0.2	**29688**	**31512**
Site 18	0	1.4	90.4	0.5	6.2	0.3	1.1	**15960**	**16848**
Site 19	0	0.8	90.5	0.1	5.7	0.2	2.7	**21192**	**22056**
Site 20	0	1	93.1	0.2	4.1	0.4	1.2	**34776**	**36864**
Site 21	0	0.7	91.4	0.2	7.3	0.2	0.3	**30720**	**32904**
Site 22	0	0.6	87.4	0.2	5.4	0.2	6.1	**11064**	**11112**
Site 23	9	0.4	82.3	0.1	7.1	0.2	0.9	**21984**	**23376**
Site 24	0	2.1	90.3	0	6.5	0.3	0.8	**9168**	**9816**
Site 25	0	0.9	90.9	0.2	6.8	0.5	0.7	**13368**	**14088**
Site 26	0	0.3	92.2	0.2	6.7	0.2	0.4	**22344**	**23736**
Site 27	0	0.4	93.1	0.8	5.1	0.2	0.4	**21744**	**23256**
Site 28	0	0.3	93.2	0.5	5.2	0.3	0.5	**8832**	**9360**
*Site 29	0	1	86.7	0.3	10.1	0.3	1.8	**9528**	**10200**
Site 30	0	0.9	92.8	0.1	5	0.2	0.9	**20352**	**21792**
Site 31	0	0.7	93.6	0.2	5	0.2	0.3	**13992**	**14544**
Site 32	0	0.3	93.8	0.2	4.6	0	1.1	**14784**	**15672**
Site 33	0	0.6	93	0.1	4.9	0.1	1.2	**19488**	**20568**
Site 34	0	0.4	93	1.2.	4.6	0.1	0.6	**16056**	**17064**
Site 35	0	1.2	91.2	0.2	5.7	0.4	1.4	**12192**	**12840**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0	1.8	86.9	0.9	7.6	1.2	1.6	**44424**	**46632**
Site 38	0	0.5	90.9	1	6.1	0.3	1.3	**9456**	**10176**
Site 39	0	1	93.2	0.1	4.7	0.3	0.7	**21696**	**22728**
Site 40	0	0.8	94.1	0	4.6	0	0.5	**9312**	**9936**
Site 41	0	0.5	95.4	0.3	3.2	0.2	0.5	**30120**	**32112**
Site 42	0	0.8	92.7	0.2	5.3	0.2	0.9	**15336**	**16368**
Site 43	0	1.2	90.7	0.5	5.9	1.2	0.5	**30768**	**33432**
Site 44	0	0.9	91.2	0.2	6.6	0.4	0.7	**13056**	**13848**
Site 50	0	1.4	94.0	0.7	3.5	0.0	0.4	**6792**	**6888**
Site 51	0	0.7	92.8	0.1	4.8	0.1	1.3	**32880**	**35232**
Site 52	0	0.7	93.2	0.2	4.4	0.2	1.3	**10896**	**11616**
Site 53	0	0.6	93.5	0.5	5	0.1	0.3	**21048**	**22224**
Site 54	0	2.4	90.3	0.2	6.2	0.2	0.7	**10944**	**11352**
Site 55	2.8	0.7	85.3	0.5	8	2	0.7	**19536**	**20928**
Site 56	0	0.5	93.4	0	6.1	0	0	**4752**	**5088**
Site 57	0	1.7	87.1	0	6.6	0.3	4.3	**8400**	**8208**
Site 58	0.2	1.8	94.4	0	3.2	0.2	0.2	**13344**	**13752**

Table 3.1.5 to Show EUR6 Classification, AADT & AWDT for 2017

2017	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0	0.8	94.1	0.2	4.4	0.2	0.2	**11304**	**12096**
Site 2	0	0.7	91.8	0.2	0.1	0	0.2	**14160**	**15240**
Site 3	0	1.1	92.5	0	6.2	0	0.2	**13152**	**14064**
Site 4	0	0.7	94	0	5	0	0.2	**10104**	**10800**
Site 5	0	1	92	0	6.7	0.3	0	**7200**	**7752**
Site 6	0	1.5	89.7	0.2	7.8	0.7	0.2	**14184**	**14904**
Site 7	0	0.7	93.7	0.1	5.1	0.1	0.2	**19344**	**20808**
Site 8	0	1.2	77	0	20.5	0.6	0.6	**3888**	**4392**
Site 9	0	0.7	91.6	0.2	6.6	0.5	0.5	**14616**	**15624**
Site 10	0	4.6	89.5	0.4	4.6	0.2	0.7	**19920**	**21312**
Site 11	0	0.6	88.8	0	7.9	0	2.8	**4296**	**4512**
Site 12	0	0.6	93.4	0.1	5.4	0.2	0.2	**19920**	**21552**
Site 13	0	0.4	94.1	0	4.9	0.2	0.4	**11856**	**13368**
Site 14	0	1	91.5	0.2	6.2	0.3	0.8	**14640**	**15360**
Site 15	-	-	-	-	-	-	-	**-**	
Site 16	0	0.6	93.2	0.1	5.7	0.2	0.2	**26328**	**27960**
Site 17	0	0.6	92.7	0.2	6.2	0.2	0.2	**29808**	**31560**
Site 18	0	1.2	90.1	0.7	6.4	0.3	1.2	**13896**	**14640**
Site 19	0	0.8	90.2	0.1	6.1	0.2	2.6	**21336**	**22320**
Site 20	0	1	93.2	0.2	4.1	0.4	1.2	**24704**	**36792**
Site 21	0	0.6	91.2	0.2	7.5	0.2	0.4	**30888**	**33072**
Site 22	6	0.7	81.8	0	5.8	0.2	5.6	**10824**	**10872**
Site 23	0	0.4	88	0.5	9.8	0.4	0.9	**20448**	**21840**
Site 24	0	2.2	90.1	0	6.7	0.3	0.8	**8904**	**9528**
Site 25	0	0.7	91.5	0.2	6.7	0.4	0.5	**13344**	**14136**
Site 26	18.8	0.3	74.7	0.2	5.4	0.2	0.4	**23712**	**25152**
Site 27	0	0.5	93	0.8	5.1	0.2	0.5	**21240**	**22680**
Site 28	0.3	0.7	92.1	0.3	5.9	0	0.7	**7248**	**7680**
Site 29	0	0.7	79.8	0.2	17.1	0.5	1.7	**9936**	**10656**
Site 30	0	0.9	92.6	0.1	5	0.2	1.1	**19584**	**21024**
Site 31	0	0.6	93.3	0.2	5.2	0.3	0.5	**15360**	**16104**
Site 32	0	0.5	93.1	0.2	4.7	0.2	1.3	**14208**	**15120**
Site 33	0	0.8	92.3	0.2	5.2	0.2	1.3	**14400**	**15192**
Site 34	0	0.5	92.6	1.4	4.7	0.2	0.6	**15216**	**16200**
Site 35	21.9	1	71.9	0	4.3	0.2	0.7	**10008**	**10608**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0	1.9	86.4	0.9	7.9	1.3	1.5	**44400**	**46728**
Site 38	0.2	0.9	93	0.2	4.7	0.4	0.6	**12720**	**13344**
Site 39	0.2	1	93.2	0.1	4.7	0.3	0.7	**21696**	**22728**
Site 40	0	0.8	94	0	4.7	0	0.5	**9192**	**9792**
Site 41	0	0.4	95.3	0.3	3.2	0.2	0.6	**30384**	**32520**
Site 42	0	0.8	92.5	0.2	5.6	0.2	0.8	**15096**	**16152**
Site 43	0	1.1	90.8	0.5	6	1.2	0.5	**31056**	**33744**
Site 44	0	0.7	91.4	0.2	6.8	0.4	0.5	**13128**	**14040**
Site 50	0	1.4	93.8	0.7	3.8	0.0	0.3	**6912**	**7008**
Site 51	0	0.7	92.5	0.1	5.1	0.1	14	**32928**	**35616**
Site 52	0	0.7	93.2	0.2	4.4	0.2	1.3	**11016**	**11784**
Site 53	0	0.5	93.5	0.4	5.1	0.1	0.3	**22152**	**23520**
Site 54	0	2.5	89.8	0.2	6.5	0.2	0.7	**10632**	**11040**
Site 55	1.8	0.6	86.5	0.6	8.8	1.2	0.6	**20520**	**21984**
Site 56	0	0.5	93	0	6.5	0	0	**4464**	**4800**
Site 57	0	1.5	87	0	6.9	0.3	4.2	**8016**	**7848**
Site 58	0.2	1.6	94.5	0	3.4	0.2	0.2	**13440**	**13872**
Site 60	0.0	0.9	91.9	0	7.2	0	0	**2688**	**2832**

Table 3.1.6 to Show % Difference AADT 2017 over previous years.

Site	AADT 2014	AADT 2015	AADT 2016	AADt 2017	% Diff 2017 over 2014	% Diff 2017 over 2015	% Diff 2017 over 2016
1	11496	11424	11544	11304	-1.67	-1.05	-2.08
2	14208	14112	14088	14160	-0.34	0.34	0.51
3	12984	13296	13440	13152	1.29	-1.08	-2.14
4	9984	10368	10488	10104	1.20	-2.55	-3.66
5	7344	7224	7392	7200	-1.96	-0.33	-2.60
6	16272	16152	16152	14184	-12.83	-12.18	-12.18
7	20400	20520	20040	19344	-5.18	-5.73	-3.47
8	-	2208	2208	3888	*	76.09	76.09
9	12288	13320	13824	14616	18.95	9.73	5.73
10	20184	21192	21360	19920	-1.31	-6.00	-6.74
11	4104	4152	4248	4296	4.68	3.47	1.13
12	19392	19872	20112	19920	2.72	0.24	-0.95
13	12024	11832	11952	11856	-1.40	0.20	-0.80
14	16656	16416	16536	14640	-12.10	-10.82	-11.47
15	22008	21312	22224	-	*	*	*
16	26256	26424	26592	26328	0.27	-0.36	-0.99
17	29256	29424	29688	29808	1.89	1.31	0.40
18	-	15864	15960	13896	*	-12.41	-12.93
19	21120	20328	21192	21336	1.02	4.96	0.68
20	31824	32640	34776	34704	9.05	6.32	-0.21
21	30288	30840	30720	30888	1.98	0.16	0.55
22	10824	10560	11064	10824	0.00	2.50	-2.17
23	20904	22104	21984	20448	-2.18	-7.49	-6.99
24	9144	9192	9168	8904	-2.62	-3.13	-2.88
25	13512	13320	13368	13344	-1.24	0.18	-0.18
26	22248	22248	22344	23712	6.58	6.58	6.12
27	21528	21528	21744	21240	-1.34	-1.34	-2.32
28	12696	12552	8832	7248	*	*	*
29	10080	7920	9528	9936	-1.43	25.45	4.28
30	20592	20328	20352	19584	-4.90	-3.66	-3.77
31	14424	13968	13992	15360	6.49	9.97	9.78
32	15984	15264	14784	14208	-11.11	-6.92	-3.90
33	21408	20736	19488	14400	*	*	*
34	17472	16392	16056	15216	-12.91	-7.17	-5.23
35	13104	11928	12192	10008	*	*	*
37	-	42888	44424	44400	*	3.53	-0.05
38	8952	8952	9456	9480	5.90	5.90	0.25
39	21840	22536	21696	12720	*	*	*
40	9408	9312	9312	9192	-2.30	-1.29	-1.29
41	26160	26808	30120	30384	16.15	13.34	0.88
42	15288	15624	15336	15096	-1.26	-3.38	-1.56
43	27600	30216	30768	31056	12.52	2.78	0.94
44	12888	12912	13056	13128	1.86	1.67	0.55
50	6696	6720	6792	6912	3.23	2.86	1.77
51	31008	32544	32880	32928	6.19	1.18	0.15
52	11520	11424	10896	11016	-4.38	-3.57	1.10
53	21840	22152	21048	22152	1.43	0.00	5.25
54	10392	10440	10944	10632	2.31	1.84	-2.85
55	18864	20616	19536	20520	8.78	-0.47	5.04
56	-	5136	4752	4464	*	-13.08	-6.06
57	-	7632	8400	8016	*	5.03	-4.57
58	-	-	13344	13440	*	*	0.72
60				2688	*	*	

*calculation not carried out due to data collection issues at the site

ATC site 15 was decommissioned in early 2017 due to the final infrastructure works being carried out to complete the Morfa Distributor Road; the ATC was reinstalled on the Morfa Distributor Road and given the ID site 60. The Morfa Distributor Road was referenced within the 2017 Progress Report, Section 5.2 (pg. 194). As stated within the report the road opened in early August 2017 and a reduction of 20% in traffic flow has been observed along sections of Neath Road; this has been commented upon in section 2.3.1 of this report.

The LAQM TG(16), table 7.1, defines the criteria for ‘Roads with significantly changed traffic flows’ as being a ‘25% traffic increase on roads >10,000 vehicles/day; table 3.5.1 shows that there are no roads identified, in 2017, exceeding the threshold. Sites 8 and 60 will be assessed in the 2018 report as the AADT will increase due to the effect of the Morfa Distributor and the Nowcaster System upon traffic flows in the area.

All the sites will continue to feed into the Nowcaster System and Highways Systems; assessment of flows will continue with a view to understanding traffic trends.

3.2 Industrial / Fugitive or Uncontrolled Sources / Commercial Sources

There have been no new Industrial Installations installed since the last assessment.

There are no new potential sources of fugitive or uncontrolled particulate matter since the last assessment.

Whilst the level of peer reviewed research into the effects of solid fuel burning is increasing the Smoke Control Areas of Swansea remain unchanged and Swansea Council will continue to monitor the level of complaints etc. received and investigate accordingly; domestic wood burners are referenced in section 3.4

3.3 Planning Applications

Table 3.3.1 To show the planning applications received in 2017 that could be of possible interest with regard to Air Quality Objective Concentrations.

App Ref No.	Location	Description
2016/3704/FUL	17-18 The Kingsway Swansea SA1 5JW	Construction of purpose built student accommodation building between 5-14 storeys for residential accommodation for students (up to 307 bedrooms) with ancillary communal facilities, cycle & bin stores, with ground floor commercial unit Retail (Class A1) and/or Restaurant (Class A3) and associated works following demolition of existing single storey restaurant building
2017/1628/FUL	Sainsbury's Quay Parade Swansea SA1 8JA	Re-positioning of CHP chimney further east on the rear elevation, relocation of the CHP unit 1 metre further away from the existing service yard access gates and demolition of existing brick wall to the north of the service yard access gate and rebuild (in brick), amendment to planning permission 2016/1673 (granted 20th March 2017)
2016/3619/FUL	12-24 Belle Vue Way Swansea SA1 5BY	Sub-division of existing ground floor to provide 4 retail units with new shop fronts and new residential entrance off Trinity Place Conversion of existing first and second floors into 1 and 2 bed apartments, addition of 2 new storeys to accommodate additional 1 and 2 bed apartments (total number of 36 self-contained apartments - 18 x 1 bed + 18 x 2 bed apartments) and associated fenestration alterations and external works.
2017/0387/FUL	1-17 Belle Vue Way, Swansea, SA1 5BZ	Change of use of first floor of units 1 to 17 Belle Vue Way to 8 apartments with associated works and fenestration alterations
2017/0648/OUT	Former St Davids Centre And Other Land North And South Of Oystermouth Road City Centre Swansea Swansea	Outline planning application (with all matters reserved) for the refurbishment, alteration and / or demolition of all existing buildings / structures on the site (except St Mary's Church and St David's Church) and redevelopment of site with indicative access / layout and scale parameters on the north site of a maximum of 1 to 7 storeys and maximum new floorspace of 84,050 sqm comprising retail / commercial

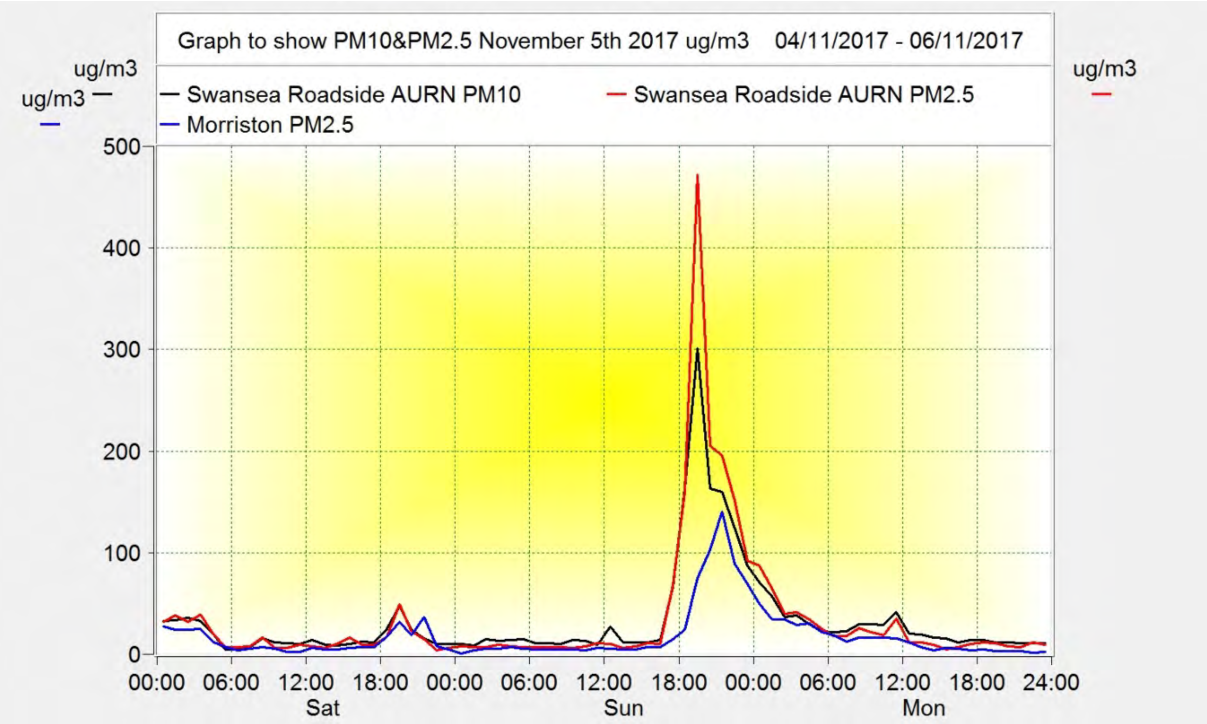
		/office use (Classes A1/A2/A3/B1) residential (Class C3), non-residential institution (Class D1) and leisure (Class D2), multi-storey car park and redevelopment of south site of a maximum of 40,700 sqm of floorspace comprising a new arena (Class D2), up to 13 storey hotel / residential building (Class C1/ C3), food and drink (Class A3), undercroft car park, potential energy centre. Across both sites, the provision of associated new public open space / public realm and landscaping, new pedestrian and vehicular access and servicing arrangements (including a pedestrian bridge link across Oystermouth Road), provision of new bus stops on Oystermouth Road, new pedestrian access through existing arches along Victoria Quay, relocation of Sir H Hussey Vivian statue, earthworks, and plant
2017/0986/FUL	Former Civic Centre Penllergaer Swansea SA4 9GH	Construction of 80 no. residential units with associated access and landscaping
2017/1096/PRE	20 Princess Way Swansea SA1 3LW	PRE-APP Demolition of existing buildings and erection of a mixed use development with commercial use at ground floor level and 50 flats above
2017/1231/FUL	Fforest Mill Garden Centre Pontarddulais Road Cadle Swansea SA5 4BA	Redevelopment of the site to provide a drive-thru restaurant (Class A3) with associated car parking, access, landscaping and ancillary works
2017/1429/FUL	Former Cape Horner Public House Miers Street St Thomas Swansea SA1 8BZ	Demolition of existing structure and construction of a 3 storey building to provide 72 bedroom student accommodation units (studios & cluster flats), access from Miers Street, landscaping and car & cycle parking
2017/2259/FUL	Bridge Centre 150 Neath Road Landore Swansea SA1 2BD	Change of use from offices to a 9 bedroom hostel with bar
2017/2572/FUL	Pines Country Club 692 Llangyfelach Road Treboeth Swansea SA5 9EL	Mixed-use development comprising 28 residential dwellings and two commercial units (Class A1)
2017/2677/FUL	Land At Heol Ddu Farm Birchgrove	Mixed-use development comprising 23 residential dwellings and Coffee Shop

	Road Birchgrove Swansea SA7 9NS	with Drive Through Facility and associated works
2017/2610/FUL	Plots A15 & A16 Langdon Road SA1 Swansea Waterfront Swansea	Construction of two/ three storey private hospital (Class C2) with undercroft and surface car parking, service yard and associated access, infrastructure and landscaping works

3.4 Other Sources

During Bonfire night, PM monitors in Swansea often record elevated concentrations as a result of Firework displays in the city. Figure 3.4.1 shows the peaks recorded for 2017.

Figure 3.4.1 – Graph to show PM10 and PM2.5 on the 5th November 2017



Swansea Council's Building Control team also record the HETAS documentation that is received after an approved installer has carried out an installation. The detail recorded by the Building Control team refers to the number of notifications received, the information can be seen in table 3.4.1.

Table 3.4.1 to show Number of HETAS Notifications received 2013-2017

Year	Number of Notifications
2013	447
2014	445
2015	450
2016	425
2017	390

As the information in table 3.4.1 shows the number of notifications received over the last few years has been relatively consistent however, a small decline has been observed in the last two years. Given the research work ongoing into the effects of wood burning Swansea Council will continue to monitor PM concentrations and keep up to date with research as and when it is published.

Swansea Council has identified the following new local developments which may impact on air quality in the Local Authority area.

- Former Cape Horner Public House Miers Street St Thomas Swansea SA1 8BZ. Planning Ref: 2017/1429/FUL. Air Quality Assessment can be found in Appendix E

These will be taken into consideration in the next Annual Progress Report.

4. Polices and Strategies Affecting Airborne Pollution

4.1 Local / Regional Air Quality Strategy

Non-applicable

4.2 Air Quality Planning Policies

The Council submitted the Swansea Local Development Plan 2010-2025 (the 'LDP') to the Ministers of the Welsh Government for independent examination on 28 July 2017. Following formal acceptance of the submitted Swansea LDP on 4 August 2017, the Ministers of the Welsh Government have appointed Inspectors **Rebecca Phillips** BA(Hons) MSc DipM MCIM MRTPI and **Paul Selby** BEng (Hons) MSc MRTPI to conduct the independent examination to assess the soundness of the LDP. Rebecca Phillips has been appointed as the Lead Planning Inspector and Paul Selby as the Assistant Planning Inspector. On completion of the Examination, the Inspector will issue a Report for the Council giving recommendations for action which will be binding on the Council.

At a Council meeting on 25th October Elected Members recommended to approve a statutory public consultation on the Deposit LDP arising from the examination. Tables 4.2.1 and 4.2.2 below shows the two policies for Air and Noise contained within the LDP; the Inspector's report is anticipated on 10th January 2019.

Table 4.2.1 – RP2A. Noise Pollution

RP 2A: ~~AIR~~, NOISE ~~AND LIGHT~~ POLLUTION
Where development could lead to exposure to a source of ~~air~~, noise ~~or light~~ pollution it must be demonstrated that appropriate mitigation measures will be implemented, and incorporated into the design of the development to minimise the effects on existing and future occupants. Noise sensitive developments will not be permitted unless effective/appropriate mitigation is carried out to prevent exposure ~~where exposure~~ to existing noise generating uses ~~could occur~~. Development which would cause or result in a significant increase in levels of environmental noise in an identified ~~Quiet Area~~ Noise Action Planning Priority Area, or would have unacceptable impacts on an identified Quiet Area or the characteristics of tranquillity that led to the designation of a Quiet Area, will not be permitted.

Table 4.2.2 – RP2A. Air and Light Pollution

RP 2B: AIR, ~~NOISE~~ AND LIGHT POLLUTION Where development could lead to exposure to a source of air ,~~noise~~ or light pollution it must be demonstrated that appropriate mitigation measures will be implemented, and incorporated into the design of the development to minimise the effects on existing and future occupants. ~~Noise sensitive developments will not be permitted where exposure to existing noise generating uses could occur. Development which would cause or result in a significant increase in levels of environmental noise in an identified Quiet Area, or would have unacceptable impacts on the characteristics of tranquillity that led to the designation of a Quiet Area, will not be permitted.~~

4.3 Local Transport Plans and Strategies

LAQM.TG(16) paragraphs 4.30 – 4.31 indicates guidance on the inclusion within Progress Reports to those measures within the Local Transport Plan (LTP) that specifically relate to bringing about air quality improvements. Within Wales, the LPT had been replaced with the Regional Transport Plan (RTP). The South West Wales Integrated Transport Consortium (SWWITCH) was one of the four transport consortia in Wales which were required to produce a Regional Transport Plan. The SWWITCH consortia region relevant to the City & County of Swansea included a partnership with the neighbouring authorities of Neath Port Talbot County Borough Council, Carmarthenshire County Council and Pembrokeshire County Council. Unfortunately, the Welsh Assembly withdrew funding for the consortia from the end of the 2013/14 financial year. All staff had been redeployed following the withdrawal of funding. However, the Welsh Assembly Government reverted back to Local Transport Plans for 2015-2020. The new Local Transport Plan was adopted in January 2015. Details of the adopted plan can be found at http://www.swansea.gov.uk/localtransportplan An annual progress report was submitted to the Welsh Government in January 2016, details of which are reproduced within Appendix B.

4.4 Active Travel Plans and Strategies

The Active Travel (Wales) Act (2013) places a legal duty upon local authorities in Wales to map, plan for and promote active travel journeys.

The Active Travel (Wales) Act is a landmark piece of Welsh legislation brought forward in 2013 which aims to make it easier for people to walk and cycle in Wales, specifically to promote walking and cycling as viable modes of transport for everyday journeys such as to the shops, work or college.

The Integrated Network Map - *Approved by the Welsh Government in February 2018*. This map show the routes which the Council intends to deliver over the next fifteen years (up to 2033) https://www.swansea.gov.uk/media/25625/Integrated-Network-Map-Consultation-Report/pdf/Integrated_Network_Map_Consultation_Report_-_October_2017_3.pdf .

The Existing Route Map and Integrated Network Map will be reviewed and updated periodically in conformity to the requirements of the Act.

The Council also prepares annual reports which are submitted to the Welsh Government to monitor the costs and use of Active Travel within the City & County of Swansea. These reports can also be found in the downloads section https://www.swansea.gov.uk/activetravelact

4.5 Local Authorities Well-being Objectives

The Swansea Public Services Board Assessment of Local Well-being 2017 included Outcome F1: The Natural Environment is Healthy and Resilient. Table 4.5.1 shows the summary.

Table 4.5.1 – Outcome F1

F1: The natural environment is healthy and resilient

Evidence:	State of Natural Resources Report (SoNaRR) [NRW]
	Swansea Local Biodiversity Action Plan [SBP]
	The State of Nature report 2016 [RSPB]
	LANDMAP [NRW]
	RIGS (Geological/Geomorphological Sites) audit [CCS]
	Open Spaces Assessment [CCS]
	AONB Management Plan [CCS]
	Percentage of water bodies achieving good or high overall status (NI45) [NRW]
	Swansea Air Quality Progress Report 2016 and air quality data [CCS]
	Tawe Trial Community Consultation Project Report [SEF]
	Swansea Environment Strategy Progress Review 2016 [SEF]
Well-being score and summary:	**5** - Certain aspects of our natural environment are in a positive situation but the continuing loss of biodiversity and accessible greenspace, along with the ecological status of our waterbodies and poor air quality in some areas, give serious cause for concern as these are likely to have an adverse impact on everyone's well-being. Ecosystem services need to be recognised and utilised more effectively and sustainably to ensure wellbeing can be improved now and sustained in the future.
Note: Public Consultation (Feb-17)	• The consultation draft suggested that the score should be a 5. The average score given by the public was 5. • The main issue cited within this driver was the protection of green spaces and natural assets.

https://www.swansea.gov.uk/media/19869/Swansea-Public-Services-Board---Assessment-of-Local-Well-being-2017/pdf/Final_Swansea_PSB_Well-being_Assessment_2017.pdf

Swansea Council's Corporate Plan 2018-2022 sets out the priorities:

- **Safeguarding** people from harm - so that our citizens are free from harm and exploitation
- Improving **Education and Skills** - so that every child and young person in Swansea gains the skills and qualifications they need to succeed in life
- Transforming our **Economy and Infrastructure** - so that Swansea has a thriving mixed use City Centre and a local economy that will support the prosperity of our citizens

- **Tackling Poverty** - so that every person in Swansea can achieve his or her potential
- Maintaining and enhancing Swansea's **natural resources and biodiversity -** so that we maintain and enhance biodiversity, reduce our carbon footprint, improve our knowledge and understanding of our natural environment and benefit health and well-being
- **Transformation and Future Council** development - so that we and the services that we provide are sustainable and fit for the future.

Air quality, pollution and green infrastructure are referenced within the Transforming our Economy and Infrastructure and Maintaining and Enhancing Swansea's Natural Resources and Biodiversity https://www.swansea.gov.uk/corporateimprovementplan

4.6 Green Infrastructure Plans and Strategies

The Council submitted the Swansea LDP 2010-2025 to the Ministers of the Welsh Government for independent examination on 28 July 2017; contained within the LDP is policy ER 2.

Table 4.6.1 – Strategic Green Infrastructure Network

ER 2: STRATEGIC GREEN INFRASTRUCTURE NETWORK Development will be required to maintain or enhance the extent, quality and connectivity of the County's multi-functional green infrastructure network, and where appropriate: i. Create new interconnected areas of green infrastructure between the proposed site and the existing strategic network; ii. Fill gaps in the existing network to improve connectivity; and/or iii. In instances where loss of green infrastructure is unavoidable, provide mitigation and compensation for the lost assets.

4.7 Climate Change Strategies

Climate change was highlighted in the Swansea Environment Strategy: Time to Change, which was published by Swansea Environmental Forum (SEF) in 2006.

In 2008, both carbon management and climate change adaptation were chosen by SEF as two of the five issues which it believed were too difficult to progress without greater prioritisation and wider collaboration. In 2010, SEF initiated a carbon management task to develop proposals for a new project which would seek to measure and reduce the carbon footprint for Swansea, and promote low carbon initiatives.

The Low Carbon Swansea project was established in 2011 with the following aim:

To develop a coordinated, integrated and sustainable approach to reducing carbon emissions across all sectors in the City and County of Swansea area

The Project's primary goal was to see a measurable reduction of carbon emissions level to or exceeding national targets. The Project outputs included:

- the establishment of a new carbon management partnership that meets on a regular basis;
- an audit of existing low carbon activity in Swansea;
- a new energy or carbon management action plan for Swansea;
- a programme of seminars, training workshops and public events to raise awareness of climate change, to increase understanding of the opportunities for and benefits of reducing carbon emissions and to encourage greater collaboration towards a Low Carbon Swansea;
- a significant increase in the number of low carbon projects and carbon reduction activities in Swansea and
- a notable increase in inward investment for carbon reduction initiatives in Swansea.

The initiative was adopted as a Swansea Local Service Board project and received grants from Environment Agency Wales (now Natural Resources Wales) and the Welsh Government (EU-funding), which enabled SEF to employ a project manager for two years from April 2012. A Low Carbon Swansea Partnership was formed, initially involving representatives of LSB bodies and other major public sector organisations. Early on, the partners provided data for a carbon foot printing baseline study, which was commissioned in collaboration with Carbon Trust Wales.

The core activity of the partnership is the organisation of networking and training events (usually held on a quarterly basis) to facilitate information exchange and encourage collaboration between organisations. Low Carbon Swansea has also helped initiate working groups of its members to explore the promotion and expansion of electric vehicles in Swansea, support travel planning and to explore opportunities for district heating schemes in the area.

A second tranche of data was collected from partners in 2014 and an independent project evaluation undertaken (available from the website). As the grant funding drew to an end, key members of the partnership contributed funding as an interim measure to support a transition of the project to a membership funded initiative. Since April 2015, the project has been fully funded through membership fees and event sponsorship. The membership of the network was widened in 2014 to include large commercial organisations and subsequently opened-up fully to all organisations across a wider regional base. In 2016, it became Low Carbon Swansea Bay.

Swansea Environmental Forum continues to support the Low Carbon Swansea network and take the lead in encouraging collaboration between organisations and different sectors to address carbon management and climate change issues.

Climate change has is now included with Outcome F: People Have Good Places to Live, Work and Visit of Swansea's Assessment of Local Well-being 2017. The Primary driver F3: People live in resilient and environmentally sustainable communities includes the secondary driver F3.3: Improve resilience to climate change. The document can be accessed by the following link http://www.swansea.gov.uk/media/19869/Swansea-Public-Services-Board---Assessment-of-Local-Well-being-2017/pdf/Final_Swansea_PSB_Well-being_Assessment_2017.pdf

Swansea Council's LDP submission document also includes policy and proposals regarding Climate Change.

ER1: CLIMATE CHANGE

To mitigate against the effects of climate change, adapt to its impacts, and to ensure resilience, development proposals should take into account:

- **i.** Reducing carbon emissions;
- **ii.** Protecting and increasing carbon sinks;
- **iii.** Adapting to the implications of climate change at both a strategic and detailed design level;
- **iv.** Promoting energy and resource efficiency and increasing the supply of renewable and low carbon energy;
- **v.** Avoiding unnecessary flood risk by assessing the implications of development proposals within areas susceptible to flooding and preventing development that unacceptably increases risk, and
- **vi.** Maintaining ecological resilience.

The full document can be accessed via the following link
https://www.swansea.gov.uk/media/17120/Deposit-LDP---June-2016/pdf/Deposit_LDP_Consultation_-__FINAL_JULY_2016.pdf

5. Conclusions and Proposed Actions

5.1 Conclusions from New Monitoring Data

Data has revealed that exceedences of the annual mean Objective Concentration for NO_2 are now only been recorded within the existing AQMA. The exceedences at sites 340 and 409 are not deemed appropriate for the annual mean exposure and are not in exceedence of the hourly mean Objective Concentration. Four of the five Diffusion Tube sites that are in excess of 37µgm^{-3} are located within the existing AQMA and will continue to be address within the Action Plan. The remaining site exceeding 37µgm^{-3} is located on a residential property on the outbound section of Fabian Way; this site has been either side of the annual mean Objective Concentration over the last few years but has reduced from 46.12µgm^{-3} to 38.37µgm^{-3} , this site will continue to be assessed as part of the ongoing LAQM work in Swansea.

Data, for 2017, indicates that concentrations have reduced from 2016 and are back to exhibiting a downward trend from 2013. Swansea Council will continue to monitor NO_2 diffusion tube sites in excess of 30µgm^{-3} along with the real-time monitors within the network.

5.2 Conclusions relating to New Local Developments

The application 2017/1429/FUL for the 'Former Cape Horner Public House Miers Street St Thomas Swansea SA1 8BZ' has been commented upon and all applications received with potential impacts on Air Quality will be considered in line with current Planning Polices and the future LDP policies.

5.3 Proposed Actions

The 2017 dataset has not indicated any new areas of non-compliance with the Swansea Council are and so no new AQMA's will need to be declared. Given the downward trend shown over the last few years Swansea Council will be looking forward to potentially reviewing AQMA boundaries over the next few years.

Swansea Council will be preparing their Air Quality Action Plan for public consultation in by April 2019.

References

i. City & County of Swansea Progress Report 2006
ii. City & County of Swansea Updating & Screening Assessment 2006
iii. City & County of Swansea Progress Report 2007
iv. City & County of Swansea Progress Report 2008
v. City & County of Swansea Updating and Screening Assessment 2009
vi. City & County of Swansea Progress Report 2009
vii. City & County of Swansea Progress Report 2010
viii. City & County of Swansea Progress Report 2011
ix. City & County of Swansea Updating and Screening Assessment 2012
x. City & County of Swansea Progress Report 2013
xi. City & County of Swansea Progress Report 2014
xii. City and County of Swansea Updating and Screening Assessment 2015
xiii. Technical Guidance LAQM.TG(16)
xiv. Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138)
xv. Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298)
xvi. Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedances of the 1-hour mean AQS Objective AEAT/ENV/R/264 Issue 1 May 2008

Appendices

Appendix A: Monthly Diffusion Tube Monitoring Results

Table A.1 – Full Monthly Diffusion Tube Results for 2017

Site ID	NO2 Mean Concentrations (µg/m3)														
													Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (factor) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
4	45.00	41.20	39.90	35.10									40.30	21.90	
5	60.50	43.30	39.30	42.50	32.60	24.20	26.80	30.90	33.50	33.90	48.00	44.20	38.31	28.35	
6	41.10	36.00	33.70	32.20	22.40	26.90	23.60	26.50	26.40	31.00	38.10	36.80	31.22	23.11	
7	63.00	62.00	62.80	50.40	48.00	48.20	42.70	47.90	46.50	49.10	55.20	57.50	52.78	39.05	
8	57.40	51.50	56.70	51.70	48.10	34.80	35.70	40.70	38.60	40.50	59.20	46.70	46.80	34.63	
9	52.00	29.20	27.50	34.70									35.85	27.49	
10	45.90	31.90	31.00	27.20	25.30	20.10	17.70	21.70	22.60	25.60	36.50	31.80	28.11	20.8	
11	56.30	46.40	48.40	39.40	43.60	30.00	28.00	33.90	35.00	38.90	48.90	42.90	40.98	30.32	
12	71.60	43.80	39.50	47.60	42.70	40.80	40.20	41.90	43.50	39.30	63.30	50.20	47.03	34.80	
13	47.30	37.50	34.20	36.50	9.40	23.70	23.80	26.30	29.10	24.80	37.30	36.20	30.51	22.58	
14	47.10	30.30	29.00	28.20	28.60	13.70	14.10	19.00	21.50	21.10	32.00	32.30	26.41	19.54	
15	39.10	34.20	29.80	30.10	26.40	19.60	19.80	35.70	23.50	23.20	39.90	37.10	29.87	22.10	
16	51.50	39.70	38.50	41.80			22.70	26.60	28.10	30.60	43.00	37.50	36.00	26.64	
18	74.90	59.10	63.10	50.20	56.70	10.00	38.90	40.50	43.30	49.90	58.30	56.00	50.08	37.09	
19	52.30	54.00	58.30	61.50	48.70	38.60	56.10	45.80	51.00	51.90	63.30	39.50	51.75	38.29	
20	60.80	44.20	43.90	35.70	36.90	29.00	25.80	31.50	35.30	42.70	51.70	46.90	40.37	29.87	
21	48.90	42.00	38.30	30.20									39.85	18.79	
22	53.20	40.70	41.80	32.40	31.70	30.00	28.70	26.10	30.50	37.70	37.60	43.90	36.19	26.78	
23	39.80	33.00	40.40	30.90	28.90	23.00	25.00	27.20	27.00	35.00	46.00	37.40	32.80	24.27	
25	55.20	33.70	34.10	26.70									37.43	18.64	
26	47.10	37.00	50.10	42.50	42.20	32.60	29.30	32.20	34.10	37.00	48.90	46.00	39.92	29.54	

Site ID	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)]
27	60.60	47.90	43.40	43.50	41.70	30.20	28.90	29.70	25.20	36.80	47.10	40.60	39.63	29.33	
28	46.30	33.40	37.30	33.90									37.73	17.05	
29	70.40	54.80	60.50	38.20	29.90	29.50	25.60	26.20	31.60	34.30	44.10	43.70	40.73	30.14	
31	52.00	40.70	37.10	26.70	32.30	26.00	25.10	28.90	29.40	30.40	42.80	38.70	34.17	25.29	
32	51.70	44.30	40.00	35.60	36.80	30.40	29.80	30.40	27.80	32.10	41.50	33.10	36.12	26.73	
33	51.60	40.10	37.50	37.70	31.30	28.00	23.30	29.20	26.90	34.10	48.50	43.80	36.00	26.64	
34	44.90	36.80	35.90	28.20									36.45	19.8	
35	55.00	47.00	41.40		31.10	30.90	27.60	29.50	31.20	36.60	47.30	35.00	37.51	27.76	
36	51.70	41.00	37.20	35.20	28.00	21.60	16.90	25.80	29.80	31.20	44.70	39.90	33.58	24.85	
40	46.60	33.20	32.30	29.00	23.10	22.40		23.60	25.40	28.00		34.50	29.81	22.06	
41	45.80	42.60	40.00	32.80	33.90	28.70	25.40		32.80		43.60		36.18	26.77	
43	59.00	44.20	43.60	40.40	33.60	29.80		28.60	33.00	38.90	33.60	40.70	38.67	28.62	
44	47.20	37.80	38.60	24.40	26.50	28.20	24.60	27.20	28.20	32.40	34.00	37.80	32.24	23.86	
45	45.70	34.60	32.50	31.00	29.60	15.60	22.80	25.60	29.20	23.70	46.40	40.80	31.46	23.28	
48	38.10	27.10	27.90	6.70	20.60	17.40	15.80	20.00	21.80	24.30	33.10	30.00	23.57	17.44	
50	57.80	49.20	42.80	39.80	35.90	34.60	31.00	34.30	34.40	40.50	48.30	50.40	41.58	30.77	
54	42.70	42.10	42.90	35.50	32.20	35.30	28.70	32.10	32.60	34.40	31.90	41.10	35.96	26.61	
55	48.30	46.90	40.00	28.30	31.80	27.40	25.60	29.70	29.70	35.70	39.50	37.40	35.03	25.92	
56	61.90	48.80	54.90	45.20	34.40	35.30	37.00	32.70	37.80	45.10	55.30	48.20	44.72		**15.84**
58	57.30	44.30	49.50	46.30	37.60	31.30	31.10	35.90	39.90	44.10	49.40	50.50	43.10		**27.38**
59	72.10	62.20	56.70	62.80	54.10	36.50	41.10	43.10	45.80	46.70	59.80	61.30	53.52	29.60	
60	53.20	41.90	43.60	32.70	39.50	26.20	21.50	29.10	28.80	31.90	39.00	40.50	35.66	26.39	
61	49.00	47.50	43.50		38.90	29.50	26.20	26.40	29.50	37.90	43.70	43.00	37.74	27.92	
63	43.90	28.70		24.40	21.30	21.60	18.60	20.60	24.00	22.80	37.00	33.10	26.91		16.50
64	73.30	62.10	54.00	37.60	45.40	44.20	38.10	43.80	43.60	44.00	68.10	54.40	50.72		26.94
65	45.90	35.60	34.70	28.50	26.60	20.50	18.20	21.50	24.80	26.90	31.90	32.70	28.98	21.45	
66	42.70	36.60	31.90	35.70	26.50	23.40	25.00	30.00	26.60	30.00	46.00	36.90	32.61	24.13	

Site ID	NO_2 Mean Concentrations (µg/m^3)														
													Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (factor) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
67	64.60	52.90	53.90	50.70	46.70	42.50	38.30	46.50	46.00	54.30	66.60	61.40	52.03		32.41
68	50.70	43.90	41.90	38.00	37.40	37.90	31.50	33.40	31.80	36.30	39.70	37.10	38.30	28.34	
69	70.00	45.40	51.00	51.20	38.80	40.00	31.30	37.70	43.00	44.30	53.80	57.00	46.96		30.71
70	44.00	37.30	38.10	30.30	30.10	26.80	22.30	28.00	26.70	30.90	48.20	33.70	33.03		20.20
71	51.90	33.80	31.40	29.20	25.10	21.30	21.74	26.50	26.50	29.90	32.50	40.90	30.90		17.98
72	39.70	32.10	26.60										32.80	16.05	
73	48.90	36.40	35.00	28.30									37.15	20.18	
74	45.30	22.30	26.80	23.20									29.40	15.97	
75	59.00	51.70	48.30	37.60	39.20	37.30	32.40	34.80	27.90	41.40	41.80	42.00	41.12	30.23	
76	45.80	37.00	31.50	28.50									35.70	19.40	
78	47.20	35.00	29.60	28.40									35.05	19.04	
79	46.80	39.00	35.90	28.40									37.53	20.39	
83	50.80	33.10	31.10	30.70	29.60	23.80	22.70	25.20	25.30	28.80	38.30	31.40	30.90	22.87	
84	49.80	40.60	46.00	35.40	32.60	35.30	26.90	33.60	31.80	35.90	41.40	37.10	37.20	27.53	
85	50.60	45.40	48.90	37.60	34.00	34.10	27.30	36.50	34.70	39.50	38.30	45.20	39.34	29.11	
86	50.50	35.50	35.60	28.80	26.20	23.10	19.60	23.20	23.70	28.60	37.30	34.80	30.57	22.63	
87	38.30	26.20	23.00	26.50	17.50	15.00	18.60	16.40	19.10	20.60	29.90	26.20	23.11	17.10	
88	53.30	39.50	35.60	36.70	27.60	26.30	23.90	32.40	32.60	32.80	40.30	41.70	35.22	26.07	
89	34.10	28.40	26.00	22.60	23.10	17.70	20.90	21.40	22.10	21.50	27.20	27.50	24.38	18.04	
90	48.00	41.20	39.80	31.80	34.30	31.00	24.10	25.40	26.40	31.40	30.00	34.60	33.17	24.54	
91	53.30	40.60	39.80	35.90	31.90	24.00	24.60	29.30	30.10	31.30	42.80	29.40	34.42	25.47	
92		31.20	32.70	31.40									31.77		19.76
93	41.90	32.00	40.50	26.30									35.18	19.11	
94	40.20	35.70	34.70	28.30	29.00	24.50	22.30	24.50	28.20	29.30	42.30		30.82	22.81	
95	34.90	31.80	28.70	29.30	20.40	18.70	19.70	30.90	32.70		36.00	31.90	28.64	21.19	
96	49.20	27.40	32.50	28.40	25.70	24.60	23.00	25.70	25.90	31.20	38.20	29.40	30.10	22.27	
97	54.40	41.90	45.30	40.90	36.20	27.50	28.00	32.20	31.50	33.10	48.80		38.16	28.24	

Site ID	NO_2 Mean Concentrations (µg/m^3)														
													Annual Mean		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (factor) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
98	66.50	42.70	45.60	36.80	32.60	26.20	25.90	23.40	26.40		43.30		36.94	27.34	
99	51.90	39.60	39.70	40.10	39.80	21.40	24.50	30.80	32.70	31.20	49.50	37.10	36.52	27.03	
100	44.90	34.40	30.10	24.70									33.53	18.22	
101	49.60	37.80	29.90	26.70									36.00	19.56	
102	55.40	41.30	37.90	33.40		24.40	23.90	28.60	28.80	32.00	44.10	45.60	35.95	26.60	
104	49.70	35.00	31.20	29.00	26.90	21.50	17.70	22.80	25.00	28.30	35.10	35.30	29.79	22.05	
107	51.70	40.30	42.00	32.70	28.30	29.40	24.90	29.90	30.30	34.20	41.60	39.50	35.40	26.20	
108	52.10	28.30	32.20	28.60									35.30	19.18	
109	47.30	25.80											36.55	16.54	
110	46.80	27.10	28.80	30.40	22.50	17.20	18.00	20.50	24.60	22.30	41.20	33.20	27.72	20.51	
111	55.60	39.70	30.00	36.40	27.00	19.40	22.80	27.50	24.90	26.60	48.40	40.80	33.26	24.61	
114	43.30	39.90	39.00	29.80	33.20	32.20	26.30	28.50	25.50	33.70	6.80	34.70	31.08	23.00	
115	62.60	42.40	52.50		48.00	38.20	30.60	29.70	31.60	40.30	41.20	38.30	41.40	30.64	
116	61.70	51.90	54.20	42.70	45.30	42.40	33.50	35.30	38.80	41.60		45.00	44.76	33.13	
117	56.90	49.60	42.50	40.40	40.50	29.80	29.50	33.70	32.20	40.50	45.90	46.50	40.67	30.09	
118	47.70	41.10	37.90	32.00	33.90	27.70	24.30	22.30	28.00	33.20	35.90	38.80	33.57	24.84	
119	45.10	45.80	44.50	36.40	37.00	29.80	28.90	29.70	31.80	38.40	42.40	42.90	37.73	27.92	
120	66.30	56.00	54.60	47.40	52.40	39.30	37.50	43.60	42.90	51.70	42.00	45.50	48.27	35.72	
121	62.90	56.70	54.70	55.60	51.20	47.70	44.60	46.00	45.80	48.60	54.10	58.10	52.17	38.60	
122	48.40	40.60	32.20	37.10	36.00	27.40	22.90	29.50	30.50	32.80	43.50	39.10	35.00	25.90	
123	61.40	51.60	56.40	53.90	50.70	45.70	37.90	42.00	32.50	45.80	51.60	55.80	48.78	36.09	
124		47.10	46.10	46.80		38.10	34.10	36.40		42.40	54.00	49.20	43.80	32.41	
125	54.20	49.20	56.00	62.90	52.60	43.20	35.10	44.90	41.00	51.60	68.80	61.40	51.74		32.04
126	46.10	37.50	43.30	37.60	39.20	34.10	26.90	30.60	31.00	38.80	43.90	38.80	37.32	27.61	
127	68.80	54.30	51.20	52.70	47.40	37.10	35.80	38.20	44.30	43.30	50.30	59.50	48.58	26.42	
128	58.90	49.60	50.50	34.90	40.50	34.70	28.80	30.10	35.50	32.80	55.60	44.90	41.40	30.64	
129	58.60	41.40	48.80	44.30	44.00	31.00	29.80	33.50	32.50	35.40	47.80	45.80	41.07	30.40	

Site ID	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)
131	58.50	44.00	43.50	37.60	34.20	24.40	27.00	34.10	35.10	44.40	51.10	48.90	40.23	29.77	
132	53.20	46.90	41.50	38.40	37.20	27.70	23.10	25.60	29.80	28.00	41.00	40.50	36.08	26.70	
133	48.00	39.20	36.70										41.30	20.21	
134	54.30	48.50	50.60	44.90	43.90	38.00	33.00	39.90	39.80	47.90	51.50	50.50	45.23	33.47	
135	56.10	38.60	37.70	43.90	27.00	33.20	25.30	28.60	31.60	30.90	46.20	41.30	36.70	27.16	
136	40.00	36.80	35.20	34.20	26.70	25.20	23.70	26.80	24.80	29.70	38.00	36.60	31.48	23.29	
137	52.40	40.20	38.40	30.10	33.90	31.30	23.60	24.60	26.30	31.10	34.50	35.00	33.45	24.75	
140	55.80	37.30	39.40	35.90									42.10	22.87	
143	43.00	36.00	38.00	33.10									37.52	20.39	
144	43.00	34.30											38.65	17.28	
145	51.20	35.90											43.55	19.47	
146	53.40	36.20	38.10	30.30									39.50	21.46	
147	40.20	31.90	30.20	22.70									31.25	16.98	
148	38.00	36.30	38.60	28.80									35.42	19.25	
149	47.00	33.20	27.90	29.70									34.45	18.72	
150	44.60	35.70	35.30	34.70									37.57	20.42	
151	39.10	32.30		32.80									34.73	18.26	
180		40.80	35.20	39.20	32.40	25.00	22.20	27.40	29.00	34.30	38.10	39.60	33.02	24.43	
182	47.10	37.40	35.00	30.40	28.10	23.10	22.70		26.90	30.40	41.20	37.80	32.74	24.22	
183	46.80	38.40	39.80	31.20									39.05	21.22	
197	53.40	48.40	40.80	26.90	38.10	32.60	29.80	32.60	29.30	38.60	45.90	39.20	37.97	28.10	
198	54.20	43.30	43.60	32.60	36.10	32.30	30.90	33.70	31.50	39.30	41.70	38.50	38.14	28.22	
206	61.50	52.10	54.00	44.30	45.90	38.10	37.10	40.40	36.00	44.30	47.40	49.90	45.92	33.98	
207	47.00	39.10	44.80	49.20	34.90	33.10	31.70	35.00	33.20	36.10	49.30	48.20	40.13	29.70	
208	49.10	40.80	44.00	45.50	36.70	31.80	31.50	34.40	34.10	33.50	48.20	44.20	39.48	29.22	
209	51.60	45.90	47.60	40.20	46.10	35.10	33.20	35.70	32.70	38.00	44.70	44.00	41.23	30.51	
210	46.30	39.00	39.90	42.30	32.60	21.90		30.00	29.60	31.20	42.70	39.40	35.90	26.57	

Site ID	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)
211	47.40	43.00	42.50	38.20	38.00	31.20	28.00	27.80	25.20	31.70	34.20	36.90	35.34	26.15	
212	11.30	29.80	32.40	30.70			18.60	20.10	17.90	19.50	29.20	30.30	23.98	17.75	
213	43.60	46.70	42.40	32.40	39.80	35.10	28.50	29.00	28.60	33.70	39.40	40.80	36.67	27.13	
214	35.20	28.60	25.00	30.30									29.78	16.18	
215	36.10	28.50	27.90	28.00									30.12	16.37	
216	40.60	26.40	29.90	24.30									30.30	16.46	
238	44.20	32.50	35.90	27.80									35.10	19.07	
239	49.20	39.90	36.90	23.30									37.33	20.28	
240	57.00	41.60	40.80	34.00	34.00	32.10	21.30	27.60	30.00	31.60	33.70	40.50	35.35	26.16	
241	50.40	38.20	41.10	31.30	31.60	27.40	26.30	27.40	30.60	30.40	41.30	34.50	34.21	25.31	
242	26.10	53.40	53.00	43.20	41.00	36.90	37.90	40.20	37.80	40.00	57.40	53.30	43.35	32.08	
243	50.60		47.10	49.10	35.70	33.90	33.40	36.70	40.20	40.60	58.50	51.00	43.35	32.08	
244	49.90	44.80	55.00	45.20	30.10	46.90	39.60	44.10	41.80	49.70	50.50	52.90	45.88	33.95	
245	48.10	37.40	52.40	42.80	45.70	38.10	34.00	38.00	35.60	48.40	50.90	49.20	43.38	32.10	
247	54.70	39.70	34.40	33.30	34.90	25.50	23.30	28.40	24.50	33.60	42.40	38.60	34.44	25.49	
249	52.00	36.60	39.80	31.00	31.90	23.00	26.40	28.70	26.70	35.20	42.80	42.50	34.72	25.69	
251	49.30	35.10	42.00	30.80	29.70	24.10	21.40	26.00	26.80	32.40	39.90	37.30	32.90	24.35	
252	53.50	44.70	38.90	27.40									41.13	22.34	
256	54.50	43.00	44.10	48.20	36.10		36.80	40.00	36.70	42.80	51.20	49.80	43.93	32.51	
271	52.40	42.80	39.00										44.73	21.89	
272	50.70	41.00	41.20	30.10									40.75	22.14	
275	45.30	34.90	30.50	27.90	25.40	17.50	18.40	20.80	21.90	25.40	39.00	28.50	27.96		18.20
276	45.50	42.40	45.50	35.20	34.30	32.50	27.10	29.90	30.50	38.10	45.10	90.40	41.38	30.62	
277	48.60	44.90	43.30	41.00	39.20	34.00	29.30	34.10	34.20	39.90	44.70	39.80	39.42	29.17	
278	41.00	7.40	48.70	37.70	41.50	39.20		30.30	37.20	38.30	34.90	39.40	35.96	26.61	
279	77.70	66.50	58.50	58.90	55.50	39.90	38.20	47.10	46.90	49.70	70.30	60.70	55.83	41.31	
280	66.90	59.90	47.70	41.90	45.80	40.40	33.90	36.70	39.40	45.10	56.40	50.50	47.05		31.30

Site ID	NO_2 Mean Concentrations (μg/m³)														
	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)
281	67.90	57.00	50.50	50.80	43.00	33.40	32.50	32.80	39.50	42.20	54.40	45.80	45.82		28.49
282	63.70	45.30	47.90	50.00	39.60	35.70	32.40	36.80	38.60	42.90	57.80	54.00	45.39		28.27
284	51.80	35.40	36.40	36.40	33.30	27.10	26.50	31.30	31.90	31.20	41.20	41.20	35.31	26.13	
285	56.80	42.40	41.40	35.70	32.20	27.10	22.80	28.60	28.60	36.90	42.30	38.90	36.14	26.74	
286	50.10	43.40	42.90	36.00	35.70	21.60	25.40	30.30	31.30	33.70	43.20	42.40	36.33	26.89	
287	47.90	38.10		36.20	29.90	24.90	21.40	25.10	27.20	30.80	43.10	39.30	33.08	24.48	
288	38.20	35.90	39.90		32.90	27.60	26.20	30.80	30.70	36.30	20.00	31.50	31.82	23.55	
289	54.80	42.50	42.80	39.20	33.00	24.90	25.30	30.10	32.70	36.50	51.80	35.60	37.43	27.10	
290	43.70	34.00	32.00	26.20									33.98	18.46	
291	58.20	54.40	52.40	49.70	41.20	36.20	37.20	41.50	42.80	51.10	61.30	51.40	48.12	35.61	
295	56.70	38.90	42.80	34.50	29.30		26.90	32.50	32.60	34.60	51.80	45.30	38.72		26.79
296	58.60	54.10	50.90	36.10	36.50	37.30	31.20	35.90	30.20	40.10	48.20	47.60	42.22	31.25	
323	58.00	46.60	46.40	34.90	34.30	35.30	32.72	35.10	32.70	36.00	49.40	38.80	40.02	29.61	
324	43.70	36.50	35.30	29.30									36.20	19.67	
331	60.00	46.20	46.70	39.90	41.90	36.70	33.90	33.70	33.80	39.10	44.40	40.30	41.38	30.62	
333	67.00	46.70	60.60	57.00	50.00	40.70	39.10	43.30	49.30	49.70	62.30	60.00	52.14		28.05
334	51.50	41.80	39.80	37.80	33.40	22.80	23.40	27.80	27.60	35.40	42.20	35.10	34.88	25.81	
335	43.70	35.00	35.80	30.50	31.40	28.50	23.40	26.60	27.00	30.20	40.10	39.00	32.60	24.12	
336	49.70	58.80	47.30	47.40	37.00	31.00	28.00	31.80	31.80	37.00	49.90	42.40	41.01	30.35	
337	61.80	56.50	58.30	46.90	56.10	43.50		43.90	41.00	48.70	62.50	59.40	52.60		31.60
338	58.70	46.20	45.90	42.40	38.60	29.80	30.90	30.50	31.50	35.10	44.40	46.30	40.03	29.62	
339	55.00	44.40	48.60	45.00	42.70	37.00	29.90	36.20	36.70				41.72	30.87	
340	66.40	59.90	39.30		53.20	55.10	43.30	52.60	48.10	55.10	69.30	66.90	55.38	40.98	
341	61.00	48.70	52.80	57.80	42.30	40.10	41.90	43.30	42.70	49.00	57.60	56.40	49.47		32.56
342	56.10		51.00	47.80	52.00	39.50		41.80	41.80	40.80	46.50	36.50	45.38		27.60
343	54.90	44.90	38.20	43.70	32.10	30.90	31.70	30.90	32.80		49.90	44.30	39.48	29.22	
344	63.30	46.60	43.20	45.30	46.60	30.90	32.20	36.00	39.60	33.00	53.10	47.50	43.11		24.94

Site ID	NO₂ Mean Concentrations (µg/m³)														
	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)
345	55.40	43.20	41.70	47.70	45.80	26.70	30.10	35.90	37.10	35.40	51.20	47.60	41.48		24.12
346	48.50	41.80	38.60	42.50	35.50	24.20	25.50	34.20	36.20	28.70	54.20	48.90	38.23	28.29	
347	41.00	43.00	38.50		35.10	31.80	32.10	34.30	34.70	32.40	44.90	40.90	37.15	27.49	
348	45.80	43.30	43.10	41.30		30.40	30.20	32.50	36.40	37.90	48.80	36.50	38.75	28.67	
349	51.40	36.60	40.30		35.00	30.80	30.30	36.60	36.10	40.00	50.30	40.20	38.87	28.77	
350	57.50	49.40	46.40	45.40	43.80	40.10	38.00	41.50	37.40	46.90	53.00	39.00	44.87	33.20	
351	47.40	39.40	35.10	29.50	33.40	25.10	33.50	24.60	24.80	29.90	34.30	36.40	32.78	24.26	
352	52.30		36.40	37.80	33.70	28.90	20.40	26.60	26.30	31.50	34.30	29.90	32.55	24.09	
353	56.90	32.30	42.00	39.90	37.60	32.00	27.90	30.50	34.00	40.80		60.00	39.45		21.76
354	58.70	34.80	42.00		37.20	26.80	29.80	27.50	31.80	36.80	53.60	60.40	39.95		24.12
355	60.30	46.90	44.80		42.00	31.90	28.40	30.40	31.50	35.60	54.40	56.40	42.05		23.83
356	54.60	39.90	39.50	32.50	30.70	24.20	20.80	28.20	25.20	32.90	38.30	39.20	33.83	25.01	
357	58.20	53.70	48.10	36.90	33.40	34.90	34.60	39.70	38.00	49.20	50.80	49.50	43.92		23.31
358	54.50	54.50	49.30	45.10	38.40	35.60	30.40	37.80	37.20	38.60	57.70	49.30	44.03		24.05
359	48.30	58.20	53.20	45.80	49.40	43.60	35.70	43.30	41.20	48.60			46.73		25.53
360	59.90	43.00	40.30		37.10	28.40	26.90						39.27	27.66	
361	51.30	45.60	42.60	38.20	43.40	24.50							40.93	26.76	
362		49.30	51.50	50.50	53.10	43.50	35.90	44.80	44.50		54.20		47.48	35.13	
363	58.70	36.50	39.30	43.90	38.50	31.50	29.00	30.90	34.00	33.60	46.90		38.44	28.44	
364		44.60	50.60	51.70	46.10		31.50	39.70	40.20	37.90	49.50	48.10	43.99	32.55	
365	50.60	37.70	36.20	32.60	30.20	26.40		24.70	25.10	28.10	10.30	42.80	31.34	23.19	
366	56.30	47.40	39.60	33.20	35.50	30.00	24.50	24.80	29.40	36.30	49.60	45.50	37.67	27.88	
367	55.10	45.70	44.40	39.80	36.50	29.10	28.80		27.90		40.50	41.00	38.88	28.77	
368	61.00	51.20	48.60	45.40	40.70	30.40	32.10	37.50	38.70	41.20	55.90	52.40	44.59		23.61
373	51.70	35.70	40.10	40.60	32.10	33.60		34.50	32.40	35.70	51.00	36.10	38.50	28.49	
374	39.70	38.10	35.80	36.20	29.50	26.10	24.30	26.20	27.00	25.30	43.70	38.50	32.53		19.39
375	31.30	24.80	23.10	19.60	17.30	10.90	12.90	16.30	13.10	16.50	26.30	25.60	19.81	14.66	

Site ID	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)
376	49.60	37.50	39.50	35.60	31.50	27.40	25.90	24.30	28.10	30.70	39.30	36.00	33.78	25.00	
377	57.10	45.80	40.10	30.90	37.30	35.10	33.10	29.30	33.50	40.60	52.50	49.50	40.40	29.90	
378	41.70	24.20	25.50	21.70	20.10	13.80	12.30	15.90	16.50	19.70	34.80	28.80	22.92		13.91
379	34.70	17.70	16.10	13.30									20.45	11.11	
380	30.20	21.30	15.50	16.50									20.88	11.34	
381	26.80	22.10	19.80	20.20									22.22	12.08	
382	38.40	23.60	23.90	23.30									27.30	14.83	
383	36.10	28.20	25.00	24.00									28.32	15.39	
384	40.70	24.80	23.70	26.90									29.03	15.77	
385	43.00	37.90	34.50	28.50	26.10	17.90	19.10	24.00	25.00	27.30	38.00	32.60	29.49	21.82	
386	42.80	43.20	38.60	35.70	25.80	29.10	27.90	28.50	30.70	33.80	39.20	43.60	34.91		22.87
387	38.10	31.40	27.10	20.50	20.40	15.00		18.40	19.50	21.90	29.90	27.50	24.52	18.14	
388	39.60	29.30	26.50	16.50	19.80	14.20	16.40	16.40	19.50	22.40	31.70	25.90	23.18	17.16	
389	60.90	58.40	60.20	54.40	49.70	45.20	38.70	43.70	42.40	43.40	68.70	56.50	51.85	38.37	
390	49.50	42.90	46.90	42.10	37.20	32.00	37.40	33.30	36.70	39.60	55.40	47.00	41.67	30.83	
391	45.30	37.30	38.50	34.20	27.20	25.80	23.80	27.80	28.20	31.60	39.60	35.00	32.86	24.32	
392	20.30	12.50	9.40	8.20									12.60	6.85	
393	37.10	32.80	25.90	20.40	17.80	17.10	16.40	17.30	20.40	22.30	33.60	29.70	24.23		14.28
394	35.50	26.30	22.80	19.10	17.20	17.20	13.10	16.50	16.90	20.30	31.30	26.00	21.85	16.17	
395	29.30	28.30	24.20	20.80	16.50	13.70	13.60	16.10	16.50	20.30	30.50	27.10	21.41	15.84	
396	39.60	22.60	28.50	24.20	19.50	20.90	16.80	20.50	20.20	22.40	33.50	29.90	24.88	18.41	
397	44.30	31.80	32.10	21.00	24.50	20.00	18.20	21.90	19.50	27.80	29.30	31.20	26.80		14.28
398	36.90	23.50	24.10	21.70	18.80	13.20	14.60	16.00	19.40	22.00	28.00	25.40	21.97		11.10
399	49.90	29.40	37.70	28.90	36.80	24.30	27.70	26.20	32.00	35.50	34.00	31.90	32.86		17.46
400	50.50	33.70	36.30	25.90	28.60	23.70	19.90	23.60	23.00	31.50	33.00	26.80	29.71		20.79
401	52.20	37.30	45.60	36.60	30.10	28.70	27.50	27.40	31.90	32.40	47.90	41.50	36.59		22.20
402	64.70	38.10	40.90	40.60	39.50	28.10	24.20	31.90	33.30	37.70	45.50	50.40	39.57		24.42

Site ID	NO₂ Mean Concentrations (µg/m³)														
	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)
403	59.50	52.60	48.60	46.30	40.80	35.30	32.00	33.10	38.70	42.70	41.20	50.10	43.41	32.12	
404			40.60	26.90	35.80	27.70		28.80	27.90	31.90	39.55	39.80	33.22		19.09
405				19.10	17.50	6.10		17.20	16.90	20.00	28.50	25.30	18.82		10.06
406				61.70	44.80	36.90	33.90	29.40	42.40	48.30	52.70	57.20	45.26	33.49	
407				25.80	24.00	21.40	17.10	20.10	22.20	27.40	65.80	29.10	28.10	20.79	
408	77.30	62.30	56.10	51.80	46.90	37.20	34.80	45.10	44.30	47.80	53.90	54.40	50.99		35.89
409					64.80	59.70	47.50	51.00	48.30	62.10			55.57		46.55
410					32.20	26.40	21.90	27.70	24.90	34.00		41.90	29.86		18.72
411					43.40	39.20	33.90	27.10	25.20	34.00	40.80	37.60	35.15		19.68
412								28.50	26.00	24.30	30.00	32.10	28.18	21.79	
413								25.80	25.10	29.00	41.10	36.50	31.50	24.36	

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m³ are shown in **bold**.

NO_2 annual means exceeding 60µg/m³, 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 B: A Summary of Local Air Quality Management

Purpose of an Annual Progress Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in the Environment Act 1995 and associated government guidance. 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 being achieved. Where exceedances occur, or are likely to occur, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) within 18 months of declaration setting out the measures it intends to put in place in pursuit of the objectives. Action plans should then be reviewed and updated where necessary at least every 5 years.

For Local Authorities in Wales, an Annual Progress Report replaces all other formal reporting requirements and have a very clear purpose of updating the general public on air quality, including what ongoing actions are being taken locally to improve it if necessary.

Air Quality Objectives

The air quality objectives applicable to LAQM in Wales are set out in the Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138), Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298), and are shown in Table B.1.

The table shows the objectives in units of microgrammes per cubic metre µg/m3 (milligrammes per cubic metre, mg/m3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table B.1 – Air Quality Objectives Included in Regulations for the Purpose of LAQM in Wales

Pollutant	**Air Quality Objective**		**Date to be achieved by**
	Concentration	**Measured as**	
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18µg/m^3	Annual mean	31.12.2010
Sulphur dioxide (SO_2)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0mg/m^3	Running 8-Hour mean	31.12.2003
Lead	0.25µg/m^3	Annual Mean	31.12.2008

Appendix C: Air Quality Monitoring Data QA/QC

Diffusion Tube Bias Adjustment Factors

Swansea Council employs the services of SOCOTEC, formerly ESG Didcot for our diffusion tubes. The method used is 50% TEA in acetone and the Bias factor for 2017 was 0.77 (spreadsheet version 09/18).

Factor from Local Co-location Studies

Appendic C.1 Swansea AURN Roadside 2017 Co-location

Adjustment of DUPLICATE or TRIPLICATE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements											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 Average	Standard Deviation	CV	95% CI mean		Diffusion Tubes Precision Check
1	04/01/2017	01/02/2017	56.9	55.1	43	51.7	7.56	14.63	18.78		Good
2	01/02/2017	01/03/2017	37.6	37.2	39.9	38.2	1.46	3.81	3.62		Good
3	01/03/2017	30/03/2017	39.8	32.6	38.8	37.1	3.90	10.52	9.69		Good
4	30/03/2017	26/04/2017	23.2	25.2	31.5	26.6	4.33	16.26	10.76		Good
5	26/04/2017	01/06/2017	31.8	32	32.1	32.0	0.15	0.48	0.38		Good
6	01/06/2017	28/06/2017	19.7	20.7	21.1	20.5	0.72	3.52	1.79		Good
7	28/06/2017	09/08/2017	20.3	19.5	20.1	20.0	0.42	2.09	1.03		Good
8	09/08/2017	06/09/2017	26.4	26.6	24.7	25.9	1.04	4.03	2.59		Good
9	06/09/2017	03/10/2017	28.2	27	28.8	28.0	0.92	3.27	2.28		Good
10	03/10/2017	01/11/2017	30.6	31.5	33.6	31.9	1.54	4.83	3.82		Good
11	01/11/2017	06/12/2017	45	44	41.1	43.4	2.03	4.67	5.03		Good
12	06/12/2017	10/01/2018	34.7	41.5	39.2	38.5	3.46	8.99	8.59		Good
13											

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

Jaume Targa, for AEA
Version 04 - February 2011

Site Name/ ID: Swansea AURN 2017

Adjusted measurement (95% confidence level)
Without periods with CV larger than 20%
Bias calculated using 12 periods of data
Tube Precision: 6 Automatic DC: 99%
Bias factor A: 0.74 (0.7 - 0.79)
Bias B: 35% (27% - 42%)
Information about tubes to be adjusted
Diffusion Tube average: 33 μgm^{-3}
Average Precision (CV): 6
Adjusted Tube average: 24 +/- 2 μgm^{-3}

Adjusted measurement (95% confidence level)
with all data
Bias calculated using 12 periods of data
Tube Precision: 6 Automatic DC: 99%
Bias factor A: 0.74 (0.7 - 0.79)
Bias B: 35% (27% - 42%)
Information about tubes to be adjusted
Diffusion Tube average: 33 μgm^{-3}
Average Precision (CV): 6
Adjusted Tube average: 24 +/- 2 μgm^{-3}

Appendix C.2 Cwm Level Park – Urban Background 2017 Co-location

Adjustment of DUPLICATE or TRIPLICATE Tubes

AEA Energy & Environment
From the AEA group

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Average	Standard Deviation	CV	95% CI mean	Diffusion Tubes Precision Check
1	04/01/2017	01/02/2017	56.9	55.1	43	51.7	7.56	14.63	18.78	Good
2	01/02/2017	01/03/2017	37.6	37.2	39.9	38.2	1.46	3.81	3.62	Good
3	01/03/2017	30/03/2017	39.8	32.6	38.8	37.1	3.90	10.52	9.69	Good
4	30/03/2017	26/04/2017	23.2	25.2	31.5	26.6	4.33	16.26	10.76	Good
5	26/04/2017	01/06/2017	31.8	32	32.1	32.0	0.15	0.48	0.38	Good
6	01/06/2017	28/06/2017	19.7	20.7	21.1	20.5	0.72	3.52	1.79	Good
7	28/06/2017	09/08/2017	20.3	19.5	20.1	20.0	0.42	2.09	1.03	Good
8	09/08/2017	06/09/2017	26.4	26.6	24.7	25.9	1.04	4.03	2.59	Good
9	06/09/2017	03/10/2017	28.2	27	28.8	28.0	0.92	3.27	2.28	Good
10	03/10/2017	01/11/2017	30.6	31.5	33.6	31.9	1.54	4.83	3.82	Good
11	01/11/2017	06/12/2017	45	44	41.1	43.4	2.03	4.67	5.03	Good
12	06/12/2017	10/01/2018	34.7	41.5	39.2	38.5	3.46	8.99	8.59	Good
13										

Diffusion Tubes Measurements | Data Quality Check

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

Jaume Targa, for AEA
Version 04 - February 2011

Site Name/ ID: Cwm Level Park Urban Background 2017

Adjusted measurement (95% confidence level)
Without periods with CV larger than 20%
Bias calculated using 10 periods of data
Tube Precision: 7 Automatic DC: 97%
Bias factor A: 0.81 (0.74 - 0.9)
Bias B: 23% (11% - 36%)
Information about tubes to be adjusted
Diffusion Tube average: 33 μgm^{-3}
Average Precision (CV): 6
Adjusted Tube average: 27 +/- 3 μgm^{-3}

Adjusted measurement (95% confidence level)
with all data
Bias calculated using 10 periods of data
Tube Precision: 7 Automatic DC: 97%
Bias factor A: 0.81 (0.74 - 0.9)
Bias B: 23% (11% - 36%)
Information about tubes to be adjusted
Diffusion Tube average: 33 μgm^{-3}
Average Precision (CV): 6
Adjusted Tube average: 27 +/- 3 μgm^{-3}

Discussion of Choice of Factor to Use

Swansea Council has been carrying out a local tri-location study for many years. The locally derived bias factor has been utilised in the reports since it began and so, for consistency of approach, the factor will continue to be used.

PM Monitoring Adjustment

The MetOne PM10 units are indicative measurements and no adjustment factors have been applied.

The Bam1020 PM10 data reported in the document has been ratified as part of the AURN network and so Swansea Council has not applied any factors to the dataset.

The Bam1020 PM2.5 data is reported from a SMART Bam and so no offset is applied.

QA/QC of Automatic Monitoring

AURN

This calibration data is automatically logged as invalid by the analyser. In addition officers from this authority performed routine fortnightly manual calibrations. The analyser is subjected zero cylinder generated zero air to assess the analyser's response to zero air. The analyser is also subjected to traceable calibration gases at a known concentration and the response of the analyser recorded. All manual calibration data is then forwarded to Ricardo to perform data management procedures. The data is then further subjected to full network QA/QC procedure's undertaken by Ricardo on behalf of the Department of Environment, Food and Rural Affairs (DEFRA). The station is serviced and maintained twice yearly by Enviro Technology Services Plc. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. All equipment on site is fully audited twice yearly by Ricardo together with the calibration gases stored on site

Morriston

This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine fortnightly manual calibrations. The analysers are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The analysers are also subjected to traceable calibration gases at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. Since the awarding of the contract by the Welsh Assembly Government to Ricardo (formally AEA Energy & Environment) to run the Welsh Air Quality Forum in April 2004, all equipment on site will be fully audited yearly by Ricardo AEA together with the calibration gases stored on site. The L40 span gas cylinders are replaced on a regular basis and are to a certified and traceable standard.

Cwm Level

The API gas analysers have been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the data-logger. In addition officers from this authority perform routine monthly manual calibrations. The analysers are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air.

The NO_x analyser is subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. The internal span calibration is used with the ozone analyser. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. Since the awarding of the contract by the Welsh Assembly Government to Ricardo to run the Welsh Air Quality Forum in April 2004, all equipment on site will be fully audited yearly by Ricardo AEA, together with an audit of the calibration gases stored on site. Data is re-scaled by Ricardo following the authority supplying routine monthly calibration reports. The L10 span gas cylinders (NO) will be replaced on a regular basis and are to a certified and traceable standard.

Hafod

- **QA/QC for NO, Nitrogen Dioxide and Ozone**

If (C1 >0 and C1 > 2 * C2 and C3 > 10) then result: = C1 else result: = C0

C0 – Null value

C1 – Pollutant Concentration

C2 – Standard Deviation of pollutant

C3 – Light Level of pollutant

- **QA/QC for Benzene**

If (C1 >0 and C1 > 2 * C2 and C3 > 40) then result: = C1 else result: = C0

C0 – Null value

C1 – Pollutant Concentration

C2 – Standard Deviation of pollutant

C3 – Light Level of pollutant

It should be noted that the data presented here represents the spatial average over the whole of the 250-meter measurement path and not a "point measurement" as seen within other "traditional or conventional" monitoring equipment/locations. It should also be noted that the DOAS methodology of monitoring does not comply with the EU Directive methods of measurement (chemiluminescent for NO_2, UV fluorescence for SO_2 etc.) at present but the system has achieved MCERTS certification and TUV certification.

The station is now subject to Xenon lamp changes on a quarterly basis, with zero and span calibrations now taking place on an annual basis. These works are undertaken by Enviro Technology Plc, the UK distributor for Opsis of Sweden

St Thomas DOAS

All individual measurement points that have not met the QA/QC conditions (detailed below) are replaced with null values within the new dataset. The user can then compile 5 minute means from the validated dataset and undertake analysis.

- **QA/QC for SO_2, Nitrogen Dioxide and Ozone**

If (C1 >0 and C1 > 2 * C2 and C3 > 10) then result: = C1 else result: = C0

C0 – Null value

C1 – Pollutant Concentration

C2 – Standard Deviation of pollutant

C3 – Light Level of pollutant

- **QA/QC for Benzene**

If (C1 >0 and C1 > 2 * C2 and C3 > 40) then result: = C1 else result: = C0

C0 – Null value

C1 – Pollutant Concentration

C2 – Standard Deviation of pollutant

C3 – Light Level of pollutant

The station is subject to Xenon lamp changes on a 6 monthly basis with zero and span calibrations now taking place on a yearly basis. These works are undertaken by Enviro Technology Plc, the UK distributor for Opsis of Sweden. The frequency of lamp change differs to that of the Hafod DOAS as this station does not measure the NO channel and as such does not suffer the drop off/degradation in lamp intensity during the 5^{th} and 6^{th} months of operation. Changing the Xenon lamps every 6 months does not invoke any data issue concerns at this site.

High Street

In addition officers from this authority perform routine fortnightly manual calibrations. The analyser is subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The NO_x analyser is subjected to traceable calibration gas at a known concentration and the response of the analyser and data-logger is recorded. All manual calibration data is recorded as invalid data by the data-logger and is removed from any subsequent analysis.

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc. At present, the data is collected by the Welsh Air Quality Forum but it does not form part of the QA/QC contract with Ricardo. The L10 span gas cylinder (NO) will be replaced on a regular basis and is to a certified and traceable standard.

QA/QC of Diffusion Tube Monitoring

LAQM Helpdesk – October 2018

Summary of Laboratory Performance in AIR NO_2 Proficiency Testing Scheme (January 2017 – October 2018).

Reports are prepared by LGC for BV/NPL on behalf of Defra and the Devolved Administrations.

Background

AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combined two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

AIR offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air. One such sample is the AIR NO_2 test sample type that is distributed to participants in a quarterly basis.

AIR NO_2 PT forms an integral part of the UK NO_2 Network's QA/QC, and is a useful tool in assessing the analytical performance of those laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). With consent from the participating laboratories, LGC Standards provides summary proficiency testing data to the LAQM Helpdesk for hosting on the web-pages at http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html. This information will be updated on a quarterly basis following completion of each AIR PT round.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the AIR PT scheme. Laboratory performance in AIR PT is also assessed, by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Intercomparison Exercise carried out at Marylebone Road, central London.

The information is used to help the laboratories to identify if they have problems and may assist devising measures to improve their performance and forms part of work for Defra and the Devolved Administrations under the Local Air Quality Management Services Contract.

AIR NO_2 PT Scheme overview

Purpose of scheme

The AIR PT scheme uses laboratory spiked Palmes type diffusion tubes to test each participating laboratory's analytical performance on a quarterly basis and continues the format used in the preceding WASP PT scheme. Such tubes are not designed to test other parts of the measurement system e.g. sampling. Every quarter, roughly January, April, July and October each year, each laboratory receives four diffusion tubes doped with an amount of nitrite, known to LGC Standards, but not the participants. At least two of the tubes are usually duplicates, which enables precision, as well as accuracy, to be assessed. The masses of nitrite on the spiked tubes are different each quarter, and reflect the typical analytical range encountered in actual NO_2 ambient monitoring in the UK.

NO2 PT Summary – AIR PT Rounds AR018, 19, 21, 22, 24, 25, 27 and 28 Page 1 of 5

LAQM Helpdesk – October 2018

Preparation of test samples

Diffusion tubes are spiked using a working nitrite solution prepared from a stock solution. The concentration of this stock solution is initially assayed using a titrimetric procedure. All steps in the subsequent test sample production process, involving gravimetric and volumetric considerations, are undertaken using calibrated instruments employing traceable standards. As an additional cross check, 12 spiked Palmes tubes are picked at random from each spike loading level and submitted to a third party laboratory which is accredited to ISO 17025 to undertake this analysis using an ion chromatographic procedure.

In summary, the tube spiking precision is calculated to be better than 0.5 %, expressed as a standard deviation, and this is derived from repeat gravimetric checking of the pipette device used to spike the test samples. The calculated spike values, derived from titrimetric, gravimetric and volumetric considerations, are found to be typically within ± 3 % of results obtained by the third party laboratory using an ion chromatographic analytical procedure.

Scheme operation

The participants analyse the test samples and report the results to LGC Standards via their on-line PORTAL data management system. LGC Standards assign a performance score to each laboratory's result, based on how far their results deviate from the assigned values for each test samples. The assigned values are best estimates of the levels of nitrite doped onto the test sample tubes and are calculated from the median of participant results, after the removal of test results that are inappropriate for statistical evaluation, e.g. miscalculations, transpositions and other gross errors. At the completion of the round, laboratories receive a report detailing how they have performed and how their results relate to those of their peers.

Performance scoring

The z-score system is used by LGC to assess the performance of laboratories participating in the AIR PT NO_2 scheme.

The Z_{score}, may be defined as:

$$Z_{score} = \frac{(x_{lab} - \bar{x}_{assigned})}{\sigma_{SDPA}}$$

Where:

x_{lab} = participant result from a laboratory

$\bar{x}_{assigned}$ = assigned value

σ_{SDPA} = standard deviation for performance assessment (currently set at 7.5 % of $\bar{x}_{assigned}$)

NO2 PT Summary – AIR PT Rounds AR018, 19, 21, 22, 24, 25, 27 and 28 Page 2 of 5

LAQM Helpdesk – October 2018

Performance score interpretation

A Z_{score} is interpreted as described below:

$\lvert Z_{score} \rvert \leq 2$	indicates satisfactory laboratory performance
$2.0 < \lvert Z_{score} \rvert < 3$	indicates questionable (warning) laboratory performance
$\lvert Z_{score} \rvert \geq 3$	indicates unsatisfactory (action) laboratory performance

As a general rule of thumb, provided that a laboratory does not have systematic sources of bias in their laboratory measurement system, then on average, 19 out of every 20 z-scores should be $\leq \pm 2$. In this scheme each laboratory receives 4 test samples per round and therefore submits 4 z-scores per round. Hence over 5 rounds laboratories would receive 20 test samples and report 20 z-scores.

Assessing the performance of a laboratory

End users that avail of analytical services from laboratories should satisfy themselves that such laboratories meet their requirements. A number of factors ideally need to be considered including

- Expertise and skills of staff within the laboratory?
- Does the laboratory follow accepted measurement standards, guidance?
- Does the laboratory operate a robust internal quality control system?
- Is the laboratory third party accredited to relevant standards such as ISO 17025?
- Does the laboratory successfully participate in relevant external proficiency testing schemes?
- How good is their customer care (communication, turnaround times, pricing etc)?

Participation therefore, in an external proficiency-testing scheme such as AIR PT, represents but one factor in such considerations.

Participation in a single round of an external proficiency-testing scheme represents a "snap-shot" in time of a laboratory's analytical quality. It is more informative therefore to consider performance over a number of rounds.

Following on from above, therefore over a rolling five round AIR PT window, one would expect that 95 % of laboratory results should be $\leq \pm 2$. If this percentage is substantially lower than 95 % for a particular laboratory, within this five round window, then one can conclude that the laboratory in question has significant sources of error within their analytical procedure.

A summary of the performance, for each laboratory participating in the AIR PT scheme, is provided in Table 1. This table shows the percentage of results where the absolute z-score, for each laboratory, was less than or equal to 2, i.e. those results which have been assessed as satisfactory.

LAQM Helpdesk – October 2018

Contacts

Further **specific** information on the LGC AIR NO_2 PT scheme is available from LGC proficiency testing on 0161 7622500 or by email at customerservices@lgcgroup.com.

For **general** questions about the scheme within the context of wider LAQM activities please contact Nick Martin at NPL on 0208 943 7088 or nick.martin@npl.co.uk.

Table 1: Laboratory summary performance for AIR NO_2 PT rounds AR0018, 19, 21, 22, 24, 25, 27 and 28

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

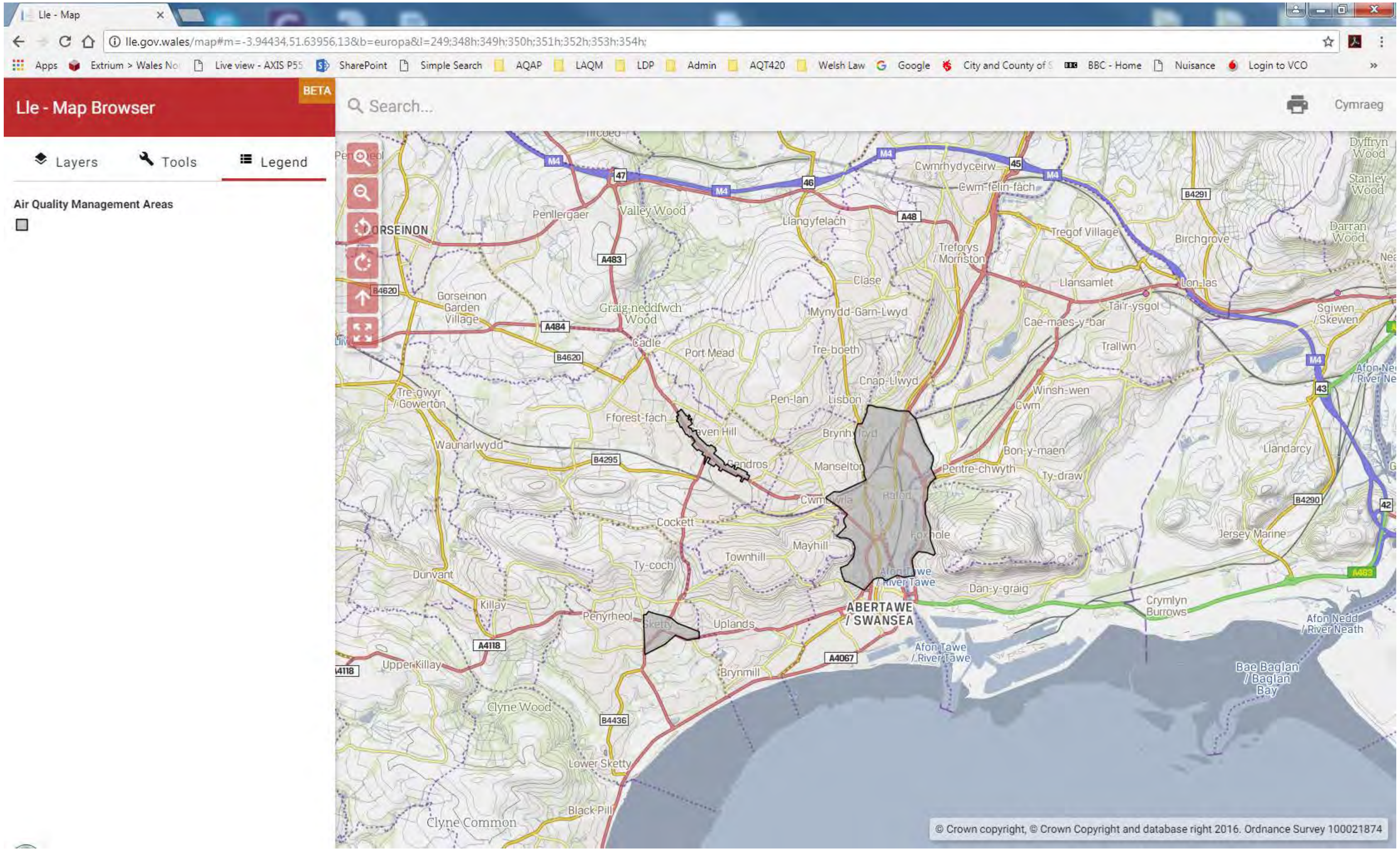
AIR PT Round	AIR PT AR018	AIR PT AR019	AIR PT AR021	AIR PT AR022	AIR PT AR024	AIR PT AR025	AIR PT AR027	AIR PT AR028
Round conducted in the period	January – February 2017	April – May 2017	July – August 2017	September – October 2017	January – February 2018	April – May 2018	July – August 2018	September – October 2018
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	50 %	0 %	100 %	100 %	100 %	50 %	100 %
Gradko International [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Lambeth Scientific Services	100 %	NR [2]	NR [2]	100 %	NR [2]	NR [2]	NR [2]	25 %
Milton Keynes Council	100 %	75 %	0 %	75 %	100 %	75 %	100 %	100 %
Northampton Borough Council	0 %	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Somerset Scientific Services	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Staffordshire County Council	100 %	100 %	100 %	100 %	50 %	100 %	100 %	100 %
Tayside Scientific Services (formerly Dundee CC)	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %	NR [2]
West Yorkshire Analytical Services	100 %	100 %	100 %	100 %	50 %	75 %	100 %	100 %

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

2015 - 2017 Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies, by Laboratory

Appendix D: AQMA Boundary Maps

Figure D.1 –



Appendix E: Planning Air Quality Assessment

Air Quality Assessment: Former Cape Horner Site, Swansea

June 2017

Experts in air quality
management & assessment

Document Control

Client	Hawksfire Development	Principal Contact	Matthew Gray (Asbri Planning)

Job Number	J2945A

Report Prepared By:	Lucy Hodgins & Penny Wilson

Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
J2945A/1/F1	22 June 2017	Final	Stephen Moorcroft (Director)

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Executive Summary

The air quality impacts associated with the proposed student accommodation development on Fabian Way, Swansea have been assessed.

In the opening year of the development, pollutant concentrations are predicted to be below the air quality objectives at the worst-case locations assessed, and air quality conditions for new residents will be acceptable.

Overall, the air quality effects of the proposed development are judged to be „not significant".

Contents

Tables

Figures

1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed 64-bed student accommodation at the Former Cape Horner site, Swansea. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Hawksfire Development.

1.2 The nature of the development is such that it will not significantly increase traffic on local roads, as only 12 car parking spaces are proposed. The new student accommodation will, however, be subject to the impacts of road traffic emissions from the adjacent road network. The proposed development lies close to the A483 Fabian Way. The main air pollutants of concern related to traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.3 This report describes existing local air quality conditions, and the predicted air quality in the anticipated year of opening (2019).

1.4 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with the City and County of Swansea Council.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) and the Welsh Assembly Government provides the policy framework (Defra, 2007) 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.

Planning Policy

National Policies

2.2 Land-use planning policy in Wales is established within the policy document Planning Policy Wales (PPW) (Welsh Government, 2016) and its updates which provide the strategic policy framework for the effective preparation of local planning authority development plans. PPW is supported by a series of Technical Advice Notes (TANs) and National Assembly for Wales Circulars. Local planning authorities have to take PPW, TANs and Circulars into account when preparing Development Plans.

2.3 With respect to planning policy guidance, TAN 18 on transport (Welsh Government, 2007) makes reference to local air quality and the need for Air Quality Action Plans to be prepared for any Air Quality Management Areas declared.

2.4 PPW places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. Local development plans should enable consideration of the effects that the proposed development may have on air quality, as well as the effect that air quality may have on the proposed development. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location.

2.5 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

Local Policies

2.6 The City and County of Swansea Unitary Development Plan (UDP) was adopted in November 2008 (City and County of Swansea, 2008). Policy EV 40 relates to air, noise and light pollution and states that *„Development proposals will not be permitted that would cause or result in significant harm to health, local amenity, natural heritage, the historic environment or landscape character because of significant levels of air, noise or light pollution."*

2.7 The UDP goes on to say that *„planning permission will not be granted for development that would cause significant harm to air quality by virtue of emissions from the development itself or the additional new traffic movements it would generate. Neither will permission be granted where a development is proposed that would increase the number of exposed individuals in an area likely to fail UK air quality objectives."*

2.8 The UDP is due to soon be replaced by the City and County of Swansea Local Development Plan. The LDP underwent public consultation in 2016 and will be submitted to the Planning Inspectorate and the Welsh Government in 2017.

Air Quality Action Plans

National Air Quality Plans

2.9 Defra has produced Air Quality Plans to reduce nitrogen dioxide concentrations in major cities throughout the UK (Defra, 2015). Following a High Court ruling in November 2016 (Royal Courts of Justice, 2016), Defra undertook to replace these Plans with a new Plan by 31st July 2017. To this end, Defra began consultation on its draft new Plan (Defra, 2017a) in May 2017. There is currently no practical way to take account of the effects of either of the existing Plans, or the draft new Plan, in relation to the assessment presented in this report. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the draft new Plan.

Local Air Quality Action Plan

2.10 The City and County of Swansea has declared three AQMAs for exceedances of the annual mean nitrogen dioxide objective that cover the areas of Hafod District, Sketty and Fforestfach. The Council has since developed an Air Quality Action Plan (The City and County of Swansea, 2004), which includes measures to reduce pollutant concentrations.

Assessment Criteria

2.11 The Government has established a set of air quality standards and objectives to protect human health. 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. The objectives for use by local authorities are prescribed within the Air Quality (Wales) Regulations 2000 (2000) and the Air Quality (Wales) (Amendment) Regulations 2002 (2002).

2.12 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m^3 (Defra, 2016b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m^3 (Defra, 2016b). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 µg/m^3 it is unlikely that the 24-hour mean objective will be exceeded.

2.13 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 will apply in its Local Air Quality Management Technical Guidance (Defra, 2016b). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and 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.

2.14 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.

2.15 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m³
Fine Particles (PM_{10})	24-hour Mean	50 µg/m³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m³ [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m³

[a] A proxy value of 32 µg/m³ as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2016b).

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Descriptors for Air Quality Impacts and Assessment of Significance

2.16 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[1] (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A1. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A2.

[1] The IAQM is the professional body for air quality practitioners in the UK.

3 Assessment Approach

Consultation

3.1 The assessment follows a methodology agreed with the City and County of Swansea Council via email correspondence between Tom Price (Environmental Health Officer) and Lucy Hodgins (Air Quality Consultants) held on 12th June 2017.

Existing Conditions

3.2 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra‟s Pollutant Release and Transfer Register (Defra, 2017c) and the Environment Agency‟s website „what‟s in your backyard‟ (Environment Agency, 2017). Local sources have also been identified through discussion with the City and County of Swansea Council‟s Pollution Control Division, as well as through examination of the Council‟s Air Quality Review and Assessment reports.

3.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers both the study area and nearby sites, the latter being used to provide context for the assessment. Background concentrations have been defined using the national pollution maps published by Defra (2017b). These cover the whole country on a 1x1 km grid.

3.4 Exceedances of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra for 2015 (Defra, 2017d) and for 2020 (Defra, 2016a). These are the maps used by the UK Government, together with the results from national Automatic Urban and Rural Network (AURN) monitoring sites that operate to EU data quality standards, to report exceedances of the limit value to the EU. The maps are currently available for the past years 2001 to 2015 and the future years 2020, 2025 and 2030. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations, which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

Road Traffic Impacts

Sensitive Locations

3.5 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at four locations at the proposed development. Receptors have been identified at each of these locations to represent the façades of the proposed student apartments, at varying heights representing the ground to the third floor. The receptor locations are described in Table 2 and shown in Figure 1. In addition, concentrations have been modelled at diffusion tube monitoring site located at the junction of Port

Tennant Road and Fabian Way, in order to verify the model outputs (see Appendix A3 for verification method).

Table 2: Description of Receptor Locations [a]

Receptor	Description
Receptor 1[b]	Student Accommodation
Receptor 2	Student Accommodation
Receptor 3	Student Accommodation
Receptor 4	Student Accommodation

a Receptors modelled at heights of 1.5 m, 3.2 m and 7.0 m and 10 m to represent ground, first, second and third floor levels.

b Ground-floor level is a social area at ground-floor level, rather than student bedrooms

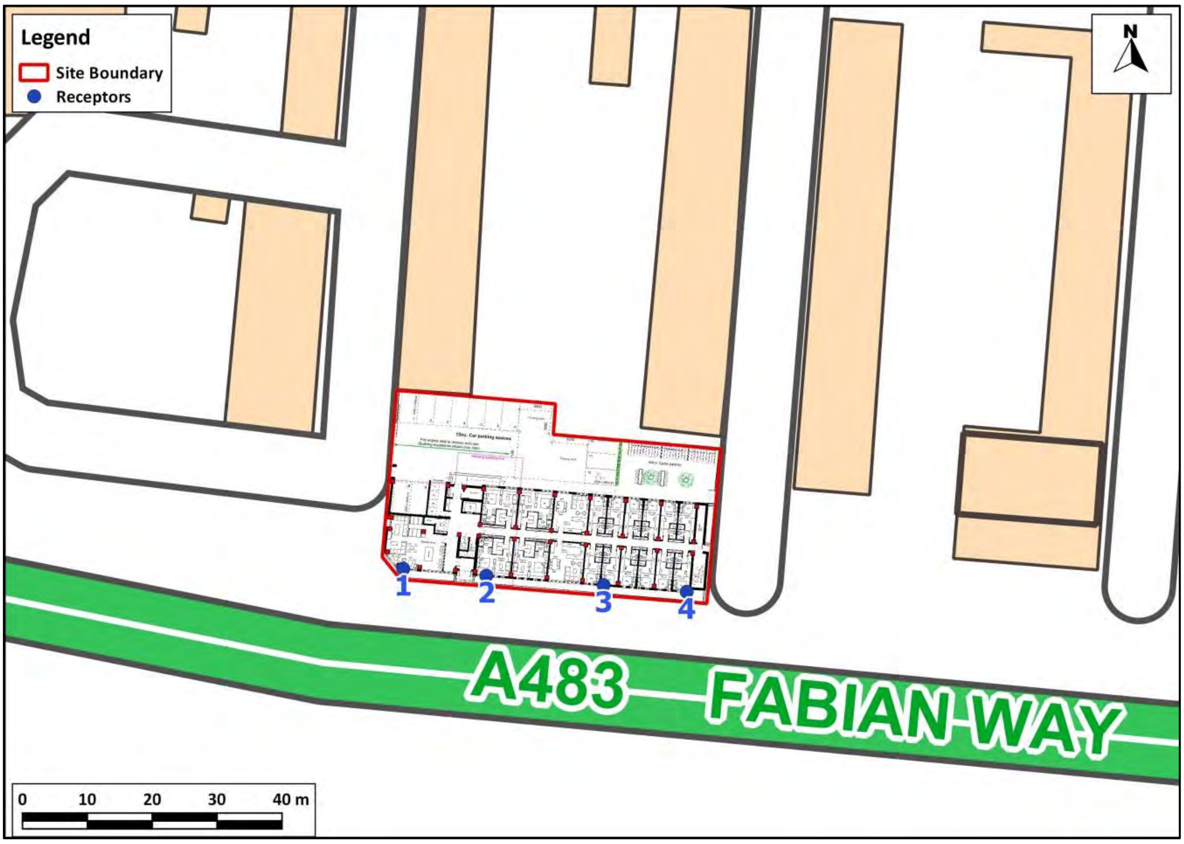

Figure 1: Receptor Locations

Assessment Scenarios

3.6 Nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been predicted the proposed year of opening (2019). In addition to the set of „official" predictions, a sensitivity test has been carried out for nitrogen dioxide that involves assuming much higher nitrogen oxides emissions from certain vehicles than have been predicted by Defra, using AQC"s Calculator Using Realistic Emissions for Diesels (CURED V2A) tool (AQC, 2016a). This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016b).

Modelling Methodology

3.7 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs, assumptions and the verification are provided in Appendix A3, together with the method used to derive base and future year background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Traffic Data

3.8 Traffic data for the assessment have been determined from the interactive web-based map provided by the Department for Transport (DfT, 2017). Further details of the traffic data used in this assessment are provided in Appendix A3.

Uncertainty in Road Traffic Modelling Predictions

3.9 There are many components that contribute to the uncertainty of modelling predictions. 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. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

3.10 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A3). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2016) concentrations.

3.11 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

3.12 Historically, large reductions in nitrogen oxides emissions have been projected, which has led to significant reductions in nitrogen dioxide concentrations from one year to the next being predicted. Over time, it was found that trends in measured concentrations did not reflect the rapid reductions that Defra and DfT had predicted (Carslaw et al., 2011). This was evident across the UK, although the effect appeared to be greatest in inner London; there was also considerable inter-site variation. Emission projections over the 6 to 8 years prior to 2009 suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25%, whereas monitoring data showed that concentrations remained relatively stable, or even showed a slight increase. Analysis of more recent data for 23 roadside sites in London covering the period 2003 to 2012 showed a weak downward trend of around 5% over the ten years (Carslaw and Rhys-Tyler, 2013), but this still falls short of the improvements that had been predicted at the start of this period.

3.13 The reason for the disparity between the expected concentrations and those measured relates to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have had to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles has often been no better than that of earlier models. This has been compounded by an increasing proportion of nitrogen dioxide in the nitrogen oxides emissions, i.e. primary nitrogen dioxide, which has a significant effect on roadside concentrations (Carslaw et al., 2011) (Carslaw and Rhys-Tyler, 2013).

3.14 A detailed analysis of emissions from modern diesel vehicles has been carried out (AQC, 2016b). This shows that, where previous standards had limited on-road success, the „Euro VI" and „Euro 6" standards that new vehicles have had to comply with from 2013/16[2] are delivering real on-road improvements. A detailed comparison of the predictions in Defra"s latest Emission Factor Toolkit (EFT) v7.0 against the results from on-road emissions tests has shown that Defra"s latest predictions still have the potential to under-predict emissions from some vehicles, albeit by less than has historically been the case (AQC, 2016b). In order to account for this potential under-prediction, a sensitivity test has been carried out in which the emissions from Euro IV, Euro V, Euro VI, and Euro 6 vehicles have been uplifted as described in Paragraph A3.5 in Appendix A3, using AQC"s CURED (V2A) tool (AQC, 2016a). The results from this sensitivity test are likely to over-predict emissions from vehicles in the future (AQC, 2016b) and thus provide a reasonable worst-case upper-bound to the assessment.

[2] Euro VI refers to heavy duty vehicles, while Euro 6 refers to light duty vehicles. The timings for meeting the standards vary with vehicle type and whether the vehicle is a new model or existing model.

4 Site Description and Baseline Conditions

4.1 The proposed development site is located approximately 600 m to the southeast of Swansea city centre. The site is bounded by Fabian Way to the south, Miers Street to the west and Inkerman Street to the east. The site currently consists of the derelict Cape Horner restaurant and car park. There are existing residential properties to the north of the site, and to the south beyond Fabian Way are commercial properties, and Swansea Waterfront which comprises restaurants, bars and cafes.

Industrial sources

4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2017c) and National Resources Wales (National Resources Wales, 2017) websites has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality.

Air Quality Management Areas

4.3 The City and County of Swansea has investigated air quality within its area as part of its responsibilities under the LAQM regime. In September 2001 an AQMA was declared for an area on the west bank of the River Tawe covering the Hafod district, Sketty and Fforestfach for exceedances of the annual mean nitrogen dioxide objective. The proposed development lies approximately 400 m south of the Hafod district AQMA and the location of this is shown in Figure 2.

4.4 In terms of PM_{10}, the Council concluded that there are no exceedances of the objectives. It is therefore reasonable to assume that existing PM_{10} levels will not exceed the objectives within the study area.

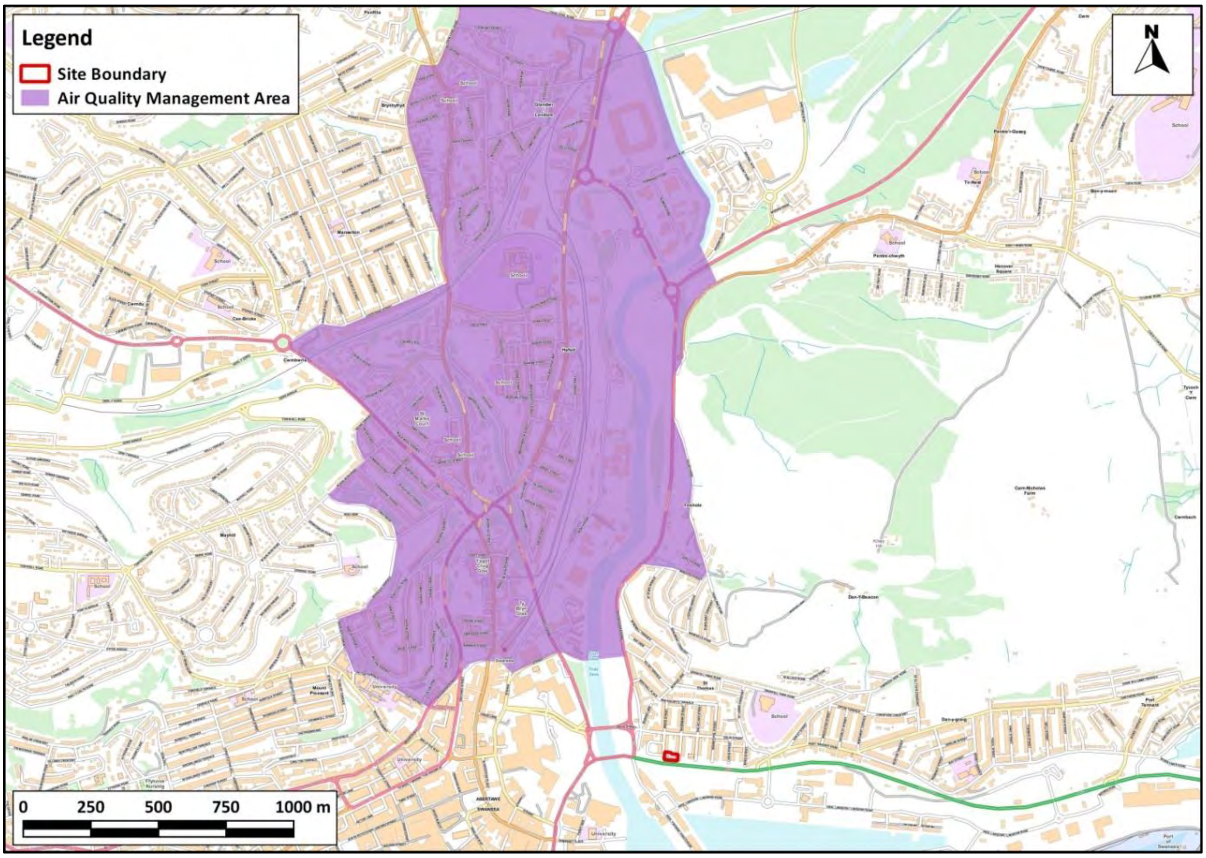

Figure 2: Declared AQMA

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Local Air Quality Monitoring

Nitrogen Dioxide

4.5 The City and County of Swansea operates three automatic monitoring stations within its area, and two open path monitoring stations. These are not considered representative of air quality at the application site. The Council also operates an extensive network of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Harwell Scientifics (using the 50% TEA in acetone method). The closest diffusion tube monitoring sites are located on Fabian Way and Delhi Street, to the north and east of the application site. Data for these sites have been provided by the City and County of Swansea. Results for the years 2010 to 2016 are summarised in Table 3 and the monitoring locations are shown Figure 3.

Table 3: Summary of Annual Mean Nitrogen Dioxide Diffusion Tube Monitoring μg/m^3 (2010-2016) [a,b]

Site No.	Site Type	2010	2011	2012	2013	2014	2015	2016
35	Roadside	**40.7**	**40.4**	33.5	31.3	32.2	31.4	37.7
36	Roadside	34.4	33.6	31.7	30.1	27.5	26.5	33.4
38	Roadside	39.1	37.2	35.40	33.6	31.1	32.7	N/A
102	Roadside	30.0	33.1	29.5	29.7	28.7	28.0	33.5
408	Roadside	N/A	N/A	N/A	N/A	N/A	N/A	**43.5**
Objective		**40**						

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

[b] 2010 to 2015 data have been taken from the 2016 Annual Status Report (Swansea, 2016). 2016 raw data and a bias adjustment factor have been provided by the Council.

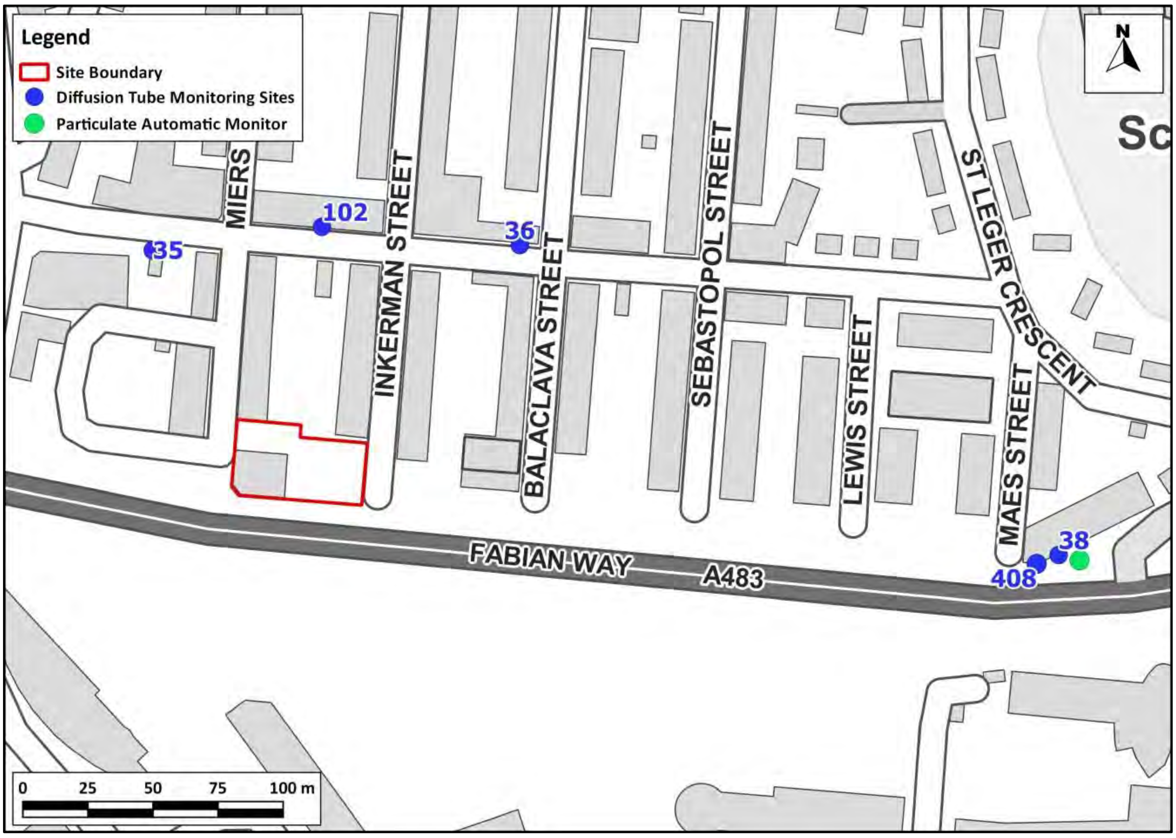

Figure 3: Monitoring Locations

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4.6 Monitoring locations 38 and 408 are located on Fabian Way in a similar setting to the application site. At the start of 2016, site 38 was relocated closer to Fabian Way and now referred to as site 408 (at 2.5m from the kerbside). Measured concentrations in 2016 at site 408 were above the objective; this monitoring site is closer to a junction than the application site, and therefore concentrations at the application site would be expected to be lower.

4.7 Nitrogen dioxide monitoring results show a general downward trend in concentrations.

Particulate Matter

4.8 The City and County of Swansea Council also monitors PM_{10} at Port Tennant Junction approximately 300 m east of the application site. Monitored concentrations are not directly comparable with the objectives as measurements are made using a Met One E-Bam, which is not a reference equivalent method. Results for the years 2013 to 2015 are summarised in Table 4. Measured concentrations are well below the objectives.

Table 4: Summary of PM_{10} Automatic Monitoring (2013-2015)

Site No.	Site Type	Location	2013	2014	2015
PM_{10} Annual Mean (µg/m^3)					
-	Roadside	SA1 Junction Port Tennant	17.7	14.5	12.0
Objective			**40**		
PM_{10} No. Days >50 µg/m^3					
-	Roadside	SA1 Junction Port Tennant	4	2	0
Objective			**35**		

Exceedances of EU Limit Value

4.9 There are no AURN monitoring sites within 1 km of the application site with which to identify exceedances of the annual mean nitrogen dioxide limit value. The national maps of roadside annual mean nitrogen dioxide concentrations (Defra, 2017d), used to report exceedances of the limit value to the EU, do not identify any exceedances within the study area in 2015. Defra"s mapping for 2020, which takes account of the measures contained in its 2015 Air Quality Plan (Defra, 2015), also does not identify any exceedances within the study area. Defra is in the process of updating its air quality plan and associated modelling, but it has not yet published its revised maps.

Background Concentrations

4.10 In addition to these locally measured concentrations, estimated background concentrations at the proposed development site have been determined for 2016 and the opening year 2019 using Defra"s background maps (Defra, 2017b). The background concentrations are set out in Table 5 and have been derived as described in Appendix A3. The background concentrations are all well below the objectives.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2016 and 2019 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2016	13.8	13.6	9.4
2019 [a]	12.0	13.2	9.0
2019 Worst-case Sensitivity Test [b]	*12.7*	*N/A*	*N/A*
Objectives	**40**	**40**	**25** [c]

N/A = not applicable.

[a] In line with Defra"s forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described in Appendix A3.

[c] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

5 Impacts on the Development

5.1 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at the proposed receptor locations (see Figure 1 and Table 2). The predicted concentrations, for the opening year (2019), are set out in Table 6 and Table 7. The predictions for nitrogen dioxide include a sensitivity test which accounts for the potential under-performance of emissions control technology on modern diesel vehicles. In addition, the modelled road components of nitrogen oxides have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A3).

Table 6: Modelled Annual Mean Concentrations of Nitrogen Dioxide (μg/m^3) at Proposed Receptors in 2019

Receptor (Height)	In line with Defra Forecasts [a]	*Worst-case Sensitivity Test* [b]
1 (1.5 m) [c]	35.2	38.8
2 (1.5 m)	34.3	37.7
3 (1.5 m)	33.5	36.9
4 (1.5 m)	33.0	36.4
1 (3.2 m)	31.1	34.1
2 (3.2 m)	30.3	33.2
3 (3.2 m)	29.6	32.5
4 (3.2 m)	29.3	32.2
1 (7.0 m)	22.7	24.6
2 (7.0 m)	22.4	24.2
3 (7.0 m)	22.0	23.8
4 (7.0 m)	21.8	23.6
1 (10.0 m)	19.4	20.8
2 (10.0 m)	19.2	20.6
3 (10.0 m)	18.9	20.4
4 (10.0 m)	18.8	20.2
Objective	**40**	

[a] In line with Defra"s forecasts.

[a] Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.5.

[c] Receptor 1 is a social area at ground-floor and kitchens on the upper levels, as opposed to bedrooms.

Table 7: Modelled Annual Mean Concentrations of PM_{10} and $PM_{2.5}$ at Proposed Receptors (μg/m^3)

Receptor (Height)	PM_{10}	$PM_{2.5}$
1 (1.5 m)	14.5	9.7
2 (1.5 m)	14.5	9.7
3 (1.5 m)	14.4	9.7
4 (1.5 m)	14.4	9.7
1 (3.2 m)	14.2	9.6
2 (3.2 m)	14.2	9.6
3 (3.2 m)	14.2	9.5
4 (3.2 m)	14.1	9.5
1 (7.0 m)	13.7	9.3
2 (7.0 m)	13.7	9.3
3 (7.0 m)	13.7	9.3
4 (7.0 m)	13.7	9.3
1 (10.0 m)	13.5	9.2
2 (10.0 m)	13.5	9.2
3 (10.0 m)	13.5	9.2
4 (10.0 m)	13.5	9.2
Objective / Criterion	**32** [a]	**25** [b]

[a] While the annual mean PM_{10} objective is 40 μg/m^3, 32 μg/m^3 is the annual mean concentration above which an exceedence of the 24-hour mean PM_{10} concentration is possible, as outlined in LAQM.TG16 (Defra, 2016a). A value of 32 μg/m^3 is thus used as a proxy to determine the likelihood of exceedence of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Nitrogen Dioxide

5.2 The modelled annual mean nitrogen dioxide concentrations are below the objective at all receptors in the opening year (2019). The results from the sensitivity test are not materially different from those derived using the „official‟ predictions.

PM_{10} and $PM_{2.5}$

5.3 The annual mean PM_{10} and $PM_{2.5}$ concentrations are well below the annual mean objectives at all receptors. Furthermore, as the annual mean PM_{10} concentrations are below 32 μg/m^3, it is unlikely that the 24-hour mean PM_{10} objective will be exceeded at any of the receptors.

Significance of Operational Air Quality Impacts

5.4 The air quality impacts without mitigation are judged to be „not significant". This professional judgement is made in accordance with the methodology set out in Appendix A1, and also takes into account the results of the worst-case sensitivity test for nitrogen dioxide. Future year concentrations are expected to lie between the two sets of results, although the impacts are likely to be closer to the sensitivity test, in the short term. The judgement that the air quality impacts will be „*not significant*" without mitigation takes account of the assessment that concentrations will be below the air quality objectives for all worst-case receptor locations within the new development. Air quality for future residents within the development will thus be acceptable.

6 Conclusions

6.1 The assessment considers the potential air quality impacts associated with the proposed 64-bed student accommodation at the Former Cape Horner site, Swansea.

6.2 Air quality for students within the proposed development have been shown to be acceptable at the worst-case locations assessed, with concentrations being below the air quality objectives.

6.3 The overall operational air quality impacts of the development are judged to be not significant. This conclusion, which takes account of the uncertainties in future projections, in particular for nitrogen dioxide, is based on the concentrations being below the objectives at all worst-case receptor locations assessed.

6.4 The proposed student accommodation development is compliant with Policy EV40 of the City and County of Swansea‟s Unitary Development Plan.

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8 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
CURED	Calculator Using Realistic Emissions for Diesels
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
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
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
$\mu g/m^3$	Microgrammes per cubic metre
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
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
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter

PPG	Planning Practice Guidance
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
TEMPro	Trip End Model Presentation Program

9 Appendices

A1 EPUK & IAQM Planning for Air Quality Guidance

A1.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A1.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A1.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A1.4 The good practice principles are that:

- New developments should not contravene the Council"s Air Quality Action Plan, or render any of the measures unworkable;

- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
  - Spark ignition engine: 250 mgNOx/Nm^3;
  - Compression ignition engine: 400 mgNOx/Nm^3;
  - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A1.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".

A1.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area"s emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A1.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A1.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or

- the development will have a centralised energy facility or other centralised combustion process.

A1.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor; and

A1.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A1.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent *buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.*

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

A1.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive „trigger" for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A1.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

A1.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Assessment of Significance

A1.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

A1.16 There is no official guidance in the UK in relation to development control on how to assess the significance of air quality impacts. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. The guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either „significant" or „not significant". In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts. In such circumstances, several impacts that are described as „*slight*" individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a „*moderate*" or „*substantial*" impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A1.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant.

A1.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A2.

A2 Professional Experience

Stephen Moorcroft, BSc (Hons) MSc DIC MIEnvSc MIAQM CEnv

Mr Moorcroft is a Director of Air Quality Consultants, and has worked for the company since 2004. He has over thirty-five years‟ postgraduate experience in environmental sciences. Prior to joining Air Quality Consultants, he was the Managing Director of Casella Stanger, with responsibility for a business employing over 100 staff and a turnover of £12 million. He also acted as the Business Director for Air Quality services, with direct responsibility for a number of major Government projects. He has considerable project management experience associated with Environmental Assessments in relation to a variety of development projects, including power stations, incinerators, road developments and airports, with particular experience related to air quality assessment, monitoring and analysis. He has contributed to the development of air quality management in the UK, and has been closely involved with the LAQM process since its inception. He has given expert evidence to numerous public inquiries, and is frequently invited to present to conferences and seminars. He is a Member of the Institute of Air Quality Management.

Penny Wilson, BSc (Hons) CSci MIEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than seventeen years‟ relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is Member of the Institute of Air Quality Management and a Chartered Scientist.

Lucy Hodgins, BSc (Hons) MIEnvSc MIAQM

Miss Hodgins is a Consultant with AQC, with over 7 years‟ experience in the field of air quality. She has been involved in the assessment of air quality impacts for a range of industrial, commercial and residential projects using qualitative and quantitative methods, including dispersion modelling, utilising a variety of models including ADMS Roads, Breeze Roads, ADMS-5 and Breeze Aermod. She has been responsible for the preparation of road traffic and point source emissions assessments for residential, mixed-use and industrial developments. She has undertaken numerous operational dust assessments for mineral and waste facilities, as well as assessments of construction dust emissions. She has also undertaken assessments for energy from waste, anaerobic digestion and waste biomass facilities for a range of air pollutants, along with nuisance dust and odour. Miss Hodgins has extensive experience in nuisance dust and ambient air quality monitoring and the interpretation of monitoring data. She is a Member of the Institute of Air Quality Management and the Institution of Environmental Sciences.

Full CVs are available at www.aqconsultants.co.uk.

A3 Modelling Methodology

Model Inputs

A3.1 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). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 7.0) published by Defra (2017b).

A3.2 Hourly sequential meteorological data from Mumbles for 2016 have been used in the model. The Mumbles meteorological monitoring station is located on The Mumbles headland, approximately 7 km to the southwest of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed development site; both the development site and the meteorological monitoring station are located where they will be influenced by the effects of coastal meteorology over flat-lying topography.

A3.3 AADT flows, and the proportions of HDVs, for roads adjacent to the proposed development site have been determined from the interactive web-based map provided by the Department for Transport (DfT, 2017). The 2016 AADT flows have been factored forwards to the assessment year of 2019 using growth factors derived using the TEMPro System v7.0 (DfT, 2016). Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A3.1. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2016).

Table A3.1: Summary of Traffic Data used in the Assessment (AADT Flows) [a]

Road Link	DfT Count Point	2016		2019	
		AADT	%HDV	AADT	%HDV
A483 Fabian Way	74086	32,127	4%	33,438	4%
A4217	99821	21,583	3%	22,464	3%
Newcut Road	99822	12,354	3%	12,858	3%

[a] This is just a summary of the data entered into the model, which have been input as hourly average flows of motorcycles, cars, buses, Light Goods Vehicles and Heavy Goods Vehicles, as well as diurnal flow profiles for these vehicles.

A3.4 Figure A3.1 shows the road network included within the model and defines the study area.

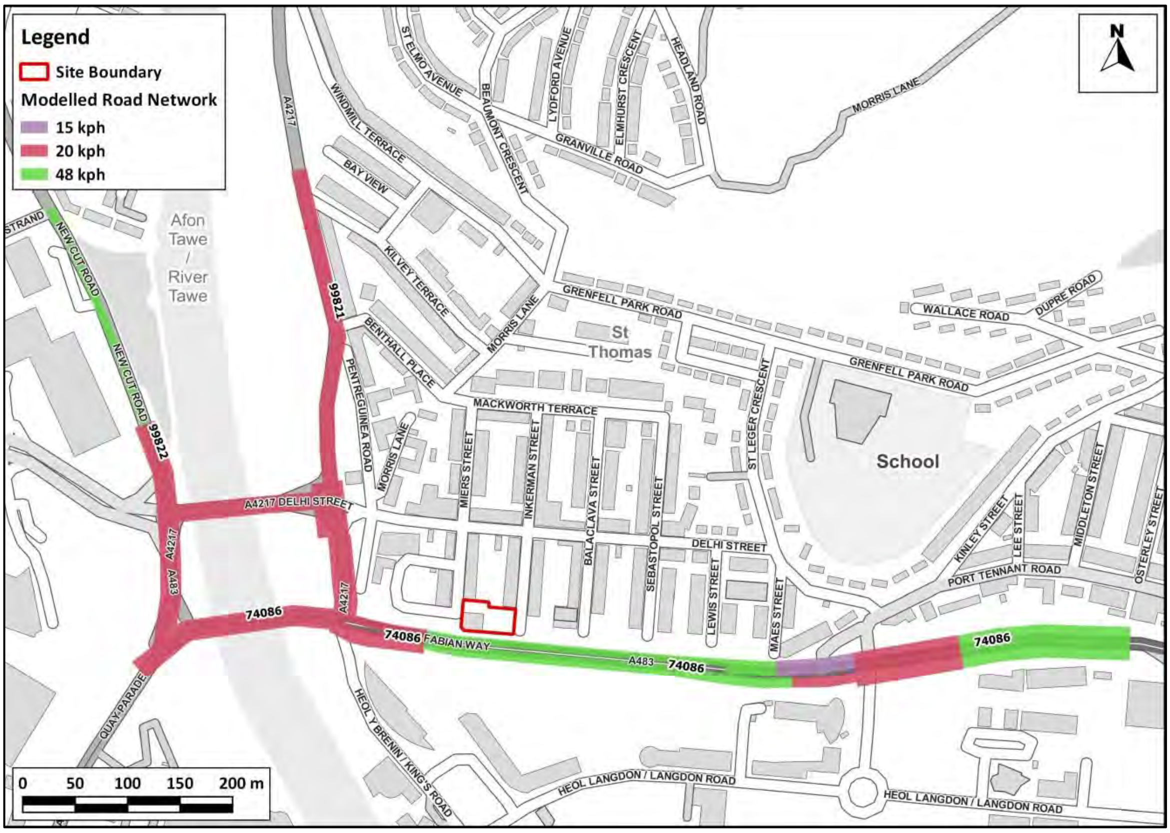

Figure A3.1: Modelled Road Network

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Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

A3.5 As explained in Section 3, AQC has carried out a detailed analysis which showed that, where previous standards had limited on-road success in reducing nitrogen oxides emissions from diesel vehicles, the „Euro VI" and „Euro 6" standards are delivering real on-road improvements (AQC, 2016b). Furthermore, these improvements are expected to increase as the Euro 6 standard is fully implemented. Despite this, the detailed analysis suggested that, in addition to modelling using the EFT (V7.0), a sensitivity test using elevated nitrogen oxides emissions from certain diesel vehicles should be carried out (AQC, 2016b). A worst-case sensitivity test has thus been carried out by applying the adjustments set out in Table A3.2 to the emission factors used within the EFT[3], using AQC"s CURED (V2A) tool (AQC, 2016a). The justifications for these adjustments are given in AQC (2016b). Results are thus presented for two scenarios: first the „official prediction", which uses the EFT with no adjustment, and second the „worst-case sensitivity test", which applies the adjustments set out in Table A3.2. The results from this sensitivity test are likely to over-predict

3 All adjustments were applied to the COPERT functions. Fleet compositions etc. were applied following the same methodology as used within the EFT.

emissions from vehicles in the future and thus provide a reasonable worst-case upper-bound to the assessment.

Table A3.2: Summary of Adjustments Made to Defra's EFT (V7.0)

<table>
<tr><th colspan="2">Vehicle Type</th><th>Adjustment Applied to Emission Factors</th></tr>
<tr><td colspan="2">All Petrol Vehicles</td><td>No adjustment</td></tr>
<tr><td rowspan="2">Light Duty Diesel Vehicles</td><td>Euro 5 and earlier</td><td>No adjustment</td></tr>
<tr><td>Euro 6</td><td>Increased by 78%</td></tr>
<tr><td rowspan="3">Heavy Duty Diesel Vehicles</td><td>Euro III and earlier</td><td>No adjustment</td></tr>
<tr><td>Euro IV and V</td><td>Set to equal Euro III values</td></tr>
<tr><td>Euro VI</td><td>Set to equal 20% of Euro III emissions [a]</td></tr>
</table>

[a] Taking account of the speed-emission curves for different Euro classes as explained in AQC (2016b).

Background Concentrations

A3.6 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2017b). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030. The background maps for 2016 have been calibrated against concurrent measurements from national monitoring sites (AQC, 2017). The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment year than those derived from the Defra maps (AQC, 2016c).

Background NO_2 Concentrations for Sensitivity Test

A3.7 The road-traffic components of nitrogen dioxide in the background maps have been uplifted in order to derive future year background nitrogen dioxide concentrations for use in the sensitivity test. Details of the approach are provided in the report prepared by AQC (2016c).

Model Verification

A3.8 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Nitrogen Dioxide

A3.9 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 2016 at the diffusion tube monitoring site 408 at the junction of Fabian Way and Port Tennant Road. Concentrations have been modelled at 2.5 m, the approximate height of the monitor.

A3.10 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 concentration and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2017b).

A3.11 An adjustment factor has been determined as the ratio of the „measured" road contribution and the model derived road contribution. This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. 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 (Defra, 2017b).

A3.12 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 43.5 µg/m^3
- Background NO_2 : 15.3 µg/m^3
- „Measured" road-NOx (using NOx from NO_2 calculator): 60.9 µg/m^3
- Modelled road-NOx = 14.7 µg/m^3
- Road-NOx adjustment factor: 60.9/14.7 = **4.14**[4]

A3.13 The factor implies that the unadjusted model is under-predicting the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

Model Verification for NOx and NO_2 Sensitivity Test

A3.14 The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of **3.56**, which has been applied to all modelled road-NOx concentrations within the sensitivity test.

PM_{10} and $PM_{2.5}$

A3.15 The measured concentrations of PM_{10} at the Port Tennant Road monitor have been compared with the background concentrations. The estimated background concentrations are greater than the measured roadside concentrations therefore it is not possible to verify the road-PM_{10} concentration. No adjustment factor has been applied to the road-PM_{10} concentration.

Model Post-processing

A3.16 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

4 Based on un-rounded values.

NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2017b). 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.

Glossary of Terms

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