Swansea Council
2017 Air Quality Progress Report

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

November 2017

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Executive Summary

The Environment Act 1995, Part IV established a national framework for air quality management that requires all local authorities to conduct air quality reviews of their areas having had regard to any guidance issued. If the reviews undertaken indicate that the objective for any of the identified pollutants will not be met by the date for compliance then an Air Quality Management Area must be declared.

The City and County of Swansea following the first round of review and assessment concluded that there was a requirement to declare the Hafod area as an Air Quality Management Area due to exceedances of the nitrogen dioxide annual mean objective.

During August 2010 and due to exceedances of the nitrogen dioxide annual mean objective being measured within the Sketty and Fforestfach areas of the authority, the Hafod Air Quality Management Area was amended by Council to include these newly identified areas and renamed the Swansea Air Quality Management Area 2010. The areas now making up the Swansea Air Quality Management Area 2010.

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 is therefore proposed to proceed to a Detailed Assessment for nitrogen dioxide concentrations within thes 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.

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.

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1 Introduction

1.1 Description of Local Authority Area

The City and County of Swansea unitary authority covers a mixed area of extensive coastline, rural villages and the City of Swansea itself. The latest Census (March 2011) estimate for the population of Swansea is 239,000. The 2011 Census also indicates some important changes within the age profile from the previous 2000 Census:-

- **Aged under-5**: a significant growth of around 1,100 (+8.8%)
- **Aged 5-14 years** (school-age): a decline of 1,600 (-6.0%), probably due in large part to reductions in the number of births recorded in the late 1990's / early 2000's.
- **15-19 age** groups: an increase of around 1,200 (+7.8%). This could mainly reflect the increasing inflow of 18 and 19 year olds to Swansea's universities.
- **20-24**: a pronounced growth of almost 5,000 (+31.8%) over the ten-year period, again linked to increasing levels of student in-migration and initial retention, including those from elsewhere in Wales, the UK and (to some extent) overseas.
- **25-29**: a significant increase in the population of this cohort over the period by 3,100(+24.5%). This growth could be attributable to a number of factors, including economic in-migration and the retention of graduates.
- **30-39**: a moderate decrease of 1,200 (-3.8%).
- **40-49**: an increase of 9.7% (+2,900), possibly linked to the 1960s 'baby boom'.
- **50-64**: a steady increase of 8.5% (+3,500), again slightly higher than the equivalent overall rate of population increase for Swansea over the period (+6.9%)
- **Older population** (all aged 65+): an increase of 1,900 (+4.6%), indicative of an ageing population, in line with established national trends. However, population growth in the older groups has been most dramatic in the population aged over 85, which is estimated to have increased in Swansea by 900 (+18.8%) over the ten year period from around 4,900 in 2001 to 5,800 in 2011.

To the west of the City of Swansea stands the gateway to the Gower Peninsula, an officially designated Area of Outstanding Beauty that boasts wide-open beaches and rugged shorelines. To the east of the City and County of Swansea lies the only major operational traditional "heavy industry" in the form of the Tata Steelworks complex at Port Talbot. Heavy industry has declined steadily within the boundaries of the authority during the last century. This former industrial activity has left its scars – most notably to the Lower Swansea Valley. From the early 1970's the areas once blighted by slag heaps have undergone extensive remediation and greening. New "light industry" and retail outlets have moved back into the Lower Swansea Valley following the establishment of Enterprise Zone's and industrial parks. Considerable regeneration is now ongoing within the Swansea area notably the docks re-development and within the city centre/marina area.

The major source of pollution is now vehicular. The topography of the Lower Swansea Valley is complex and it is thought that this aggravates pollution loading in the area. Swansea is connected to major road and rail links. The M4 motorway travels through northern area of the authority, connecting Swansea with Carmarthenshire in the west and to Cardiff and Bristol to the east. The major artery routes of the A483, A4067 and A48 connect Swansea city centre with the M4 motorway junctions to the north. Local traffic also use these routes as primary routes into the city centre.

Swansea is well served with rail links to the majority of the UK. The Inter-City 125 service from London Paddington terminates at Swansea. Local services operate from Swansea to Mid and West Wales. A major locomotive-servicing centre operates within Swansea at Landore Diesel Sheds, primarily to service the power units of the Inter City 125 service. The majority of diesel locomotives operated by First Great Western are also serviced and maintained at this facility.

The older and established areas of Swansea comprise of traditional terraced housing. These areas tend to be, but are not exclusively within approximately 3 miles of the city centre. Areas of high density terraced housing still exist around the centres of population established during the Industrial Revolution.

As would be expected, new housing provision tends to be either of detached, or semi-detached, and during the last 20 – 30 years these developments have mainly been located in areas greater than 3 miles away from the city centre. This trend is changing however and within the last 5 years Swansea has seen the SA1 development within the old docks area provide a springboard for new housing development both within the SA1 development site and more lately within the marina area. This regeneration is now also extending into the heart of the city centre with several residential developments taking the place of retail/business premises or occupying the upper floors of former wholly retail premises.

The Tawe Riverside Corridor Proposals will, when fully implemented see, the regeneration of a large of the lower Swansea Valley from the Quay Parade bridges up to the Morfa Retail Park. This area is subject to past historical industrial contamination from primarily metals processing and has been in decline for several decades. Some sites have been developed for industrial use but large sections of land remained in the same state following the lower Swansea Valley project of the late 1970's and early 1980's. This project dealt with the legacy of contamination by clearing derelict sites and undertaking limited remediation with extensive landscaping.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

For Local Authorities in Wales, Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the LAQM process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 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 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu g/m^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 – 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	
Benzene	16.25 µg/m^3	Running annual mean	31.12.2003
	5.00 µg/m^3	Annual mean	31.12.2011
1,3-butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

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

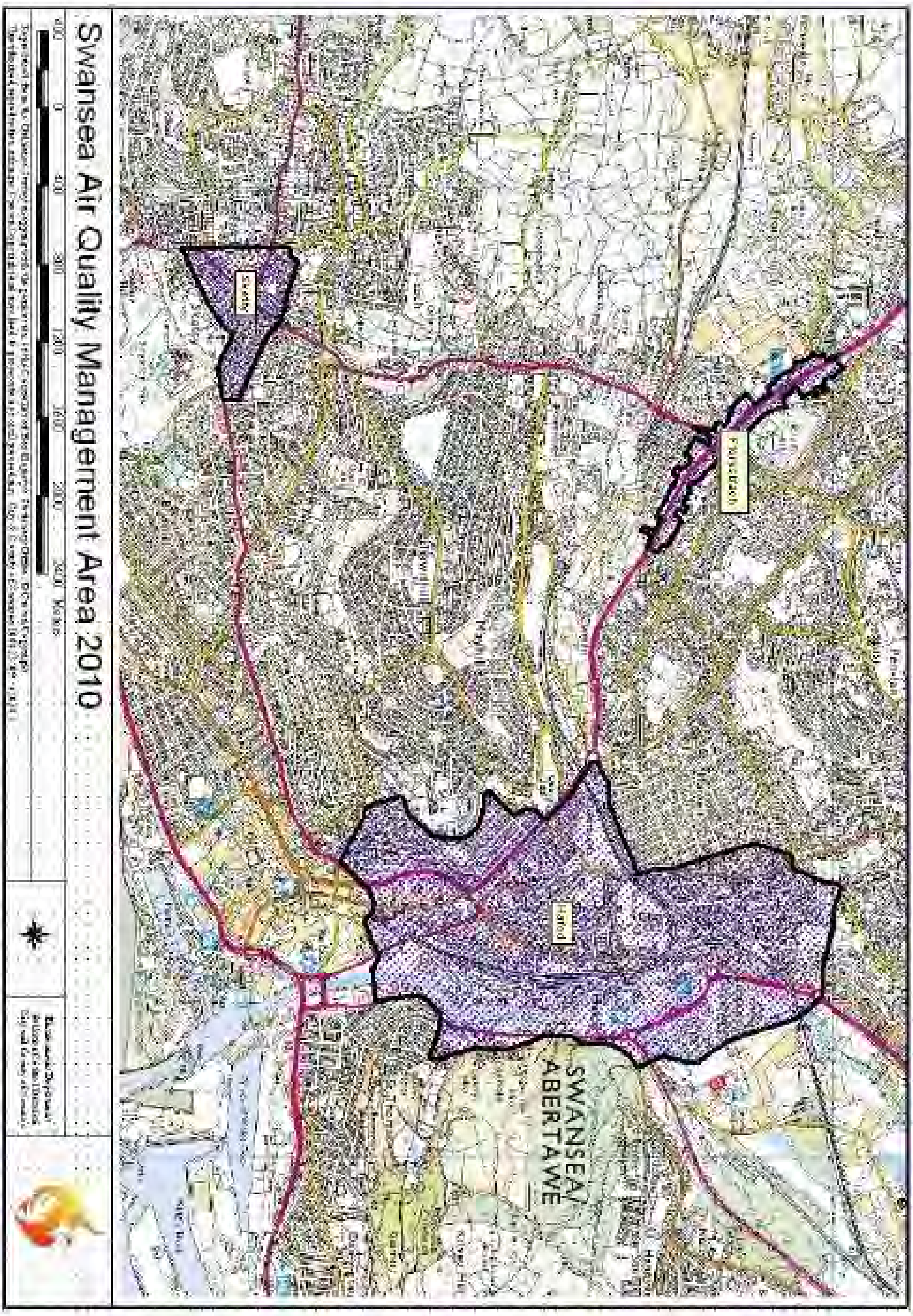
This report contains the latest air quality monitoring results within the City and County of Swansea. The conclusions reached are that the objectives for benzene, lead and sulphur dioxide will be met and that there is no requirement to proceed further with these pollutants. However, there is evidence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

Table 1.2 –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

The Internet addresses (URL's) that these reports can be downloaded from are given where appropriate.

Figure 1.1 – Map(s) of AQMA Boundaries



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

The authority operates a network of monitoring stations, mainly located within the lower Swansea valley area. The network is a mixture of four, fixed point automatic stations, together with open path measurements from two DOAS (Differential Optical Absorption Spectroscopy) stations. Details of all automatic monitoring station are given below in table 2.3 with site by site operational details provided within section 2.1.

During late 2012 the authority deployed Met One EBams PM_{10} at five locations in Swansea. These sites are detailed below and tend to be either at busy junctions or other areas of high HGV flow i.e. the EBam at Westway to monitor any impact from the Quadrant Bus Station. It is recognised that the Met One EBam has not participated in the equivalency trials to show compliance with the EU reference gravimetric method but as outlined below the data from the EBams correlate well with the Met One Bam 1020 PM_{10} monitor located at the Swansea AURN. The Met One Bam 1020 has participated in equivalency trails and has been accepted as an equivalent method. The use of the MetOne EBams has therefore been restricted to that of a “screening assessment”. Table 2.3 below includes details of these PM_{10} monitoring locations. Whilst the Sketty Cross and Fforestfach Cross EBam sites are within the existing Swansea AQMA 2010 boundary, the AQMA was declared as a result of NO_2 annual mean exceedances and not for exceedances of any PM_{10} objectives.

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 2016 was 21,192 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[1]. 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 (Morfa, 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 – Aerial view of Swansea Roadside AURN

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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

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

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). 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

Hourly ratified data for 2016 covering the pollutants Nitrogen Dioxide and Particulate Matter PM_{10} and $PM_{2.5}$ (BAM 1020) has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector. These data have 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[2]. Figure 2.1.2 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). 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.

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

Figure 2.1.2 - Aerial view - Morriston Groundhog

Therefore, only NO_2, Ozone and $PM_{2.5}$ (1020BAM) data are reported here for 2016.

Cwm Level Park, Landore

The authority established a NO_x and Ozone urban background monitoring station [3] 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. 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.

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

Figure 2.1.3 Cwm Level Park Monitoring

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.

A map showing the location of the Cwm Level Park station is given above as Figure 2.1.3. 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 2016 of 14,088 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 2.1.4 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 2016 of 16152 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 2.1.4 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[4].

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

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

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.

- **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

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

The St.Thomas OPSIS Differential Optical Absorption Spectroscopy (DOAS) has been 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 section of Pentreguinea Road had an annual average daily traffic flow (AADT) during 2014 of 21,360 vehicles and forms the eastside link up/down the Swansea Valley from Whiterock Bridge to Quay Parade bridges. 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 2.1.5 - St Thomas DOAS Transmitter

Figure 2.1.6 - 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[5].

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 2.1.7below. The site of the transmitter lies just outside of the southern boundary of the Swansea Air Quality Management Area 2010 (former Hafod AQMA). The extent of the existing order can be seen within Figure 2.1.7.

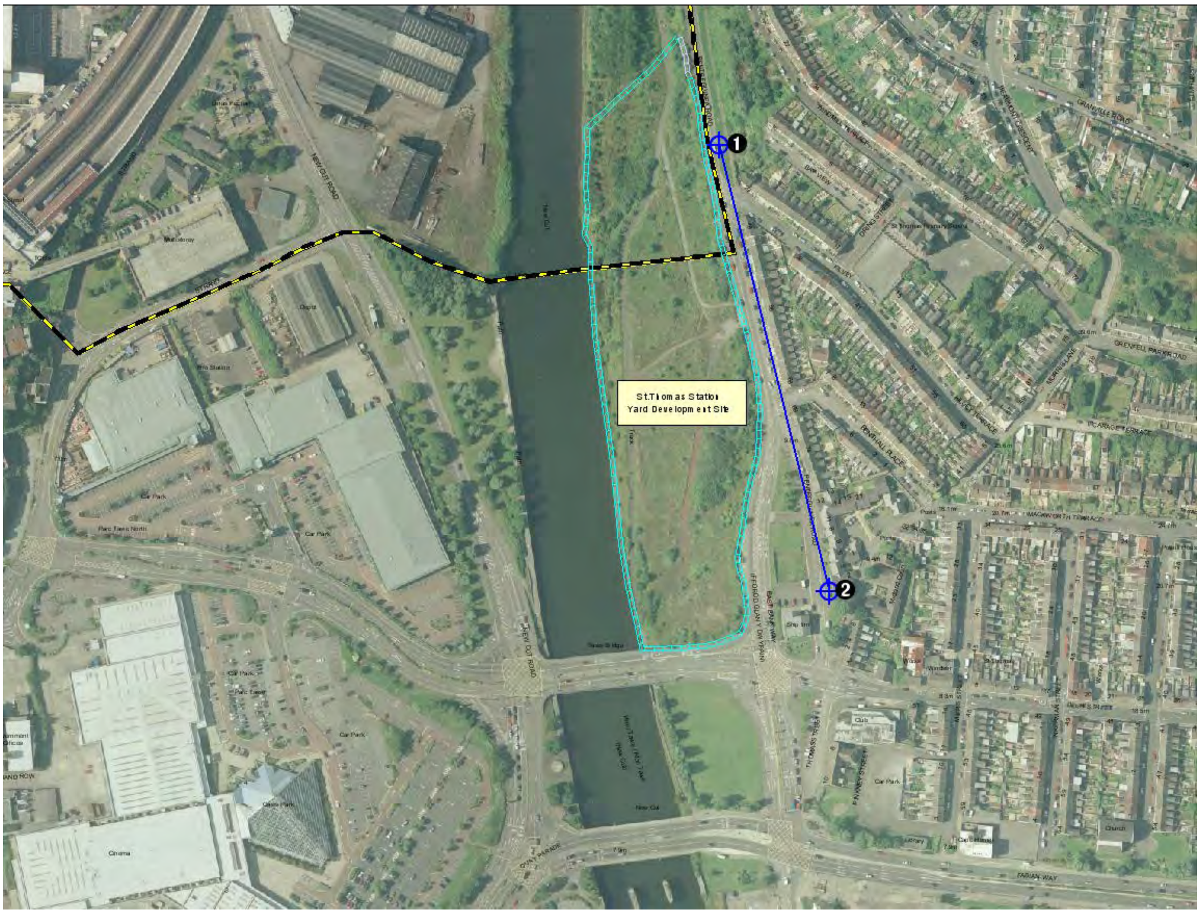

Figure 2.1.7 – Aerial View of St.Thomas OPSIS DOAS and surrounding area

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Quay Parade Bridges are to the south of this location. There are numerous dwellings located along this section of Pentreguinea Road with an application already received for residential development on the former St.Thomas Station Yard Site located between Pentreguinea Road and the River Tawe. An application for formal planning

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

consent was received during 2005 but was rejected due to the intensity of the development. It is thought that a modified scheme will eventually be resubmitted to include an element of social housing.

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. 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 5th and 6th months of operation. Changing the Xenon lamps every 6 months does not invoke any data issue concerns at this site.

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.

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. 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[6]. 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.

[6] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

The Met One Instruments, Inc model E-BAM automatically measures and records airborne PM_{10} 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 $_{14}C$ (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.

A map of the site and surrounding area is given below as figure 2.1.8.

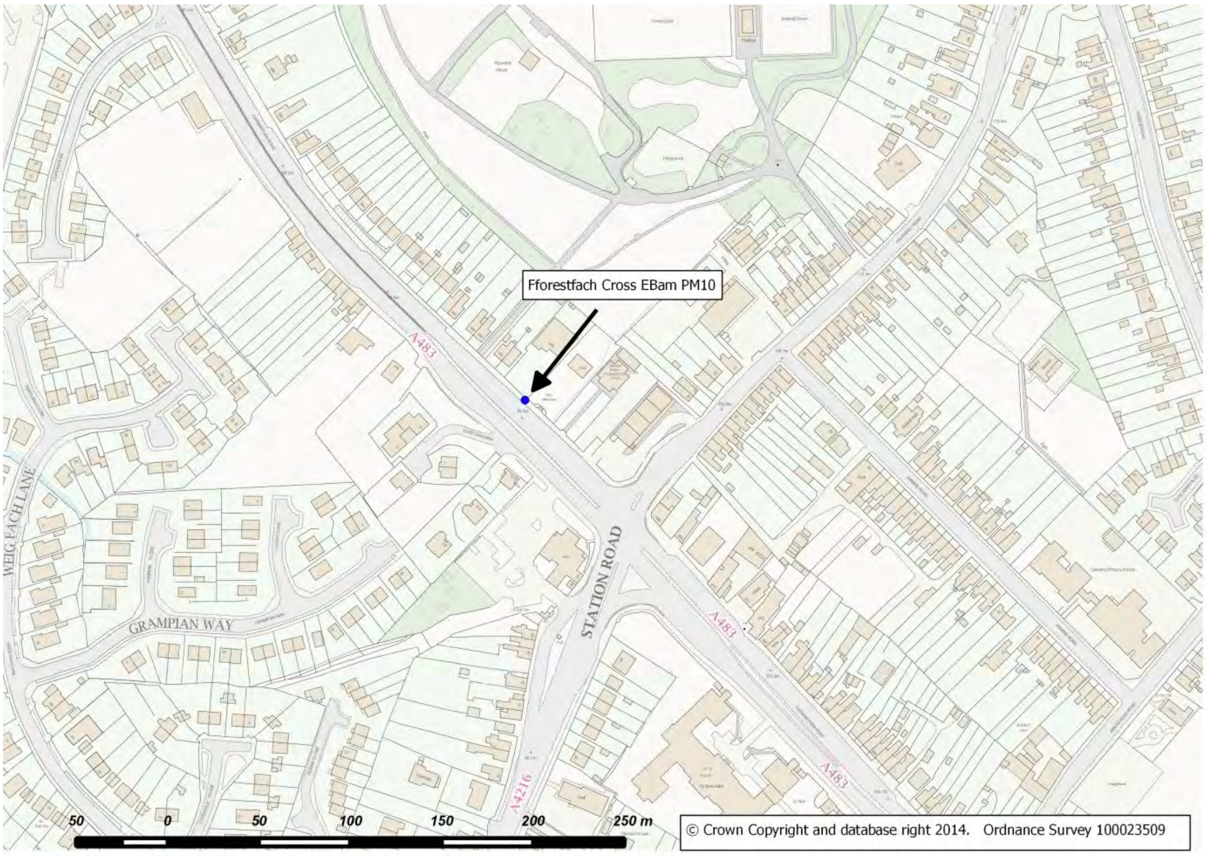

Figure 2.1.8 – *Fforestfach Cross EBam PM_{10}*

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. The chosen monitoring location is adjacent to the GPRS Automatic Traffic Counter site 33. The Annual Average Daily Traffic (AADT) flow for 2016 was 19488.

A summary of the composition of the flow during 2016 is given below:

Table 2.1

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	0.6	30.3
Cars or light Vans	93.0	37.4
Cars or light Vans with Trailer	0.1	28.6
Heavy Van, Mini bus, L/M/HGV	4.9	34.5
Articulated lorry, HGV+Trailer	0.1	27.4
Bus	1.2	27.0

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.

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[7]. 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 PM_{10} 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 $_{14}C$ (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

[7] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

Ltd. In addition, the authority has a 5 day call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as figure 2.1.9.

Figure 2.1.9 – 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.

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[8]. 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 PM_{10} 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 $_{14}C$ (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

[8] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

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.

A map of the site and surrounding area is given below as figure 2.1.10

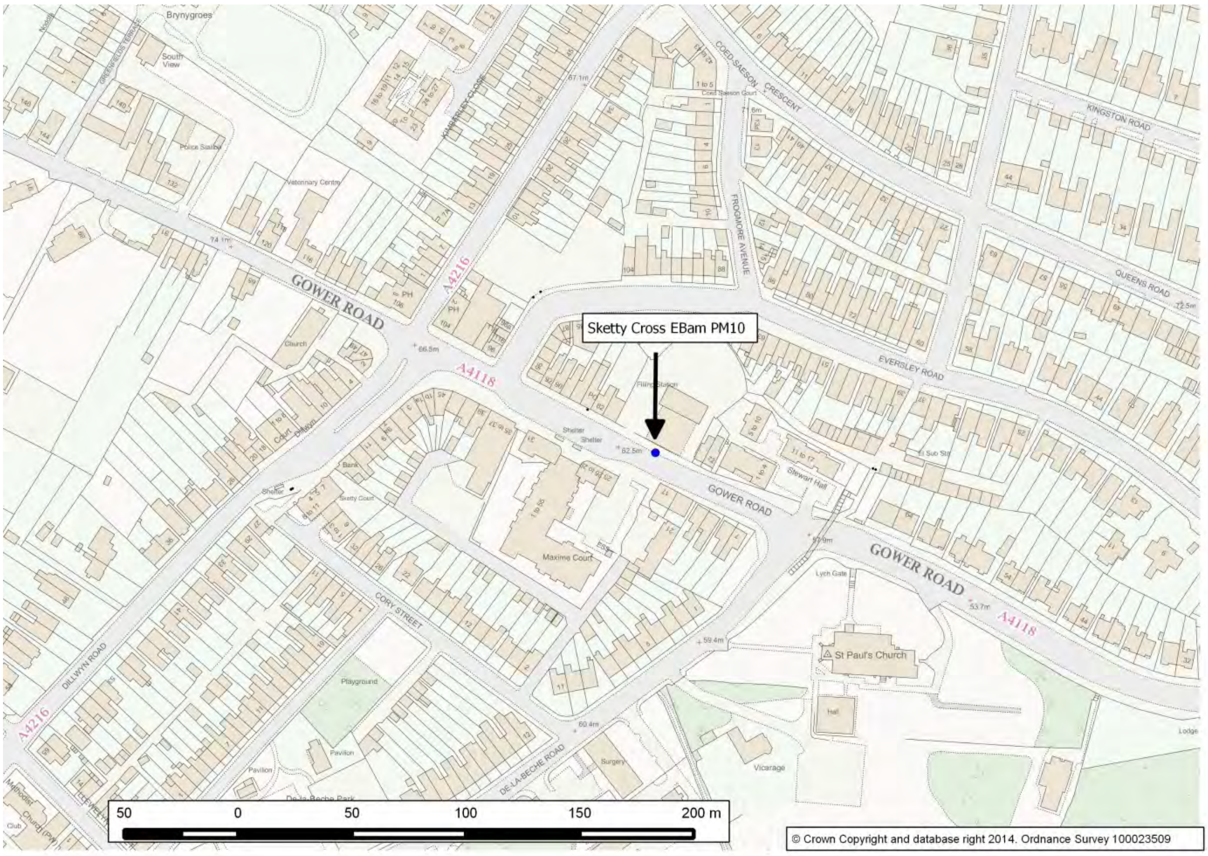

Figure 2.1.10 – *Uplands Crescent EBam PM_{10}*

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.

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[9]. 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 PM_{10} 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 $_{14}C$ (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.

[9] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

The station is serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority has a 48 hour call out response for any on-site equipment problems with Enviro Technology Services Plc.

A map of the site and surrounding area is given below as figure 2.1.11.

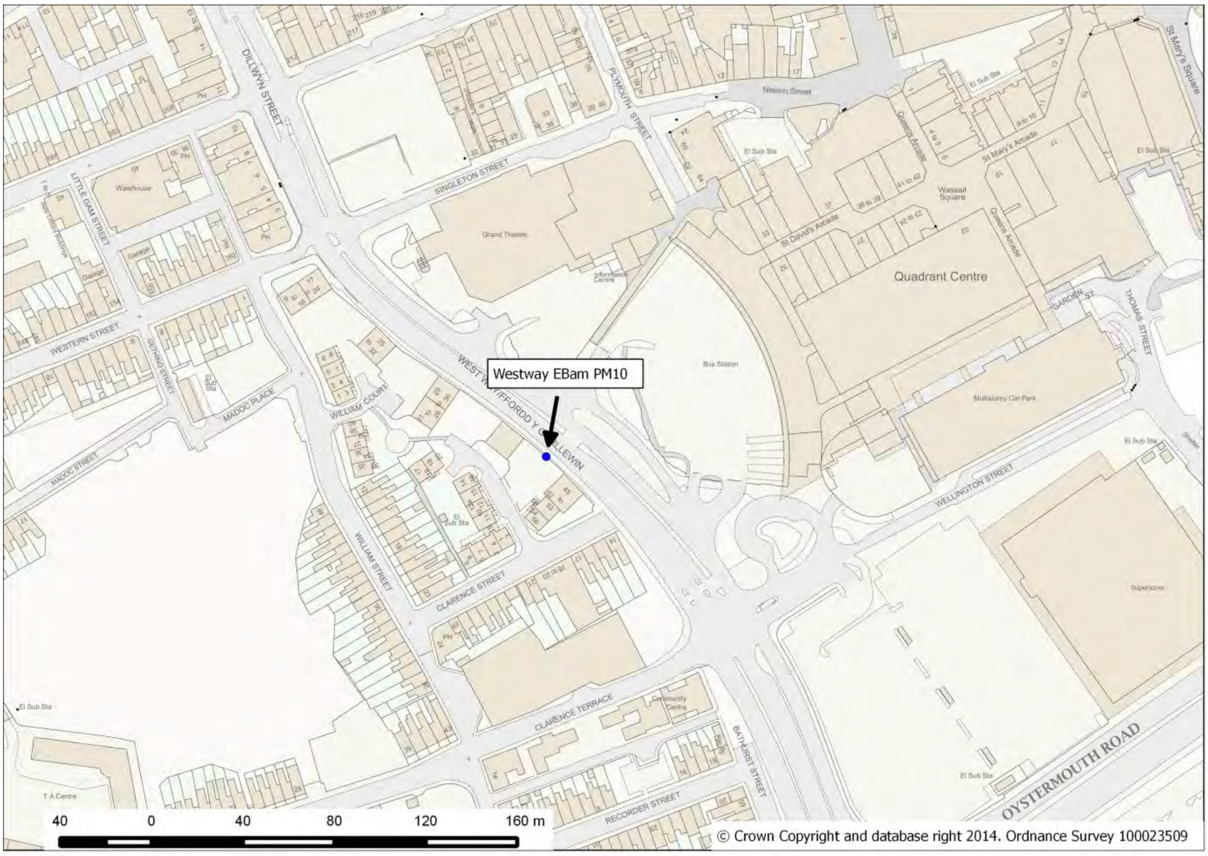

Figure 2.1.11 – *Westway EBam PM_{10}*

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 2016 was 34,776.

A summary of the composition of the flow during 2016 is given below:

Table 2.2

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	1.0	46.3
Cars or light Vans	93.1	45.9
Cars or light Vans with Trailer	0.2	37.0
Heavy Van, Mini bus, L/M/HGV	4.1	43.1
Articulated lorry, HGV+Trailer	0.4	41.1
Bus	1.2	41.0

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 tenant Road and also several within the general vicinity.

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[10]. 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 PM_{10} 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 ^{14}C (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

[10] http://uk-air.defra.gov.uk/assets/documents/reports/cat05/0606130952_UKPMEquivalence.pdf

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.

A map of the site and surrounding area is given below as figure 2.1.12

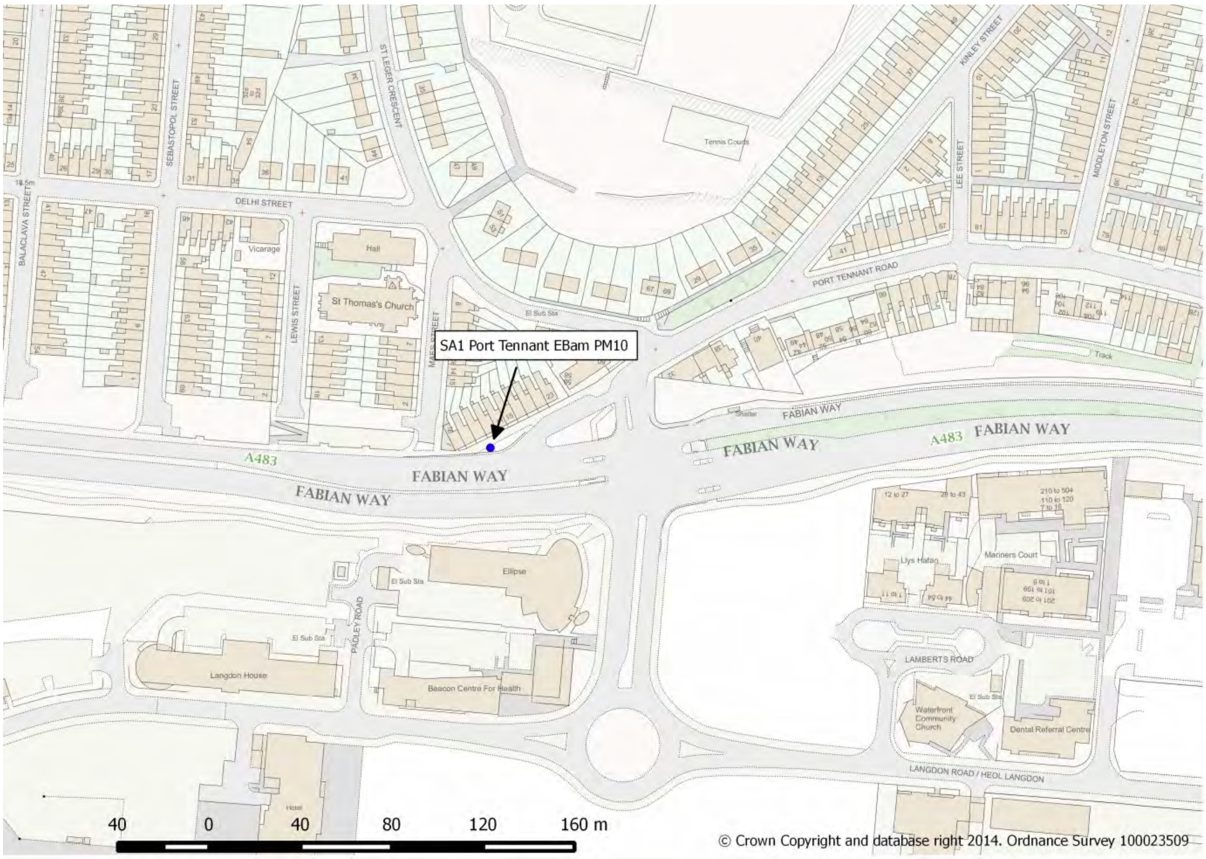

Figure 2.1.12 - *SA1 Port Tennant EBam PM_{10}*

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[11]. Figure 2.1.13 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.

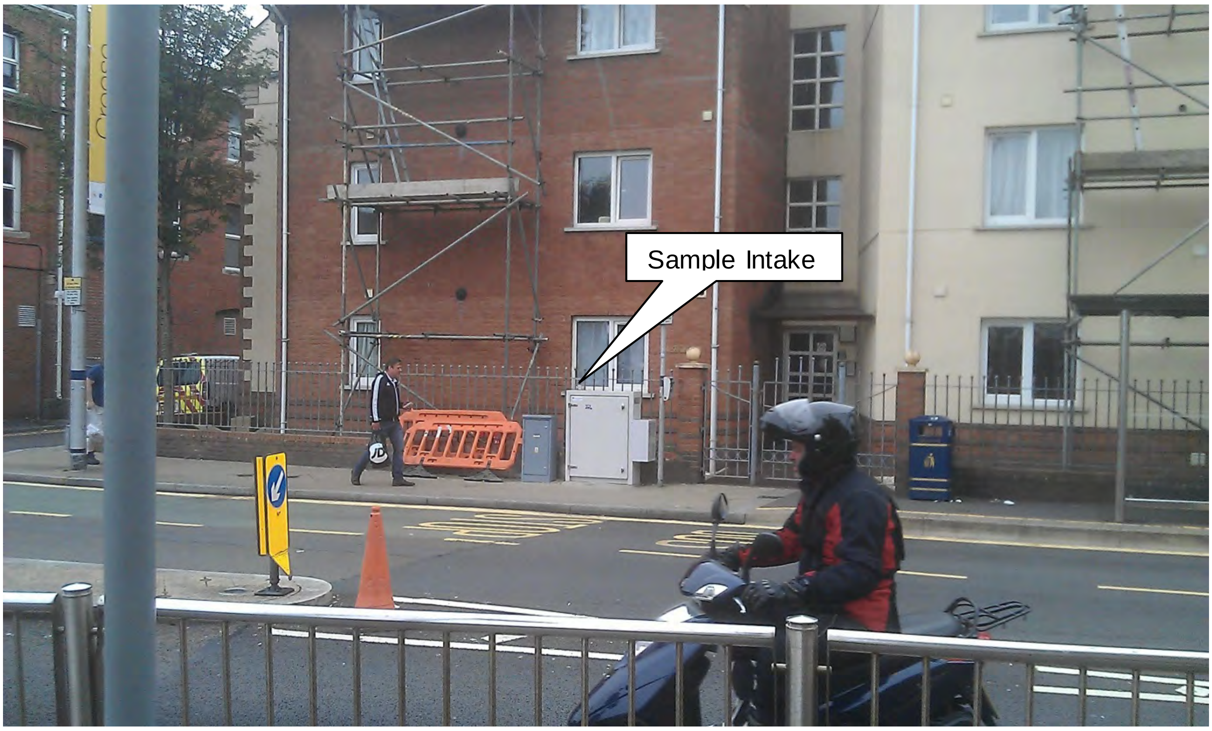

Figure 2.1.13 – Station Court, High Street NO_x monitoring site.

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

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

automatically logged as invalid by the data-logger. 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.

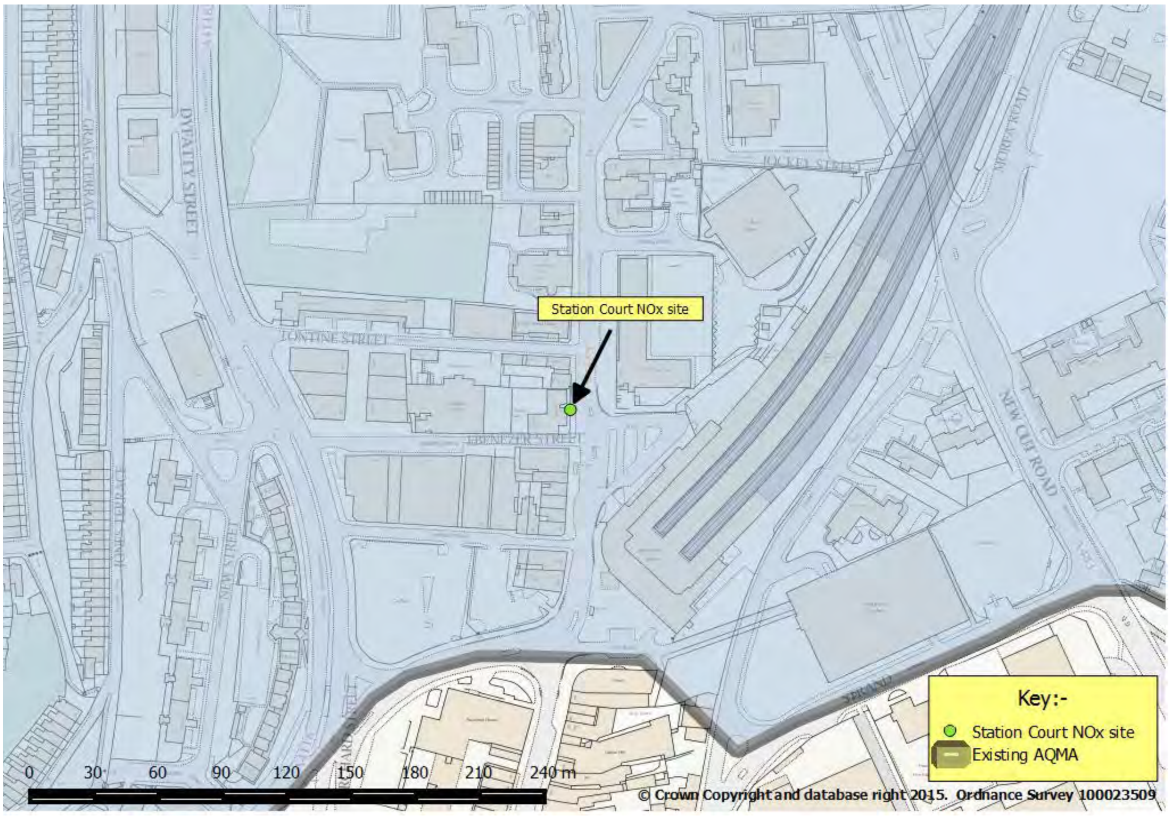

Figure 2.1.14 – Station Court High Street, Swansea NOx box

Summary of Automatic Continuous Real-Time Monitoring Locations.

For ease of reference and in order for the reader to familiarise themselves spatially with the locations that the City and County of Swansea undertake automatic continuous monitoring, all such sites are presented below within figure 2.15. Also included within figure 2.15 is the extent of the Swansea Air Quality Management Area 2010 which was declared during August 2010.

Included with this spatial view is the meteorological monitoring that is currently being undertaken within the lower Swansea Valley area. This currently only includes a dedicated 30m mast at Cwm Level Park. The meteorological monitoring from Cwm Level Park will provide the datasets required by the air quality modelling that is currently under development, with sufficient details of the meteorological conditions experienced within the complex topographical area that exists in the lower valley area..

From figure 2.15, the reader will no doubt realise that no continuous and automatic chemiluminescent NO_x monitoring has been, or is currently being undertaken within the Sketty and Fforestfach areas of the Swansea Air Quality Management Area 2010. This is unlikely to change for a considerable period of time given the current budgetary restraints. Monitoring of NO_2 within these areas has been, and will continue to be undertaken, via passive nitrogen dioxide diffusion tubes.

Figure 2.15 – Map(s) of Automatic Monitoring Sites

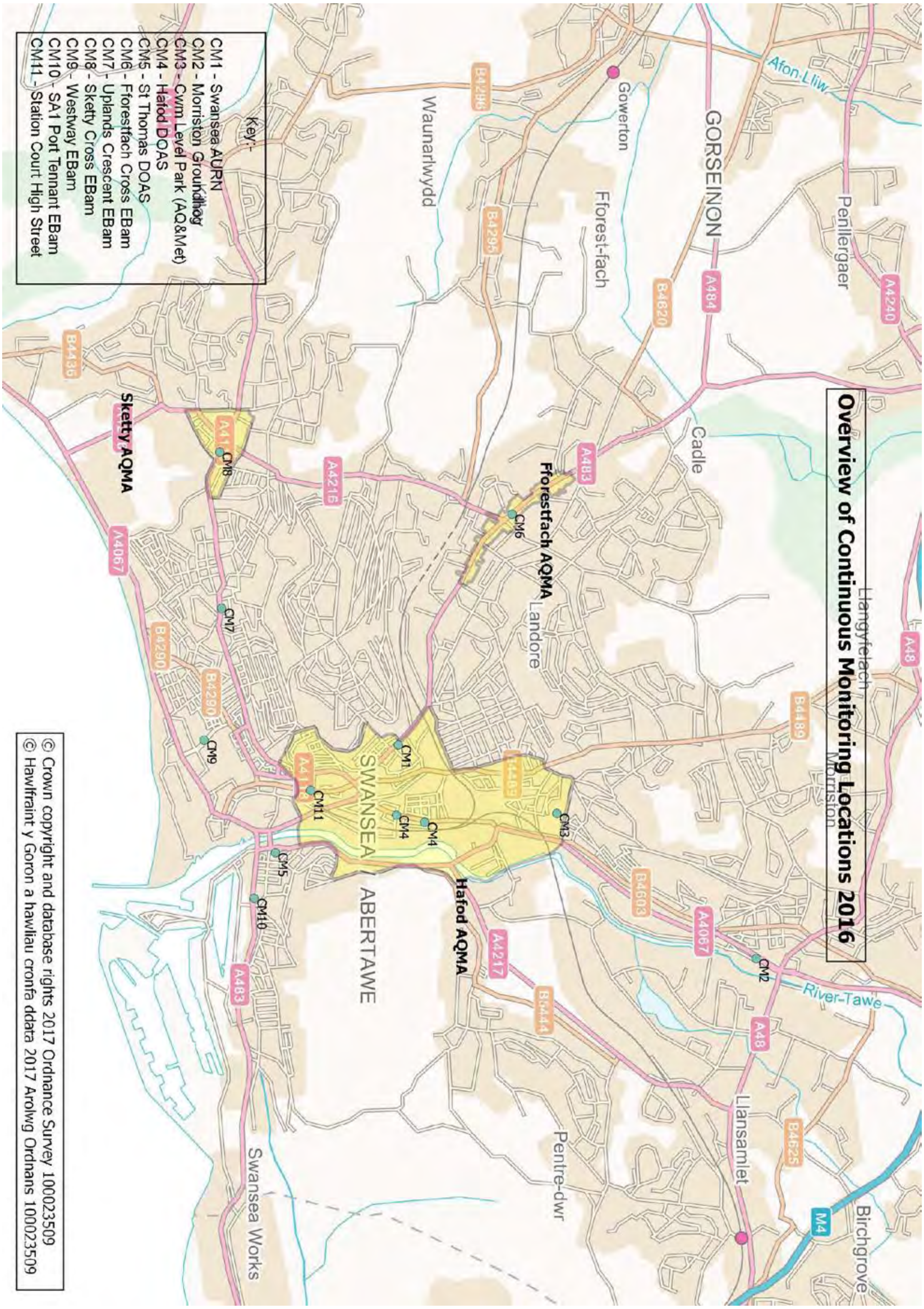

Table 2.3 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
CM1	Swansea Roadside AURN	Roadside	265299	194470	2.0	NO_2, PM_{10}, $PM_{2.5}$	Y	Chemiluminescence and BAM1020	Y (12m)	4m	N
CM2	Morriston Groundhog	Roadside	267210	197674	2.0	NO_2, PM_{10} and Ozone	N	Chemiluminescence, UV Absorption and BAM1020	Y (22m)	4m	N
CM3	Cwm Level Park	Urban Background	265912	195890	1.5	NO_2 and Ozone	Y	Chemiluminescence, UV Absorption	N (100m)	78m	N
CM4	Hafod Doas	Roadside	Transmitter 265927 Receiver 265991	Transmitter 194453 Receiver 194706	4.0	NO_2, Ozone and Benzene	Y	Differential Optical Absorption Spectrometry	Y (0.3m)	1.7m	Y
CM5	St Thomas DOAS	Roadside	Transmitter 266191 Receiver 266263	Transmitter 266263 Receiver 193370	4.0	NO_2, SO_2, Ozone and Benzene	N	Differential Optical Absorption Spectrometry	Y (2m) Varies along path length	1.7m	Y
CM6	Fforestfach Cross	Roadside	263236	195489	3.0	PM_{10}	N	EBam	Y (19m)	3m	N
CM7	Uplands Crescent	Roadside	264078	192888	3.0	PM_{10}	N	EBam	Y (12m)	1m	N
CM8	Sketty Cross	Roadside	262681	192871	3.0	PM_{10}	N	EBam	Y (14m)	1m	N

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
CM9	Westway Quadrant Bus Station	Roadside	265256	192731	3.0	PM_{10}	N	EBam	Y (11m)	2m	N
CM10	SA1 Junction Port Tennant	Roadside	266670	193179	3.0	PM_{10}	N	EBam	Y (6m)	3m	N
CM11	Station Court High Street	Roadside	265705	193686	1.5	NO_2	Y	Chemiluminescence	Y (1m)	2m	Y

Additional Continuous Monitoring

Heavy Metals Monitoring

The Department of the Environment, Transport and the Regions (DETR) 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 INCO (now Vale) being located within the authority's area at Clydach.

On the 16th July 2003 the European Commission adopted a proposal for a Directive relating to arsenic, cadmium, nickel, mercury and polycyclic hydrocarbons (PAH) in ambient air[12]. The target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of Best Available Technique (BAT). There are therefore, as yet, no binding obligations to reduce these pollutants. Ambient air concentrations of these substances only have to be monitored once emissions have passed a critical threshold.

Annexe 1 of the Directive details the target values for arsenic, cadmium, nickel and benzo(a)pyrene and these are reproduced below as table 2.4.

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

Table 2.4 Target Values 4th Daughter Directive - Heavy Metals Monitoring

Glais Primary School, School Road, ❷ was chosen as the initial monitoring location due to its proximity to the refinery ❶ and for additional security issues with the equipment at the time. A Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling

[12] *COM 2003 (423)*

unit, fitted with a PM_{10} sampling inlet with a flow rate of 16.7 l/min, has been installed on a flat roof at Glais Primary School.

During July 2006, two additional monitoring locations were added: one at Coed-Gwilym Cemetery ❸ upwind of the high level stack release and one at the Morriston Groundhog ❺ some 4.1 kilometres downwind of the stack release point (see section 2.1 for site location of the Morriston Groundhog. Both additional units were Partisol 2025 units with automatic filter cartridge exchange and are fitted with PM_{10} sampling inlets with flow rates of 16.7 l/min. Four filters are housed in the main exchange drum and the unit automatically regulates weekly exposure of each filter.

During July 2007, the building that the Partisol 2000 unit was located on at Glais Primary School was demolished due to subsidence. The site was therefore decommissioned and did not become operational again until December 2007. Whilst the site was recommissioned during 2007 it ceased to form part of the UK Heavy metals monitoring Network from the 1st January 2008. However, this authority is no longer able to continue to fund heavy metals monitoring at this site. **Monitoring ceased at Glais Primary School due to continued breakdown repair costs and analytical costs in April 2013**

A further site has been established to the north of the high level stack release point during November 2007 at YGG Gellionnen ❹ (Welsh Primary School). The site is located on top of a flat roof within the school complex and has an uninterrupted view down to the refinery complex. **This authority continued to fund heavy metals monitoring at YGG Gellionnen until January 2014 when due to the analytical costs involved, monitoring ceased.**

During December 2007, there were changes made to those sites that form part of the UK Heavy Metals Monitoring Network – these changes took effect on the 1st January 2008. Two monitoring locations now formed part of the UK network within Swansea – these are the site upwind of the high level stack release at Coed-Gwilym Cemetery ❸ and the site located downwind of the release point at the Morriston Groundhog❺. Both the sample units deployed at these sites are Rupprecht & Patashnick Co., Inc. Partisol 2000 sampling units.

The authority as stated above, can no longer fund heavy metals monitoring at the Glais Primary School ❷ and at the YGG Gellionnen ❹ (Welsh Primary School) sites.

All monitoring locations (both UK Network sites and the two Swansea funded sites) have/had an Industrial classification[13]. **Data from 2014 has only been captured from points directly to the north (Coed-Gwilym Cemetery ❸) and from south (Morriston Groundhog❺) of the high level stack release point.**

The location of Vale and the sampling locations (including those now decommissioned) can be seen below within figure 2.1.16.

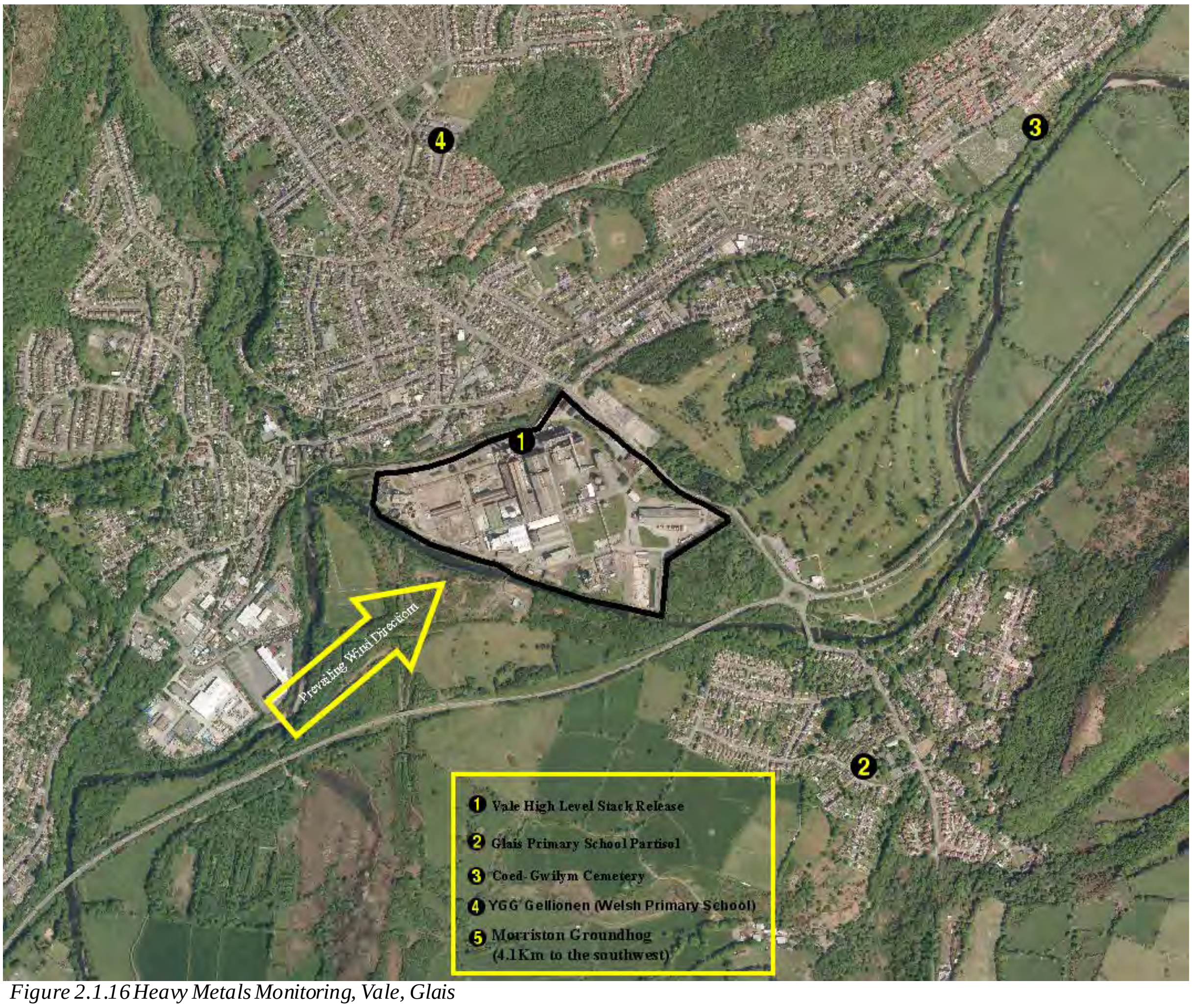

Figure 2.1.16 Heavy Metals Monitoring, Vale, Glais

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Filters are exposed on a weekly basis and sent to the National Physics Laboratory (NPL) for analysis. The analysed parameters are: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mn), Nickel (Ni), Lead (Pb),

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

Platinum (Pt), Vanadium (V), Zinc (Zn) and Mercury(Hg). Analysis for particulate-phase metals took place at NPL using a PerkinElmer Elan DRC II ICP-MS, following NPL's UKAS accredited procedure, which is fully complaint with the requirements of EN 14902:2005.

Upon arrival at NPL, the filters were cut accurately in half, and each portion digested at temperatures up to 220°C using a CEM Mars X microwave. The digestion mixtures used were:

• Hg & Pt: 5 ml of nitric acid and 5 ml hydrochloric acid.
• All other metals: 8 ml of nitric acid and 2 ml hydrogen peroxide.

ICP-MS analysis of the digested solutions took place using at least four gravimetrically-prepared calibration solutions. A QA standard was repeatedly analysed (after every two solutions), and the change in response of the QA standard was mathematically modeled to correct for the long-term drift of the instrument. The short-term drift of the ICP-MS was corrected for by use of an internal standards mixture (containing Y, In, Bi, Sc, Ga & Rh) continuously added to the all samples via a mixing block. Each sample is analysed in triplicate, each analysis consisting of five replicates.

The amount of each metal in solution (and its uncertainty) was then determined by a method of generalised least squares using XGenline (an NPL-developed program) to construct a calibration curve[14].

The uncertainty weighted mean for a series of N measurements, where the i^{th} measurement produces a value, x_i, with a measurement uncertainty, u_i, the uncertainty-weighted mean of the measurement, $\bar{x}_u$, would be given by:

$$\bar{x}_u = \frac{\sum_{i=1}^{i=N} \left(x_i / u_i^2 \right)}{\sum_{i=1}^{i=N} \left(1 / u_i^2 \right)}$$

14 2008 NPL Report-AS34 (March 2009) Annual Report for 2008 on the UK Heavy Metals Monitoring Network

Again, in order for the reader to be aware spatially of the UK Heavy Metal Monitoring sites within Swansea post January 2014, the monitoring locations are presented within figure 2.1.17 below. The Swansea Air Quality Management Area 2010 (former Hafod AQMA) is indicated for reference purposes.

Neath Port Talbot Borough Council also undertake Heavy Metals Monitoring within their boundary at a number of sites in Pontardawe. Monitoring within Pontardawe is undertaken north of both the high level discharge point at Vale and Coed Gwilym Cemetery. Additional nickel sources have been identified within Pontardawe that were at one time masked by the release from Vale.

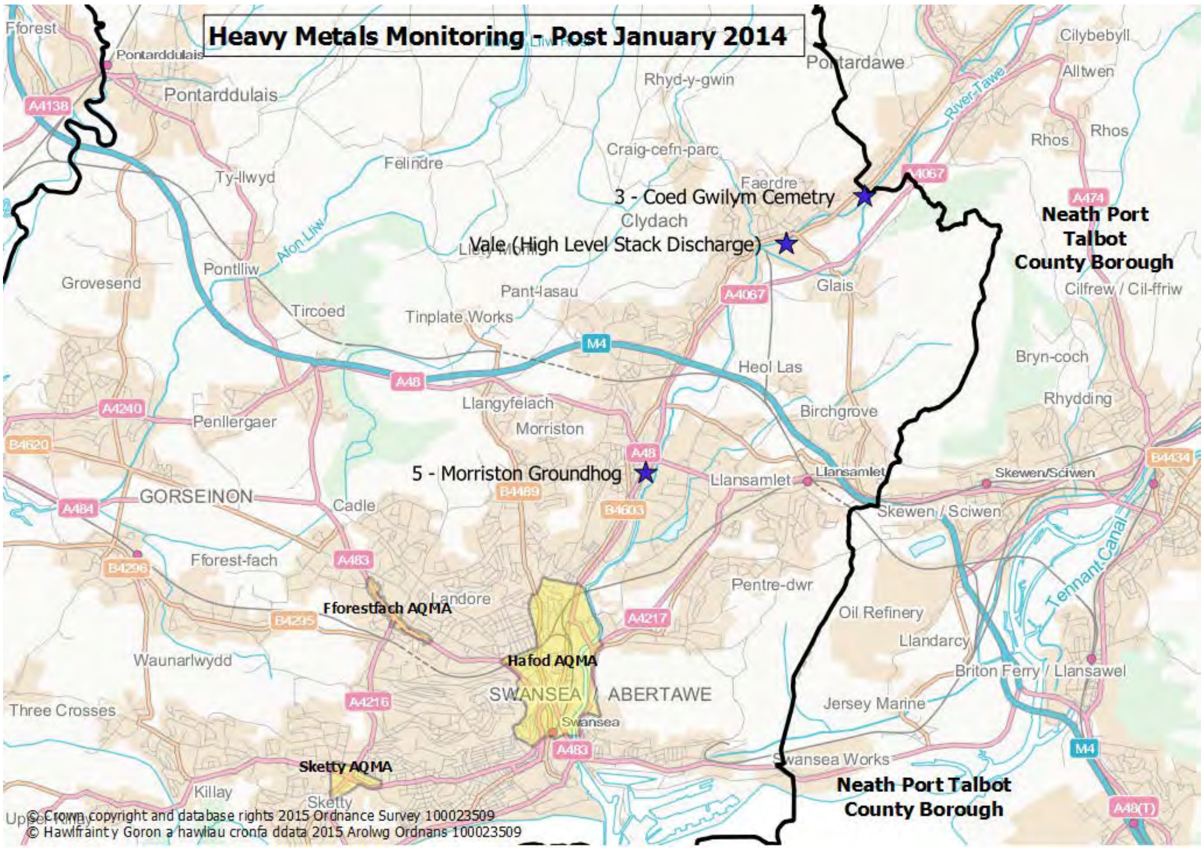


Figure 2.1.17 Swansea *UK Heavy Metal Monitoring Sites Post January 2016*

2.1.17 Continuous PAH Monitoring

The authority operate a continuous PAH monitoring site at the Cwm Level Park station (see 2.1.5 for location) on behalf of DEFRA and the Welsh Assembly

Government using a Digitel DHA-80 Air sampling System with PM_{10} inlet. This network has been upgraded during 2007 to provide fully compliant data for assessment of PAH under the 4th Daughter Directive and the National Assembly for Wales Statutory Instrument 2007 W 63 Environmental Protection Wales and the Air Quality Standards (Wales) Regulations 2007. The site has been designated as urban background,[15] with the purpose of the site to assess the levels of PAH before / as a consequence of, the influence of industry to the east and North of the Swansea area.

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

2.1.2 Non-Automatic Monitoring Sites

The authority has operated a network of passive nitrogen dioxide diffusion tubes for several years. Some sites have provided data to the UK Non-Automatic (NO_2) Network until this network ceased to operate on a weekly and monthly basis in December 2005. The remainder of the sites form part of specific studies within areas of concern. The datasets from these studies may therefore be for a limited time frame whilst conditions are assessed.

The authority expanded the coverage of monthly exposure of passive NO_2 tubes from 71 sites to 134 sites during July 2008 with a further doubling of the survey during November 2009 from 134 to 274 sites and eventually to 291 sites during late 2009 and early 2010. This new commitment to yet more additional monitoring was as a direct result of the new LAQM Technical Guidance (LAQM.TG(09)) and the conclusions reached within the USA 2009 that additional initial screening of narrow/congested streets was required where the AADT flow was greater than 5000 vehicles. However, due to budgetary constraints starting to be introduced within the authority during April 2011 a decision was made to cease monitoring at all sites that have consistently returned a bias corrected annual mean below 30ug/m^3. Monitoring ceased at these sites during May 2011 and these sites are no longer included within table 2.5 below. Additionally, in January 2014 a further decision was made to cease monitoring at all sites that, for the last 3-4 years had again consistently returned a bias corrected annual mean below 30ug/m^3 unless these sites would provide useful information due to the proximity to failing areas etc.

Monitoring is focused primarily on roadside locations with particular emphasis in determining NO_2 levels around several busy junctions and busy/narrow/congested roads. 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 facade. Full details of the sites chosen are presented below within table 2.5 and a map showing the monitoring locations is included below as figure 2.1.18. Due to the number of passive diffusion tube locations, it is not possible to label the site numbers within figure 2.1.18. In addition to figure 2.1.18 and to allow a more detailed view of the number of monitoring locations, figure 2.1.19 (city centre area), figure 2.1.20 (Fforestfach) figure 2.1.21 (Port Tennant Area), figure 2.1.22 (Sketty/Uplands area), , are presented below with the site numbers labelled within the more densely monitored areas.

Due to the proposals to regenerate the city centre, additional passive diffusion tube sites have been established during January/February 2015. It is thought that these regeneration proposals will increase the footfall within the city centre by increasing the level of residential occupancy, significantly benefiting the city centre traders. However, as has been previously reported, nitrogen dioxide concentrations have exceeded the annual mean objective at several locations along key routes in the city centre. Previously, any assessment made has been primarily to establish if any exceedances of the 1-hour nitrogen dioxide objective may have been breached around the café type restaurants which exist roadside to the café environment. However, with the aspiration to increase the number of dwellings along these roads as part of the redevelopment proposals, additional monitoring has been undertaken. The locations and results of this additional city centre monitoring are reported within this Progress Report (sites 331 to 364). Please note sites 357-364 commenced monitoring during April 2015 with sites 369-372 commencing during May 2015 so do not achieve the minimum data capture rate of 75%. The results for these sites have been annualised using the background chemiluminescent NOx analyser located at Cwm level Park using the methodology outlined in box 7.10 of LAQM Technical Guidance (TG16). A City Centre Infrastructure Study is underway with a focus on these key areas of proposed redevelopment. As mentioned above, figure 2.1.19 presents the NO_2 passive diffusion tube locations established within the city centre area.

Figure 2.1.18 – Map(s) of Non-Automatic Monitoring Sites

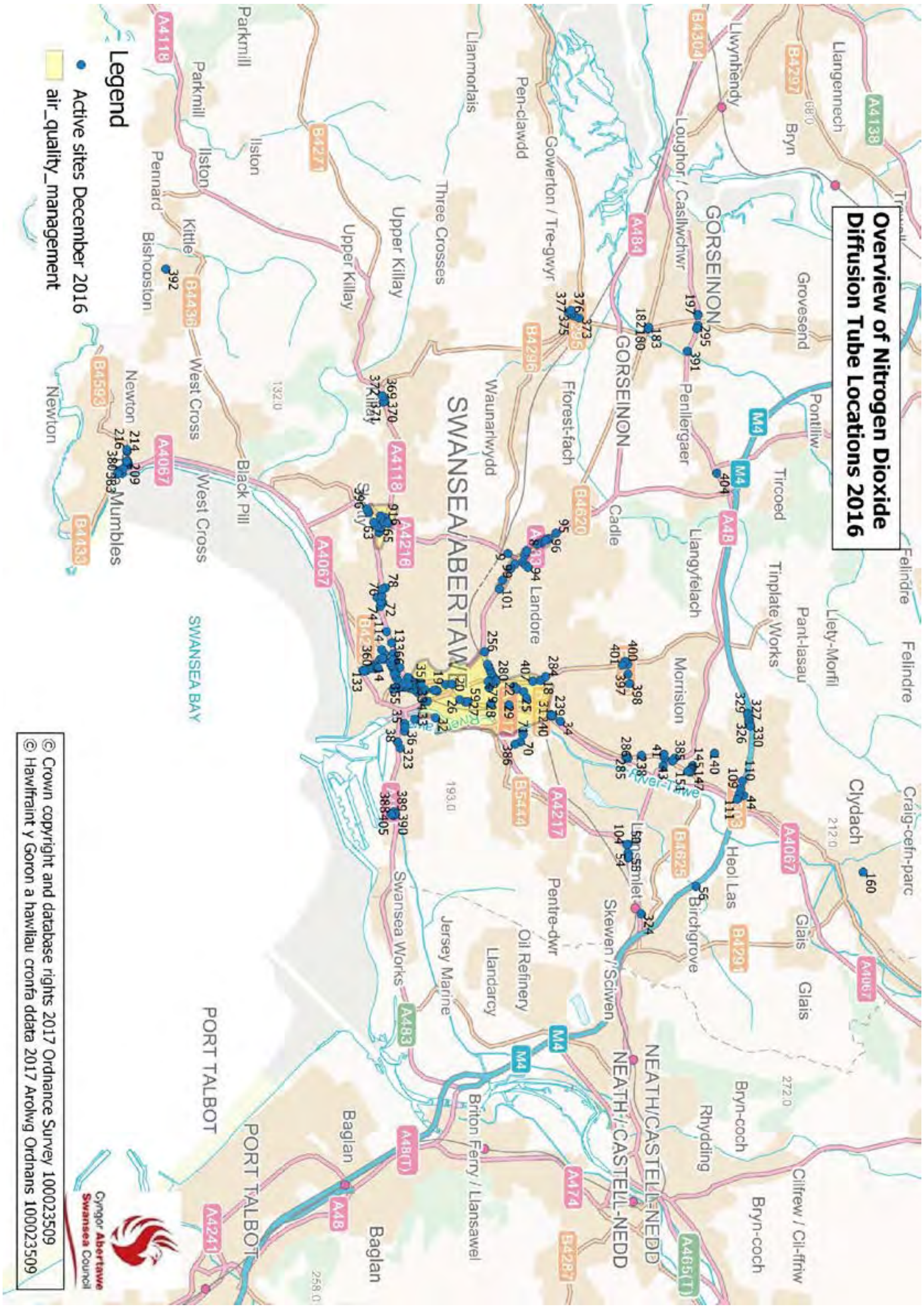


Figure 2.1.19 – Map(s) of Non-Automatic Monitoring Sites

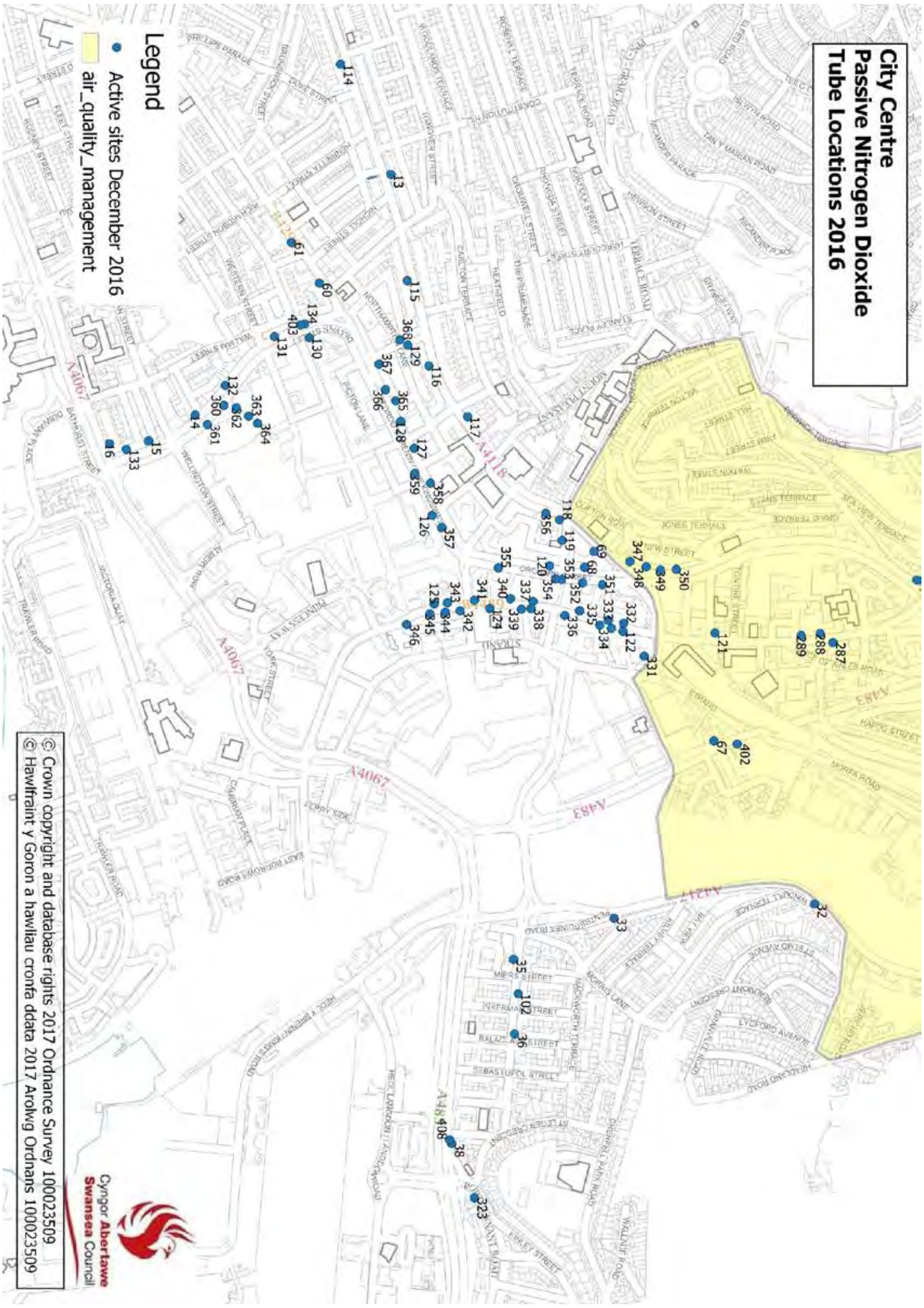


Figure 2.1.20 – Map(s) of Non-Automatic Monitoring Sites

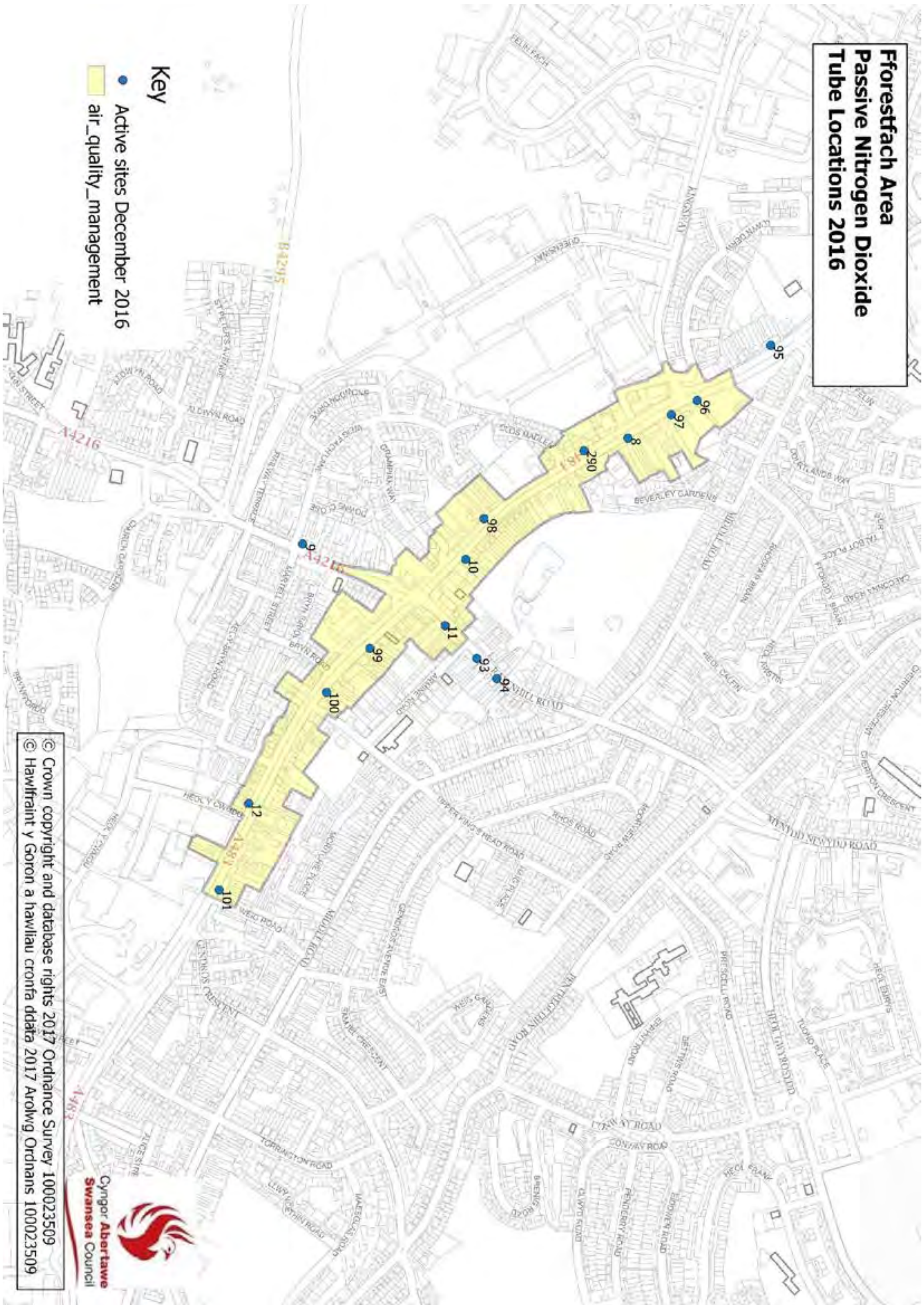


Figure 2.1.21 – Map(s) of Non-Automatic Monitoring Sites

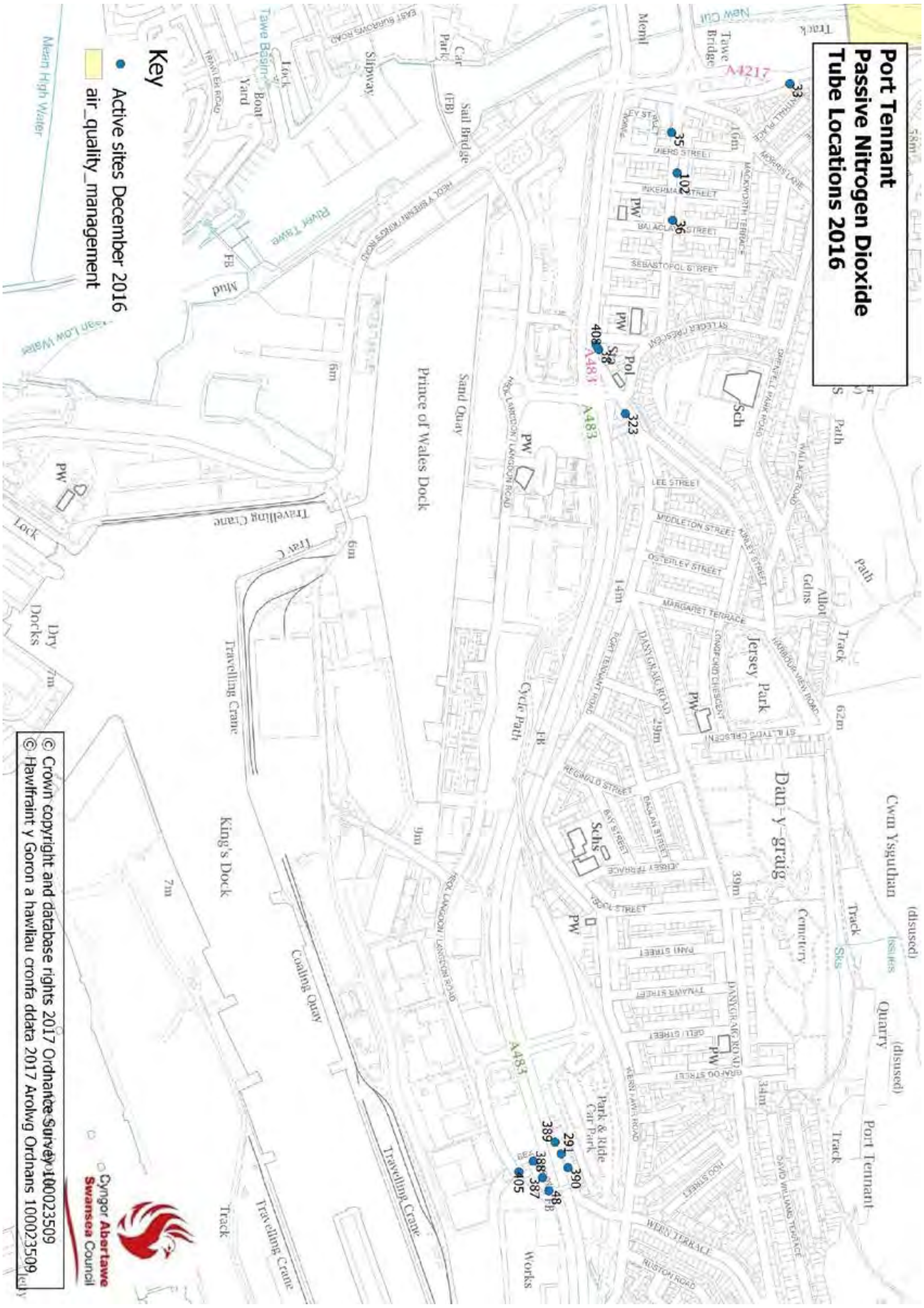


Figure 2.1.22 – Map(s) of Non-Automatic Monitoring Sites

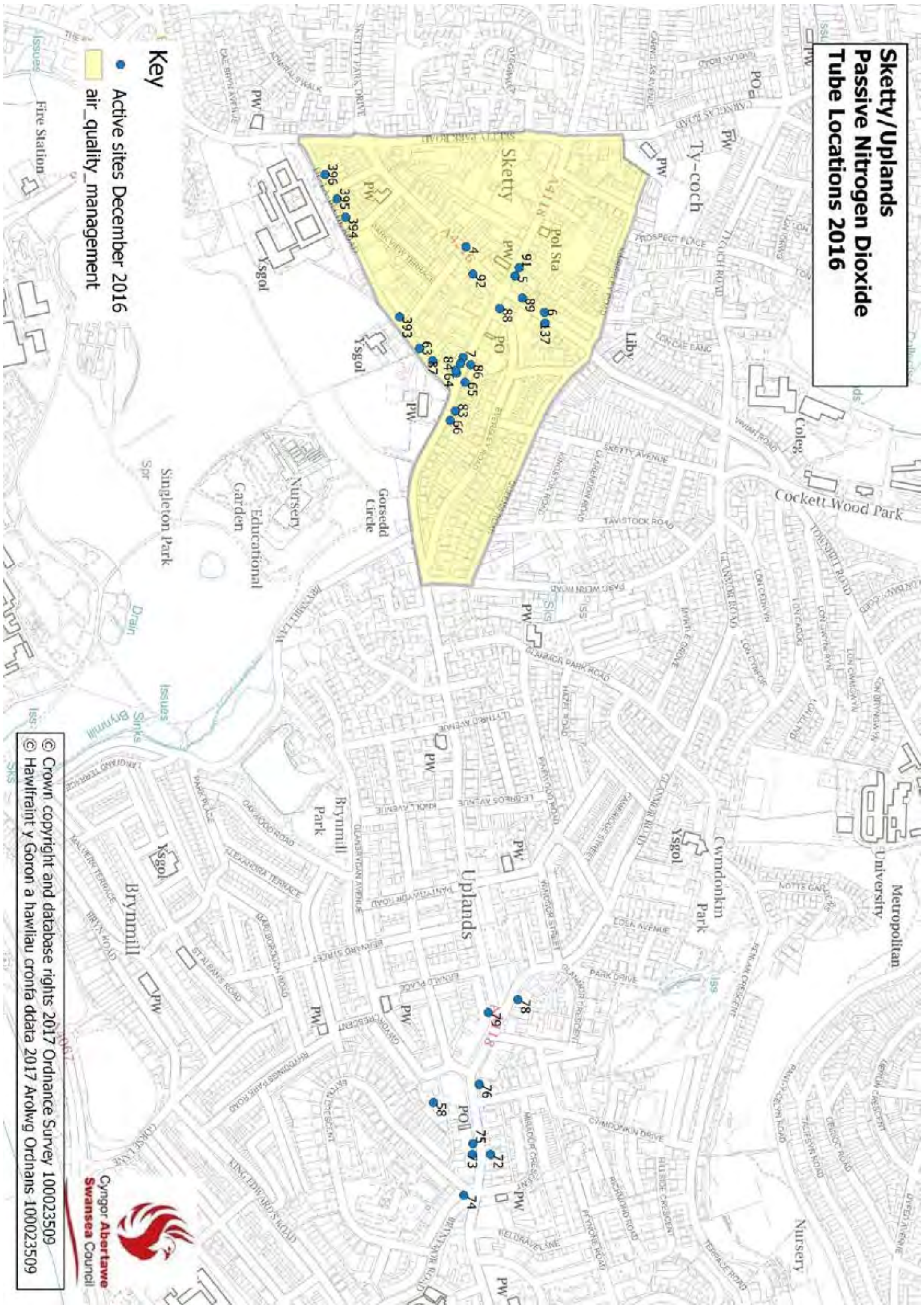


Table 2.5 – Details of Non- Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
4	Roadside	262497	192857	2.5	NO_2	Y	N	Y (0.1m)	4m	
5	Roadside	262548	192943	2.5	NO_2	Y	N	Y (0.1m)	3m	
6	Roadside	262612	192995	2.5	NO_2	Y	N	Y (0.1m)	4.5m	
7	Roadside	262691	192852	2.5	NO_2	Y	N	Y (0.1m)	2m	
8	Roadside	262990	195820	2.5	NO_2	Y	N	Y (0.1m)	3m	
9	Roadside	263190	195205	2.5	NO_2		N	Y (0.1m)	6m	
10	Roadside	263219	195513	2.5	NO_2	Y	N	Y (0.1m)	5m	
11	Roadside	263344	195474	2.5	NO_2	Y	N	Y (0.1m)	2m	
12	Roadside	263680	195103	2.5	NO_2	Y	N	Y (0.1m)	2m	
13	Roadside	264830	193066	2.5	NO_2		N	Y (0.1m)	8m	
14	Roadside	265285	192696	2.5	NO_2		N	Y (0.1m)	2.5m	
15	Roadside	265334	192608	2.5	NO_2		N	Y (0.1m)	12m	
16	Roadside	265339	192534	2.5	NO_2		N	Y (0.1m)	11m	
18	Roadside	265526	195807	2.5	NO_2	Y	N	Y (0.1m)	2m	
19	Roadside	265597	194061	2.5	NO_2	Y	N	Y (0.1m)	5m	
20	Roadside	265594	194175	2.5	NO_2	Y	N	Y (0.1m)	1.5m	
21	Roadside	265634	195316	2.5	NO_2	Y	N	Y (0.1m)	2m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
22	Roadside	265682	195374	2.5	NO_2	Y	N	Y (0.1m)	2m	
23	Roadside	265728	195494	2.5	NO_2	Y	N	Y (0.1m)	2m	
25	Roadside	265845	195547	2.5	NO_2	Y	N	Y (0.1m)	3.5m	
26	Roadside	265876	194318	2.5	NO_2	Y	N	Y (0.1m)	2m	
27	Roadside	265922	194428	2.5	NO_2	Y	N	Y (0.1m)	2m	
28	Roadside	265949	194891	2.5	NO_2	Y	N	Y (0.1m)	14m	
29	Roadside	265973	195222	2.5	NO_2	Y	N	Y (0.1m)	3.5m	
31	Roadside	266153	196003	2.5	NO_2		N	Y (0.1m)	2.5m	
32	Roadside	266209	193867	2.5	NO_2		N	Y (0.1m)	5m	
33	Roadside	266236	193488	2.5	NO_2		N	Y (0.1m)	5m	
34	Roadside	266272	196168	2.5	NO_2		N	Y (0.1m)	1.5m	
35	Roadside	266314	193298	2.5	NO_2		N	Y (0.1m)	2m	
36	Roadside	266455	193300	2.5	NO_2		N	Y (0.1m)	2m	
38	Roadside	266662	193181	2.5	NO_2		N	Y (0.1m)	6m	
40	Roadside	266951	198278	2.5	NO_2		N	Y (0.1m)	8m	
41	Roadside	266953	198085	2.5	NO_2		N	Y (0.1m)	2m	
43	Roadside	267093	198063	2.5	NO_2		N	Y (0.1m)	2m	
44	Roadside	267639	199543	2.5	NO_2		N	Y (0.1m)	23m (M4)	
45	Roadside	267661	199451	2.5	NO_2		N	Y (0.1m)	10m (M4)	
48	Roadside	268011	193101	2.5	NO_2		N	Y (0.1m)	9m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
50	Roadside	268530	197419	2.5	NO_2		N	Y (0.1m)	6m	
54	Roadside	268693	197416	2.5	NO_2		N	Y (0.1m)	9m	
55	Roadside	268789	197420	2.5	NO_2		N	Y (0.1m)	4m	
56 *	Roadside	269306	198661	2.5	NO_2		N	Y (166m)	2m	Y
58	Roadside	264052	192884	2.5	NO_2		N	Y (8m)	2m	Y
59	Roadside	265918	194463	2.5	NO_2	Y	N	Y (0.2m)	1.5m	
60	Roadside	265036	192931	2.5	NO_2		N	Y (0.1m)	2m	
61	Roadside	264959	192878	2.5	NO_2		N	Y (0.1m)	2m	
63	Roadside	262675	192775	2.5	NO_2	Y	N	Y (6.0m)	1.5m	Y
64	Roadside	262719	192840	2.5	NO_2	Y	N	Y (3.0m)	1m	Y
65	Roadside	262735	192855	2.5	NO_2	Y	N	Y (0.1m)	5m	
66	Roadside	262802	192829	2.5	NO_2	Y	N	Y (0.1m)	8m	
67	Roadside	265903	193683	2.5	NO_2	Y	N	Y (5.0m)	1m	Y
68	Roadside	265573	193432	2.5	NO_2		N	Y (0.1m)	6m	
69	Roadside	265543	193450	2.5	NO_2		N	Y (4m)	3m	Y
70	Roadside	266649	195435	2.5	NO_2		N	Y (7m)	1m	Y
71 **	Roadside	266514	195485	2.5	NO_2		N	Y (138m)	2m	Y
72	Roadside	264091	192900	2.5	NO_2		N	Y (0.1m)	18m	
73	Roadside	264138	192868	2.5	NO_2		N	Y (0.1m)	9m	
74	Roadside	264163	192853	2.5	NO_2		N	Y (0.1m)	12m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
75	Roadside	264072	192869	2.5	NO_2		N	Y (0.1m)	8m	
76	Roadside	263968	192880	2.5	NO_2		N	Y (0.1m)	9m	
78	Roadside	263819	192948	2.5	NO_2		N	Y (0.1m)	7m	
79	Roadside	263842	192896	2.5	NO_2		N	Y (0.1m)	10m	
83	Roadside	262785	192838	2.5	NO_2	Y	N	Y (0.1m)	7.5m	
84	Roadside	262714	192839	2.5	NO_2	Y	N	Y (0.1m)	6.5m	
85	Roadside	262702	192847	2.5	NO_2	Y	N	Y (0.1m)	6.5m	
86	Roadside	262704	192865	2.5	NO_2	Y	N	Y (0.1m)	4.5m	
87	Roadside	262697	192798	2.5	NO_2	Y	N	Y (0.1m)	6m	
88	Roadside	262605	192916	2.5	NO_2	Y	N	Y (0.1m)	4m	
89	Roadside	262587	192956	2.5	NO_2	Y	N	Y (0.1m)	4.5m	
90	Roadside	262631	192996	2.5	NO_2	Y	N	Y (0.1m)	4.5m	
91	Roadside	262534	192950	2.5	NO_2	Y	N	Y (0.1m)	3m	
92	Roadside	262545	192869	2.5	NO_2	Y	N	Y (3.0m)	4.5m	
93	Roadside	263406	195534	2.5	NO_2		N	Y (0.1m)	2m	
94	Roadside	263444	195572	2.5	NO_2		N	Y (0.1m)	2m	
95	Roadside	262815	196090	2.5	NO_2		N	Y (0.1m)	8m	
96	Roadside	262922	195950	2.5	NO_2		N	Y (0.1m)	3m	
97	Roadside	262946	195902	2.5	NO_2	Y	N	Y (0.1m)	4m	
98	Roadside	263142	195548	2.5	NO_2	Y	N	Y (0.1m)	4m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
99	Roadside	263387	195332	2.5	NO_2	Y	N	Y (0.1m)	2m	
100	Roadside	263470	195250	2.5	NO_2	Y	N	Y (0.1m)	4m	
101	Roadside	263843	195047	2.5	NO_2	Y	N	Y (0.1m)	4m	
102	Roadside	266379	193307	2.5	NO_2		N	Y (0.1m)	2m	
104	Roadside	268538	197389	2.5	NO_2		N	Y (0.1m)	8m	
107	Roadside	268765	197420	2.5	NO_2		N	Y (0.1m)	5m	
108	Roadside	267608	199461	2.5	NO_2		N	Y (0.1m)	15m (M4)	
109	Roadside	267510	199487	2.5	NO_2		N	Y (0.1m)	16.5 (M4)	
110	Roadside	267369	199521	2.5	NO_2		N	Y (0.1m)	35m (M4)	
111	Roadside	267705	199426	2.5	NO_2		N	Y (0.1M)	17m (M4)	
114	Roadside	264622	192971	2.5	NO_2		N	Y (0.1m)	7m	
115	Roadside	265031	193097	2.5	NO_2		N	Y (0.1m)	5m	
116	Roadside	265192	193138	2.5	NO_2		N	Y (0.1m)	4m	
117	Roadside	265288	193211	2.5	NO_2		N	Y (0.1m)	5.5m	
⊗118	Roadside	265483	193385	2.5	NO_2		N	Y (17M)	7m	
119	Roadside	265522	193390	2.5	NO_2		N	Y (0.1M)	2m	
120	Roadside	265570	193366	2.5	NO_2		N	N (6.0M)	2m	Y
121	Roadside	265706	193662	2.5	NO_2	Y	N	Y (0.1M)	3m	
122	Roadside	265694	193505	2.5	NO_2		N	Y (0.5M)	3m	
123	Roadside	265655	193423	2.5	NO_2		N	Y (0.1M)	4m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
⊗124	Roadside	265651	193253	2.5	NO_2		N	Y (2M)	4m	
⊗125	Roadside	265641	193162	2.5	NO_2		N	Y (3m)	1m	Y
⊗126	Roadside	265475	193144	2.5	NO_2		N	Y (10m)	5m	
⊗127	Roadside	265348	193110	2.5	NO_2		N	Y(4m)	0.5m	
⊗128	Roadside	265297	193085	2.5	NO_2		N	N (>50m)	4.5m	
⊗129	Roadside	265153	193098	2.5	NO_2		N	Y (5m)	7m	
⊗130	Roadside	265139	192912	2.5	NO_2		N	Y (27m)	3.5m	Y
131	Roadside	265137	192846	2.5	NO_2		N	Y(30m)	5m	
132	Roadside	265229	192753	2.5	NO_2		N	Y (5M)	2m	Y
133	Roadside	265350	192566	2.5	NO_2		N	Y (0.1m)	2m	
⊗134	Roadside	265113	192903	2.5	NO_2		N	Y(0.1m)	4m	
^136	Roadside	262612	192995	2.5	NO_2		N	Y(0.1m)	4.5m	
^137	Roadside	262631	192996	2.5	NO_2		N	Y(0.1m)	4.5m	
140	Roadside	266863	199009	2.5	NO_2		N	Y(0.1m)	1.5m	
143	Roadside	267089	198608	2.5	NO_2		N	Y(0.1m)	2m	
144	Roadside	267141	198591	2.5	NO_2		N	Y(0.1m)	2m	
145	Roadside	267139	198578	2.5	NO_2		N	Y(0.1m)	2m	
146	Roadside	267156	198571	2.5	NO_2		N	Y(0.1m)	2m	
147	Roadside	267165	198580	2.5	NO_2		N	Y(0.1m)	2m	
148	Roadside	267170	198564	2.5	NO_2		N	Y(0.1m)	2m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
149	Roadside	267204	198561	2.5	NO_2		N	Y(0.1m)	4m	
150	Roadside	267205	198545	2.5	NO_2		N	Y(0.1m)	3m	
151	Roadside	267192	198518	2.5	NO_2		N	Y(0.1m)	3m	
160	Roadside	269049	201744	2.5	NO_2		N	Y(0.1m)	3m	
180	Roadside	259064	197781	2.5	NO_2		N	Y(0.1m)	1.5m	
182	Roadside	259050	197790	2.5	NO_2		N	Y(0.1m)	2m	
183	Roadside	259036	197795	2.5	NO_2		N	Y(0.1m)	2.5m	
197	Roadside	258797	198701	2.5	NO_2		N	Y(0.1m)	2m	
198	Roadside	258811	198701	2.5	NO_2		N	Y(0.1m)	2m	
206	Roadside	261565	188211	2.5	NO_2		N	Y(0.1m)	1.5m	
207	Roadside	261561	188222	2.5	NO_2		N	Y(0.1m)	2.5m	
208	Roadside	261541	188215	2.5	NO_2		N	Y(0.1m)	2.5m	
209	Roadside	261534	188198	2.5	NO_2		N	Y(0.1m)	1.5m	
210	Roadside	261516	188207	2.5	NO_2		N	Y(0.1m)	2.5m	
211	Roadside	261501	188188	2.5	NO_2		N	Y(0.1m)	1.5m	
212	Roadside	261486	188200	2.5	NO_2		N	Y(0.1m)	2.5m	
213	Roadside	261490	188186	2.5	NO_2		N	Y(0.1m)	1.5m	
214	Roadside	261315	188193	2.5	NO_2		N	Y(0.1m)	4m	
215	Roadside	261299	188191	2.5	NO_2		N	Y(0.1m)	4m	
216	Roadside	261276	188190	2.5	NO_2		N	Y(0.1m)	4m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
238	Roadside	266902	197660	2.5	NO_2		N	Y(0.1m)	3.5m	
239	Roadside	266181	196022	2.5	NO_2		N	Y(0.1m)	1.5m	
240	Roadside	266169	195995	2.5	NO_2		N	Y(0.1m)	1.5m	
241	Roadside	266159	196013	2.5	NO_2		N	Y(0.1m)	1.5m	
242	Roadside	265655	193423	2.5	NO_2		N	Y(0.1m)	4m	
243	Roadside	265474	194949	2.5	NO_2		N	Y(0.1m)	4m	
244	Roadside	265466	194930	2.5	NO_2		N	Y(0.1m)	2m	
245	Roadside	265448	194922	2.5	NO_2		N	Y(0.1m)	2m	
247	Roadside	265394	194899	2.5	NO_2		N	Y(0.1m)	2m	
249	Roadside	265326	194871	2.5	NO_2		N	Y(0.1m)	2m	
251	Roadside	265263	194845	2.5	NO_2		N	Y(0.1m)	2m	
252	Roadside	265226	194830	2.5	NO_2		N	Y(0.1m)	2m	
256	Roadside	264995	194777	2.5	NO_2		N	Y(0.1m)	2m	
271	Roadside	266879	198078	2.5	NO_2		N	Y(0.1m)	1.5m	
272	Roadside	266888	198074	2.5	NO_2		N	Y(0.1m)	1.5m	
275	Roadside	265658	194856	2.5	NO_2		N	Y(2.0m)	1.5m	
276	Roadside	265610	194871	2.5	NO_2		N	Y(0.1m)	3m	
277	Roadside	265596	194875	2.5	NO_2		N	Y(0.1m)	3m	
278	Roadside	265573	194882	2.5	NO_2		N	Y(0.1m)	3m	
279	Roadside	265555	194926	2.5	NO_2		N	Y(0.1m)	1.5m	

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
280	Roadside	265542	194980	2.5	NO_2		N	Y(2.0m)	1m	
281	Roadside	265542	194872	2.5	NO_2		N	Y(3.0m)	1m	
282	Roadside	265540	194840	2.5	NO_2		N	Y(3.0m)	1m	
284	Roadside	265452	195899	2.5	NO_2		N	Y(0.1m)	2m	
285	Roadside	266955	197415	2.5	NO_2		N	Y(0.1m)	2m	
286	Roadside	266938	197377	2.5	NO_2		N	Y(0.1m)	4m	
287	Roadside	265715	193902	2.5	NO_2		N	Y(0.1m)	2m	
288	Roadside	265698	193878	2.5	NO_2		N	Y(0.1m)	2m	
289	Roadside	265702	193842	2.5	NO_2		N	Y(0.1m)	2m	
290	Roadside	263014	195737	2.5	NO_2		N	Y(0.1m)	2m	
291	Roadside	267952	193121	2.5	NO_2		N	Y(0.1m)	5m	
295	Roadside	258998	198698	2.5	NO_2		N	Y(5m)	0.5m	Y
296	Roadside	259054	198679	2.5	NO_2		N	Y(0.1m)	3m	
323	Roadside	266765	193224	2.5	NO_2		N	Y(0.1m)	3m	
324	Roadside	269815	197657	2.5	NO_2		N	Y(0.1m)	10m	
325	Roadside	266338	199647	2.5	NO_2		N			
326	Roadside	266299	199642	2.5	NO_2		N			
327	Roadside	266253	199637	2.5	NO_2		N			
328	Roadside	266183	199626	2.5	NO_2		N			
329	Roadside	266127	199620	2.5	NO_2		N			

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
330	Roadside	266363	199669	2.5	NO_2		N			
331	Roadside	265741	193545	2.5	NO_2		N			
332	Roadside	265679	193506	2.5	NO_2		N			
333	Roadside	265673	193477	2.5	NO_2		N	Y(4m)	0.5m	
334	Roadside	265688	193483	2.5	NO_2		N			
335	Roadside	265682	193461	2.5	NO_2		N			
336	Roadside	265664	193395	2.5	NO_2		N			
337	Roadside	265637	193335	2.5	NO_2		N	Y(4m)	0.5m	
338	Roadside	265651	193331	2.5	NO_2		N			
339	Roadside	265652	193313	2.5	NO_2		N			
340	Roadside	265632	193292	2.5	NO_2		N			
341	Roadside	265635	193224	2.5	NO_2		N	Y(3m)	1.5m	
342	Roadside	265655	193197	2.5	NO_2		N	Y(3.5m)	1m	
343	Roadside	265640	193173	2.5	NO_2		N			
344	Roadside	265658	193169	2.5	NO_2		N	Y(3m)	0.5m	
345	Roadside	265661	193140	2.5	NO_2		N	Y(3m)	0.5m	
346	Roadside	265681	193096	2.5	NO_2		N			
347	Roadside	265562	193518	2.5	NO_2		N			
348	Roadside	265572	193549	2.5	NO_2		N			
349	Roadside	265578	193576	2.5	NO_2		N			

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
350	Roadside	265577	193606	2.5	NO_2		N			
351	Roadside	265606	193466	2.5	NO_2		N			
352	Roadside	265602	193429	2.5	NO_2		N			
353	Roadside	265596	193389	2.5	NO_2		N	Y(4.5m)	0.5m	
354	Roadside	265595	193377	2.5	NO_2		N	Y(4m)	1m	
355	Roadside	265574	193269	2.5	NO_2		N	Y(3.5m)	0.5m	
356	Roadside	265471	193359	2.5	NO_2		N			
357	Roadside	265498	193162	2.5	NO_2		N	Y(5m)	0.5m	
358	Roadside	265414	193141	2.5	NO_2		N	Y(6.5m)	1m	
359	Roadside	265396	193111	2.5	NO_2		N	Y(4m)	0.5m	
360	Roadside	265267	192750	2.5	NO_2		N			
361	Roadside	265303	192719	2.5	NO_2		N			
362	Roadside	265271	192774	2.5	NO_2		N			
363	Roadside	265287	192797	2.5	NO_2		N			
364	Roadside	265301	192814	2.5	NO_2		N			
365	Roadside	265258	193075	2.5	NO_2		N			
366	Roadside	265237	193056	2.5	NO_2		N			
367	Roadside	265189	193044	2.5	NO_2		N			
368	Roadside	265143	193083	2.5	NO_2		N	Y(5m)	0.5m	
369	Roadside	260356	192927	2.5	NO_2		N			

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
370	Roadside	260394	192938	2.5	NO_2		N			
371	Roadside	260402	192910	2.5	NO_2		N			
372	Roadside	260291	192892	2.5	NO_2		N			
373	Roadside	258859	196513	2.5	NO_2		N			
374	Roadside	258824	196435	2.5	NO_2		N			
375	Roadside	258798	196371	2.5	NO_2		N			
376	Roadside	258765	196368	2.5	NO_2		N			
377	Roadside	258763	196317	2.5	NO_2		N			
378	Roadside	258722	196365	2.5	NO_2		N			
379	Roadside	261714	188096	2.5	NO_2		N			
380	Roadside	261675	188060	2.5	NO_2		N			
381	Roadside	261660	188041	2.5	NO_2		N			
382	Roadside	261631	188116	2.5	NO_2		N			
383	Roadside	261694	188038	2.5	NO_2		N			
384	Roadside	261720	188015	2.5	NO_2		N			
385	Roadside	267001	198231	2.5	NO_2		N			
386	Roadside	266698	195334	2.5	NO_2		N			
387	Roadside	267990	193091	2.5	NO_2		N			
388	Roadside	267964	193076	2.5	NO_2		N			
389	Roadside	267933	193111	2.5	NO_2		N			

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
390	Roadside	267974	193132	2.5	NO_2		N			
391	Roadside	259467	198509	2.5	NO_2		N			
392	Roadside	257959	188908	2.5	NO_2		N			
393	Roadside	262620	192740	2.5	NO_2		N			
394	Roadside	262445	192645	2.5	NO_2		N			
395	Roadside	262413	192630	2.5	NO_2		N			
396	Roadside	262370	192609	2.5	NO_2		N			
408	Roadside	266655	193177	2.5	NO_2		N			

*** Site 56** is located on Ynysallan Road, Ynystawe to the frontage of a potential housing development site that would be 10-15m from the eastbound carriageways of the M4. Relevant exposure is given at present to the nearest existing dwelling within a separate development setback from the monitoring location.

**** Site 71** Copper Quarter 3 is on the frontage of an existing housing development site that will see dwellings fronting onto the access road to Morfa Retail Park and the Liberty Stadium. Relevant exposure is given at present to the nearest existing dwelling on the development site. The nearest potential dwelling within the development (setback from the monitoring location) will be within 10m of the monitoring location when construction is complete.

***** Site 125** Army Careers Centre, City Centre – Relevant exposure is given to a block of flats over commercial premises

⊗ City centre sites along busy roads – relevant exposure is given to either restaurants where there is a Café environment or to blocks of flats. Assessment where Café environment exists is for 1 hour NO_2 objective

^Sites 135-137 are located at first floor level of properties in addition to exposure at 2.5 on the same dwelling to assess if concentrations change with height

**** **Site 295** High Street, Gorseinon is located on a lamppost outside a primary school playground. The intention here is worst case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area

2.1.19 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 each of the authority's chemiluminescent analyser sites at the Swansea Roadside AURN, Cwm Level Park and Morriston Groundhog sites. All co-location sites will operate for the foreseeable future. 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[16].

Following on from previous auditors comments dated 9th September 2010 where it was highlighted that the bias adjustment factors from the three monitoring stations mentioned above should not have been averaged to produce a "Swansea Bias Factor" it has been decided to use the result of the co-location study undertaken at the Swansea AURN to correct passive NO_2 tubes exposed during 2016.

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 2016 in Swansea is therefore 0.89. A spreadsheet containing the automatic real-time data and the passive diffusion tube data used to derive the bias factor is shown within Annexe 4.

[16] http://www.airquality.co.uk/archive/reports/cat13/0604061218_Diffusion_Tube_GN_approved.pdf

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO_2)

Automatic Monitoring Data

Measurements are undertaken with Advanced Pollution Instrumentation (API / Teledyne) real-time NO_x analysers and also by the DOAS systems at Hafod and St Thomas. The logged 15-minute means have been compiled into hourly 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[17]. 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 the annual mean.

In the case of the Swansea AURN, the QA/QC procedures undertaken by Ricardo have resulted in ratified hourly data expressed in $\mu g/m^3$ being provided. The ratified hourly means have been used to calculate the objectives for the hourly and annual means. Hourly ratified data has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector. In the case of data from the Morriston Groundhog and Cwm Level Park sites, Ricardo also undertakes QA/QC procedures on behalf of the Welsh Air Quality Forum and Welsh Assembly; this includes preliminary ratifification of the High Street NOx box data. Hourly ratified data expressed in $\mu g/m^3$ has been downloaded for the sites from http://www.welshairquality.co.uk/data_and_statistics.php . These data have then all been imported into the OPSIS Enviman Reporter databases allowing analysis and graphical presentation. Section 2.1 refers to the data collection methodology for the Hafod and St.Thomas DOAS systems. Annual means derived for 2016 are given below within table 2.6 along with those for previous years 2011-2015.

[17] LAQM.TG(16) General Considerations Paragraph 7.160 page 7-41

Table 2.6 – Results of Automatic Monitoring for NO_2: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016 % [b]	Annual Mean Concentration (µg/m³)				
				2012	2013	2014	2015	2016
CM1	Swansea AURN ** (12m)	Y	98.92%	26.0 (30.66)	26.8 (31.15)	25.0 (30.76)	23.0 (27.43)	24.4 (30.37)
CM2	Morriston Groundhog ** (22m)	N	88.37%	23.4 (28.10)	23.2 (28.58)	21.1 (25.89)	20.5 (25.02)	22.3 (29.69)
CM3	Cwm Level Park ** (100m)	Y	92.77%	19.61	18.54	17.08	14.75	16.39
CM4	Hafod DOAS	Y	99.53%	**52.60**	**50.68**	**48.99**	**40.24**	**45.59**
CM5	St.Thomas DOAS	N	97.38%	38.62	39.45	35.83	33.71	35.83
CM11	**Station Court, High Street(1.0m)	Y	93.95%	N/A	N/A	***56.85**	**50.9 (54.52)**	**48.3 (51.76)**

***** *For information purposes only. Data capture commence July 2014.*

*** The distance to the nearest receptor location is given in brackets after the site name in the above table. The NO_2 annual mean at the nearest receptor location has been derived following guidance within TG.16 paragraph 7.79 page 7-29.The supporting simple calculator Excel spreadsheet (v4.1[1]: April 2016) has been downloaded from http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html*

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m³

The resulting calculated NO_2 annual mean at the receptor location due to fall off in concentration with distance from the road is given in bold for the year of consideration. The measured roadside concentration is given in brackets.

Background 1k by 1k NO_2 concentrations (for 2016 based on Background maps base year of 2013 file name 409-no2-2016.csv) were downloaded from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013 and overlain on a GIS background map within Quantum GIS v2.4.0 (Chugiak). The background concentration required for the calculation was obtained from the nearest 1k grid square to the monitoring station. The background concentrations shown in table 2.7 below were used:

Site ID	Location	Background NO_2 Concentrations (ug/m^3)				
		2012	2013	2014	2015	2016
CM1	Swansea AURN Roadside	19.57	19.01	17.06	16.93	14.88
CM2	Morriston Groundhog	19.71	19.03	17.34	17.03	15.54
CM11	Station Court High Street	-	-	-	16.65	15.71

Table 2.7 – Background NO_2 concentrations 2012-2016

As the site at Cwm Level Park has an Urban Background classification, with the nearest receptor being 100m away, the annual mean presented above has not been corrected to the nearest receptor.

It is observed from table 2.6 that the 2016 Annual Mean concentration for the Hafod DOAS indicates an exceedance of the NO_2 annual mean objective at 45.59ug/m^3. This in an increase from the 2015 annual mean which was an unexpected concentration of 40.24ug/m^3. The result was initially disbelieved due to the perceived likelihood of an error in its calculation, the conclusion in the 2016 Progress Report was one of scepticism even though the derived annual mean has been compiled from a data capture of 99.1%; after the application of the QA/QC rules outlined in section 2.1 above. Passive diffusion tube site 59 Hafod Post Office (passive diffusion tube measurements are discussed later) is located directly opposite the 250m DOAS open path and has previously been seen to trend in-line with the measured DOAS concentrations. Whilst the Hafod DOAS 2016 shows a marked increase from the 2015 concentration it does show a downward trend in concentration since 2012; the 2016 annual mean increase is in-line with an overall increase seen at the majority of continuous monitoring locations in 2016.

The St Thomas DOAS, marginally exceeded the annual mean objective during 2011 and then has marginally complied with the annual mean objective during 2012 and 2013 - 2016 now showing full compliance. Improvements with the more recent annual means to that of 2010 at St Thomas are most likely due to the improvements made around Quay Parade bridges during November/December 2011. The two other roadside sites at the Swansea AURN and Morriston Groundhog both continue to show an overall decrease in trend. However the measured 2016 concentrations are elevated slightly but the monitoring stations continue to exhibit full compliance with the annual mean objective.

The roadside chemiluminescent NO_x monitoring undertaken during 2016 at Station Court High Street continues to show an exceedence of the NO_2 annual mean objective at this location. The site is located within the existing Swansea AQMA 2010. The location of the site and local influences are outlined within section 2.1 above. There are two ATC traffic counters which provide an insight into the composition of the traffic flow. ATC Site 22 lies to the north of the site with ATC site 57 to the south. Both sites are relevant to this location and indicate a combined HGV composition (Heavy Van/Mini bus/ L/M/HGV, Articulated lorry, and Bus) of : ATC site 22 - 12.1% and ATC site 57 - 11%. Full details of the ATC monitoring undertaken can be found in section 3 below.

Table 2.8 indicates assessments from all stations in respect of the number of exceedances of the 1-hour NO_2 objective. Where data capture rates are below 90% the 99.8th percentile is presented in brackets.

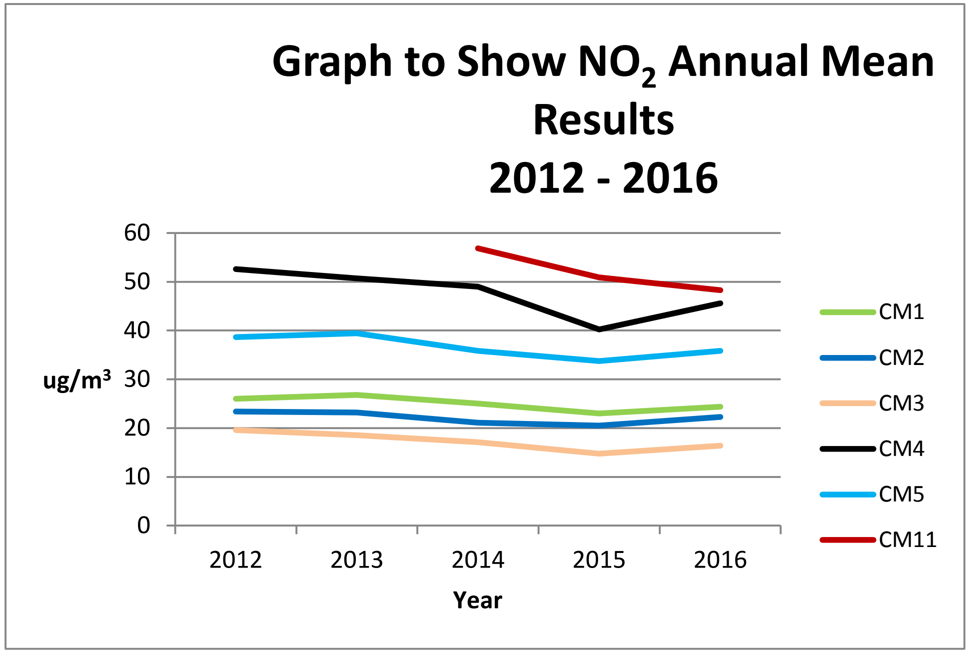
Table 2.8 – Results of Automatic Monitoring for NO_2: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA	Data Capture 2016 %	Number of Exceedances of hourly mean (200 μg/m³)					
				2011	2012	2013	2014	2015	2016
CM1	Swansea AURN	Y	98.92%	1	0	0	0	0	0
CM2	Morriston Groundhog	N	88.37%	0	0	0	0	0	1
CM3	Cwm Level Park	Y	92.77%	0	0	0	0	0	0
CM4	Hafod DOAS	Y	99.53%	16	5	6	1	0	4
CM5	St.Thomas DOAS	N	97.38%	0	0	0	0	0	0
CM11	Station Court, High Street	Y	93.95%	-	-	-	5 ****(194.7)**	2	1

Table 2.8- Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
*** Data capture rate below 90% 99.8th percentile presented in brackets*

In bold, exceedence of the NO_2 hourly mean AQS objective (200µg/m³ – not to be exceeded more than 18 times per year)

Figure 2.2.1 – Trends in Annual Mean NO_2 Concentrations Measured at Automatic Monitoring Sites



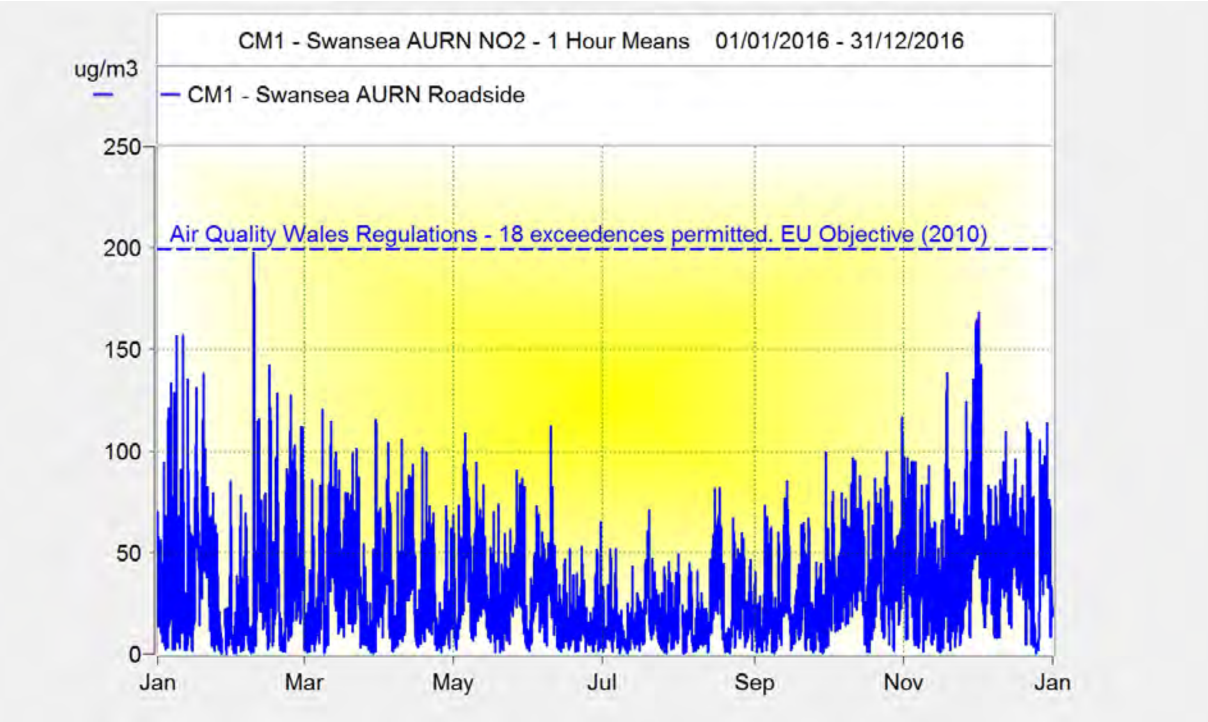


Figure 2.2.2

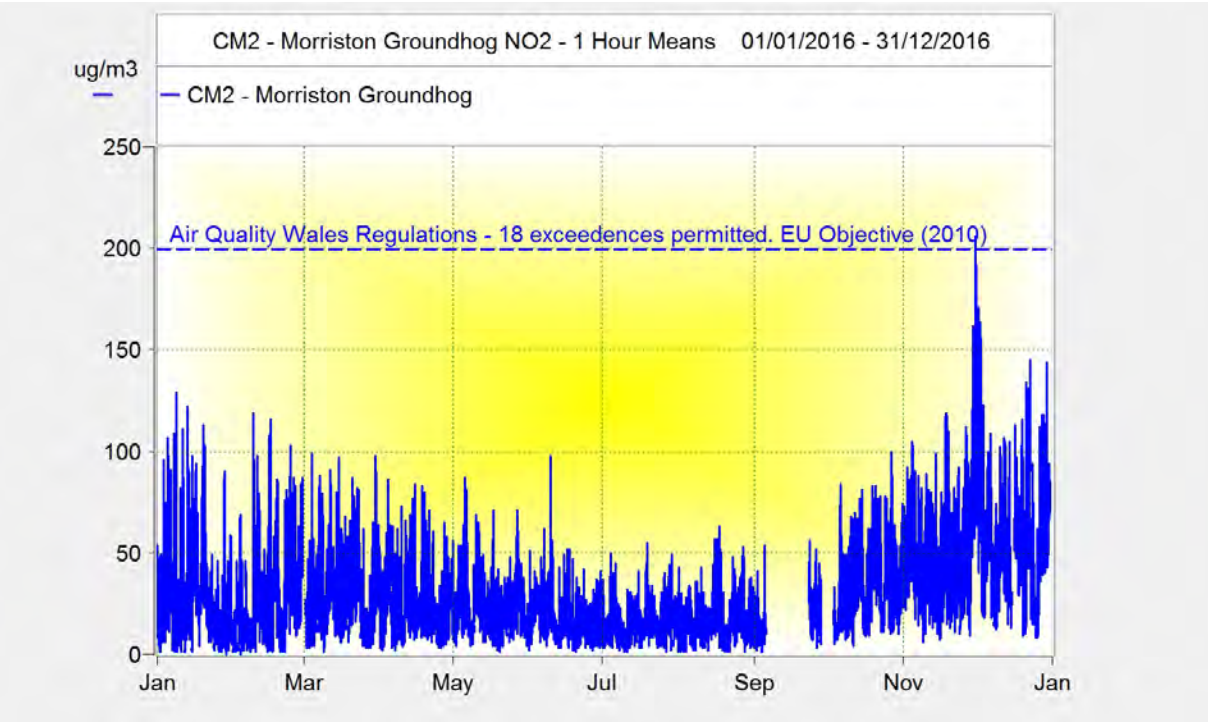


Figure 2.2.3

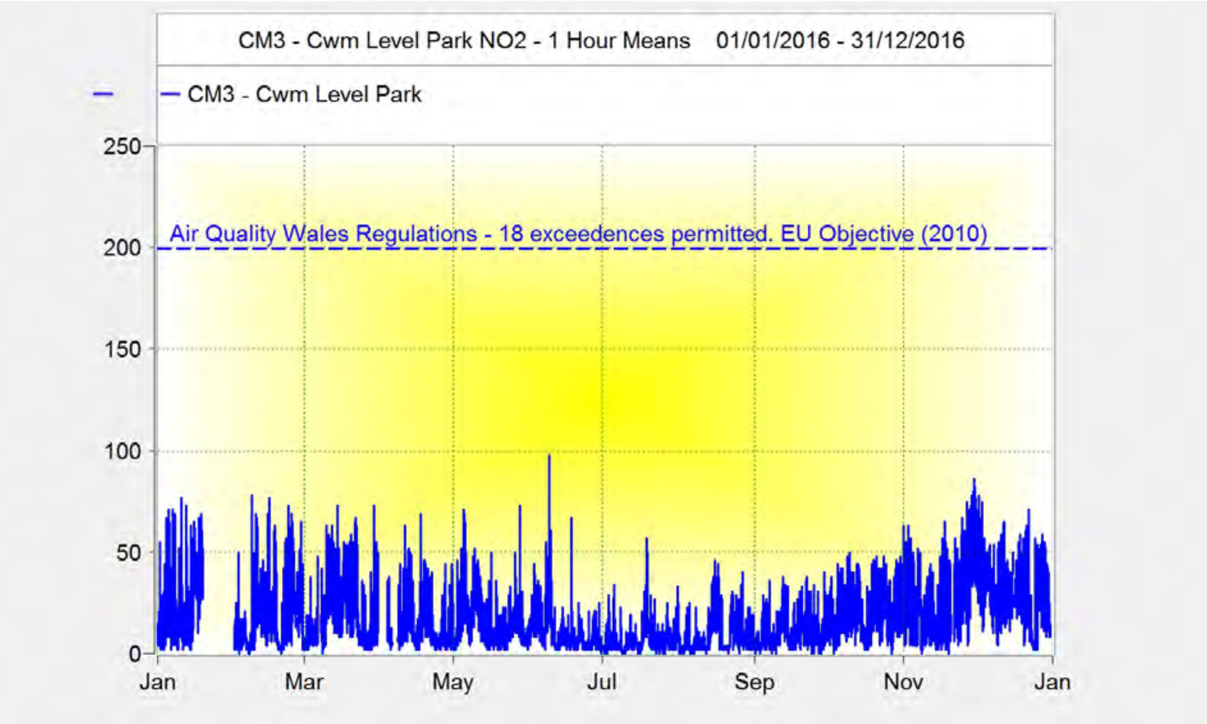


Figure 2.2.4

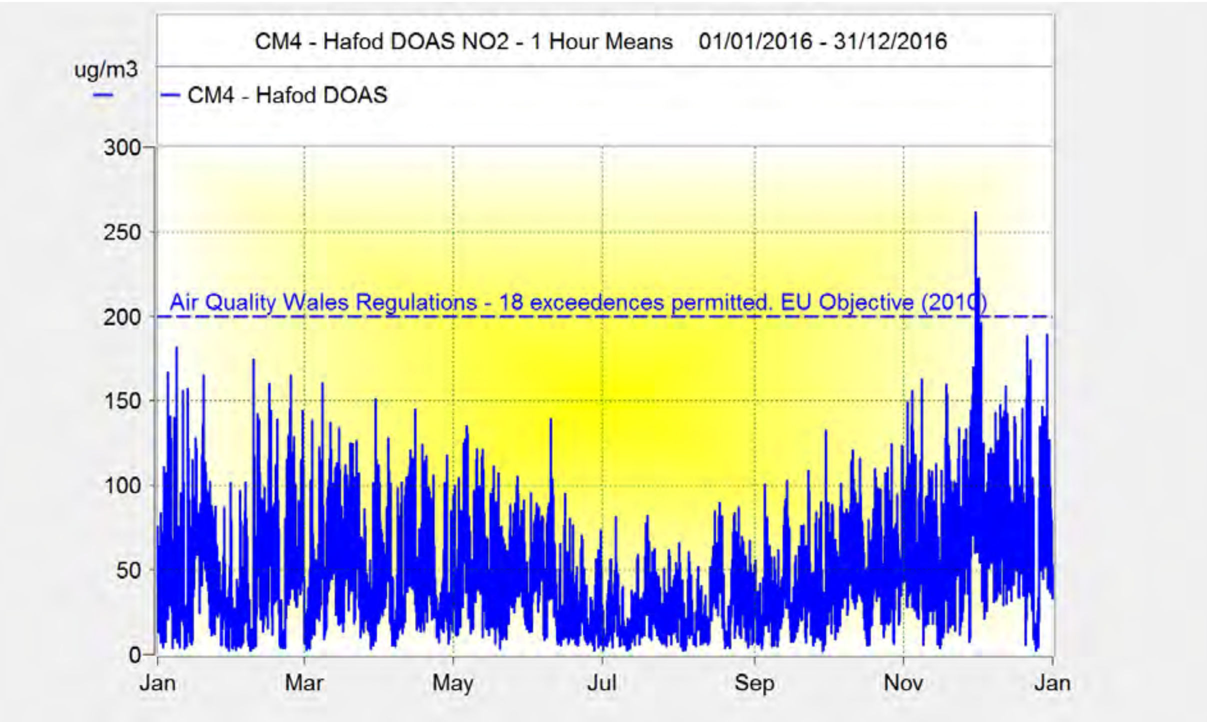


Figure 2.2.5

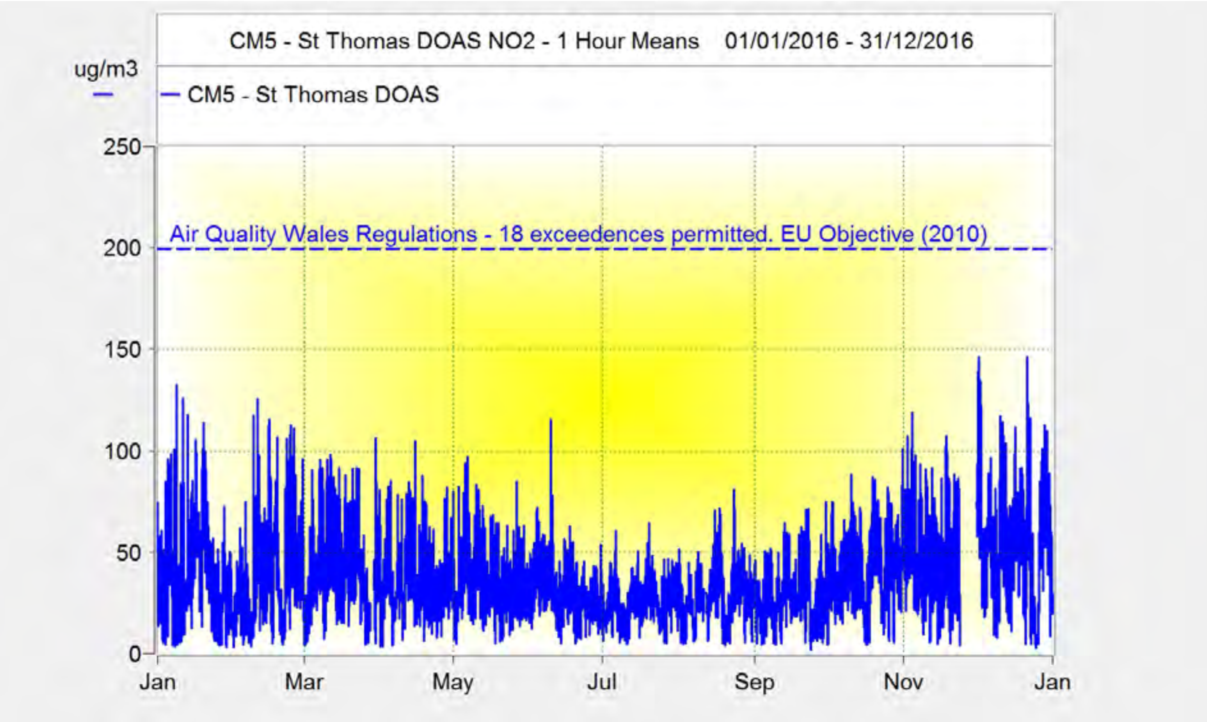


Figure 2.2.6

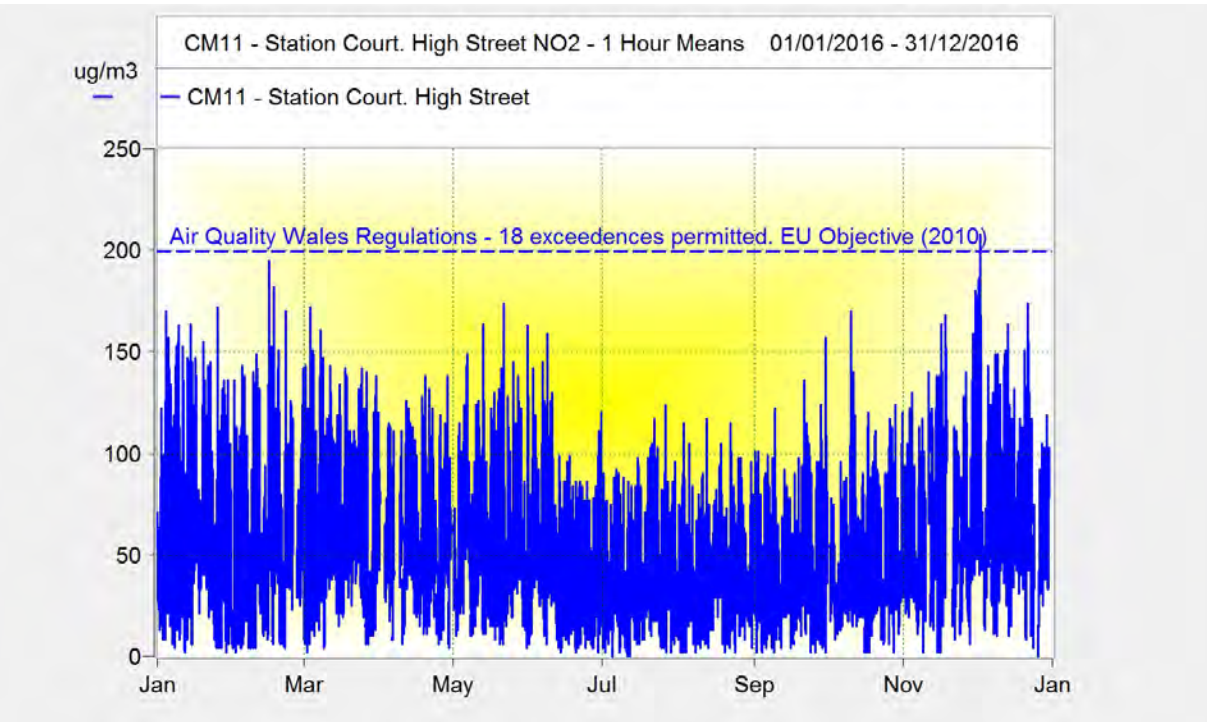


Figure 2.2.7

Diurnal NO_2 profiles of the working week (Mon – Fri) and the weekend (Sat – Sun) for each site are provided here as diurnal profiles figures 2.2.8 – 2.219. Again, as would be expected, the weekday peak concentrations are seen at each site during the morning period with the afternoon period seeing a lower concentration. It is thought that the morning peak is likely to be influenced more by the prevailing meteorological conditions during the morning period which then disperses before the afternoon period i.e. wintertime inversions; a different profile is seen for the weekend profile.

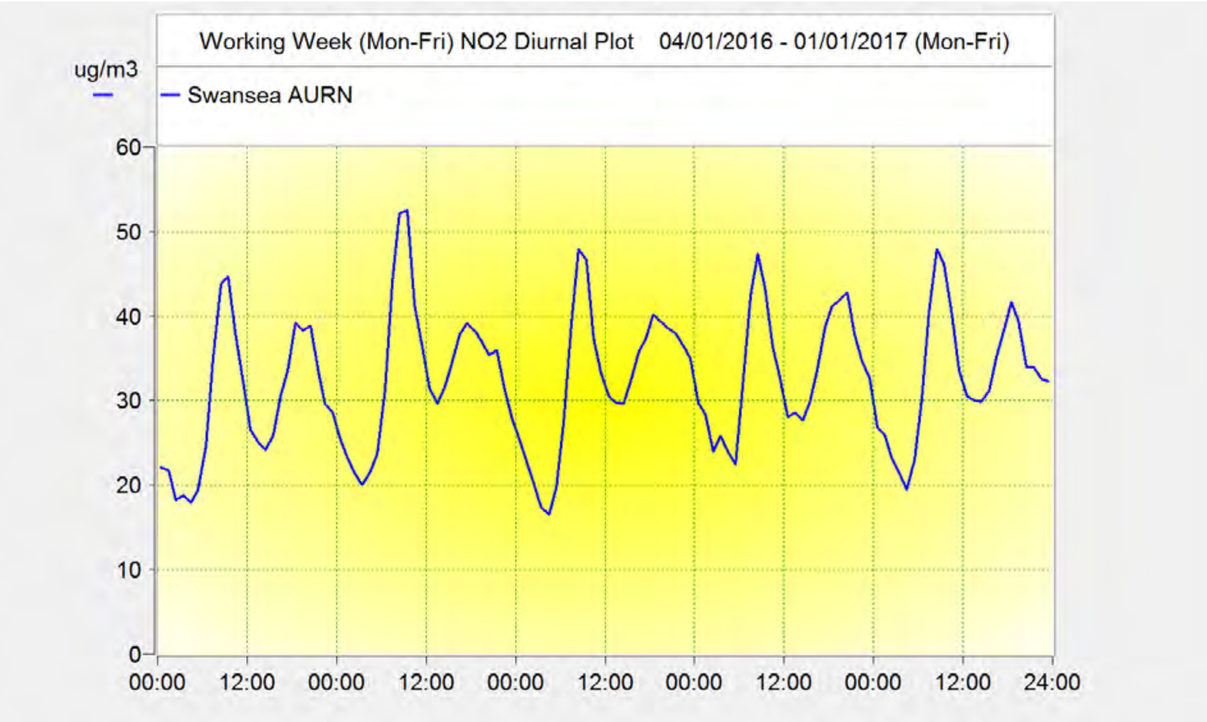


Figure 2.2.8

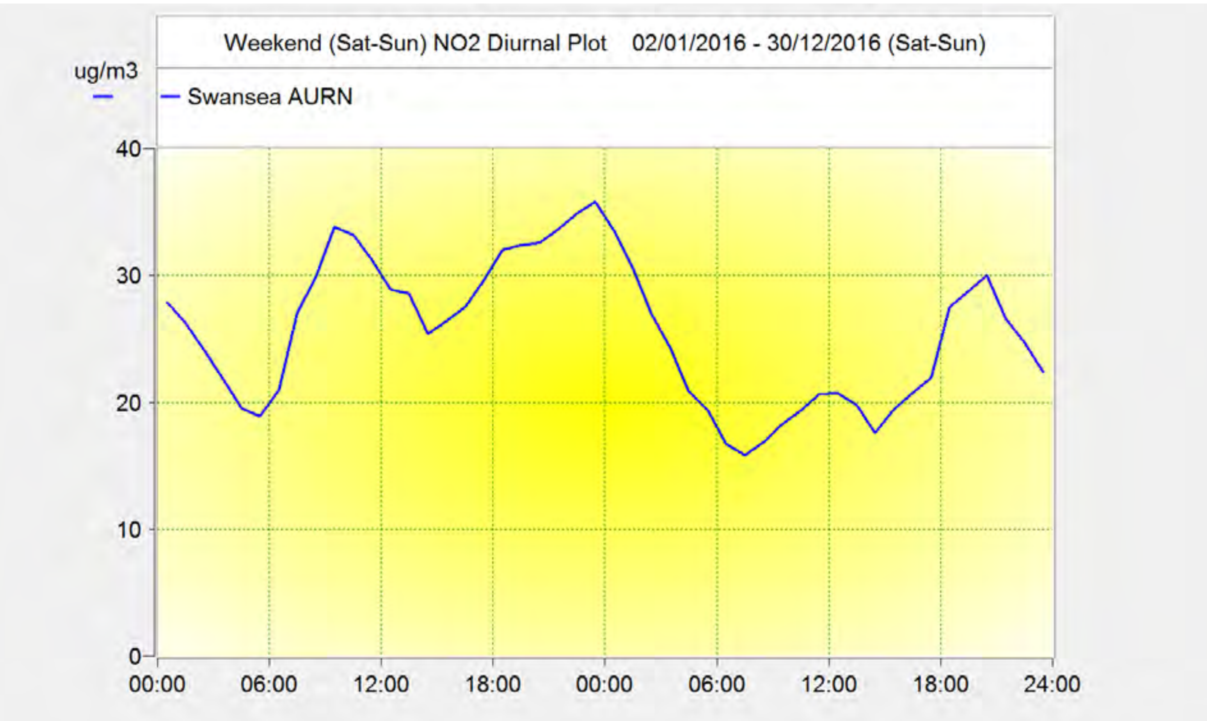


Figure 2.2.9

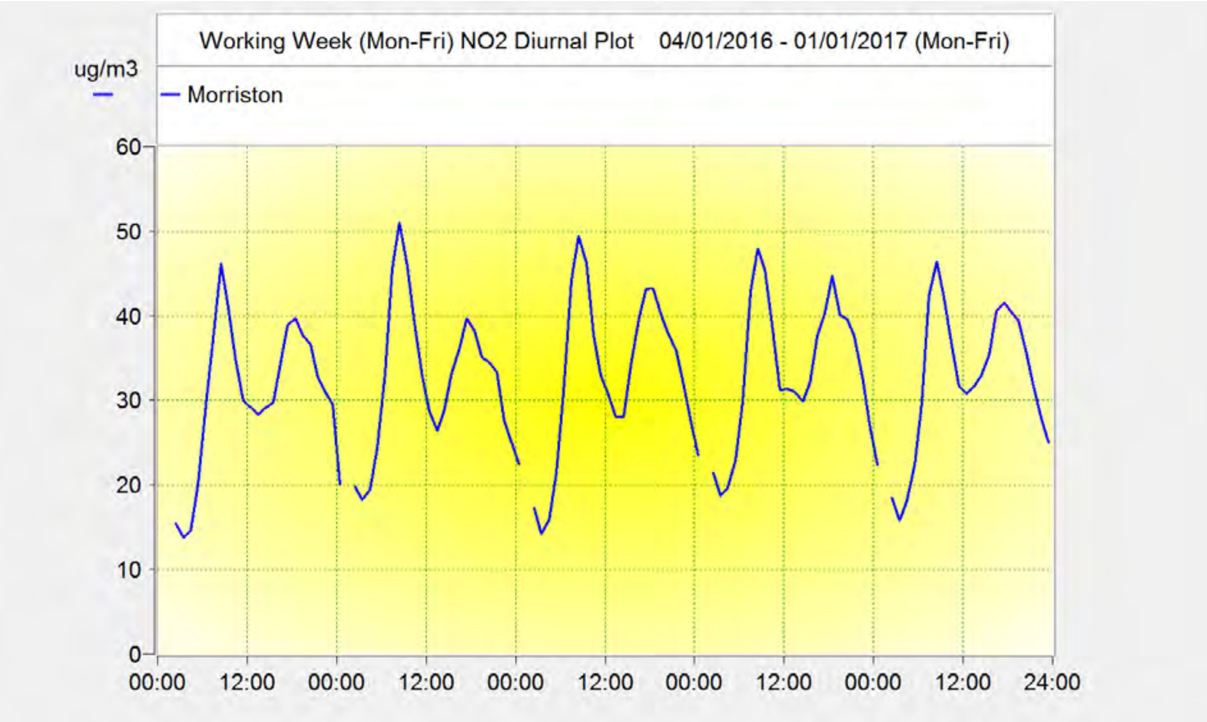


Figure 2.2.10

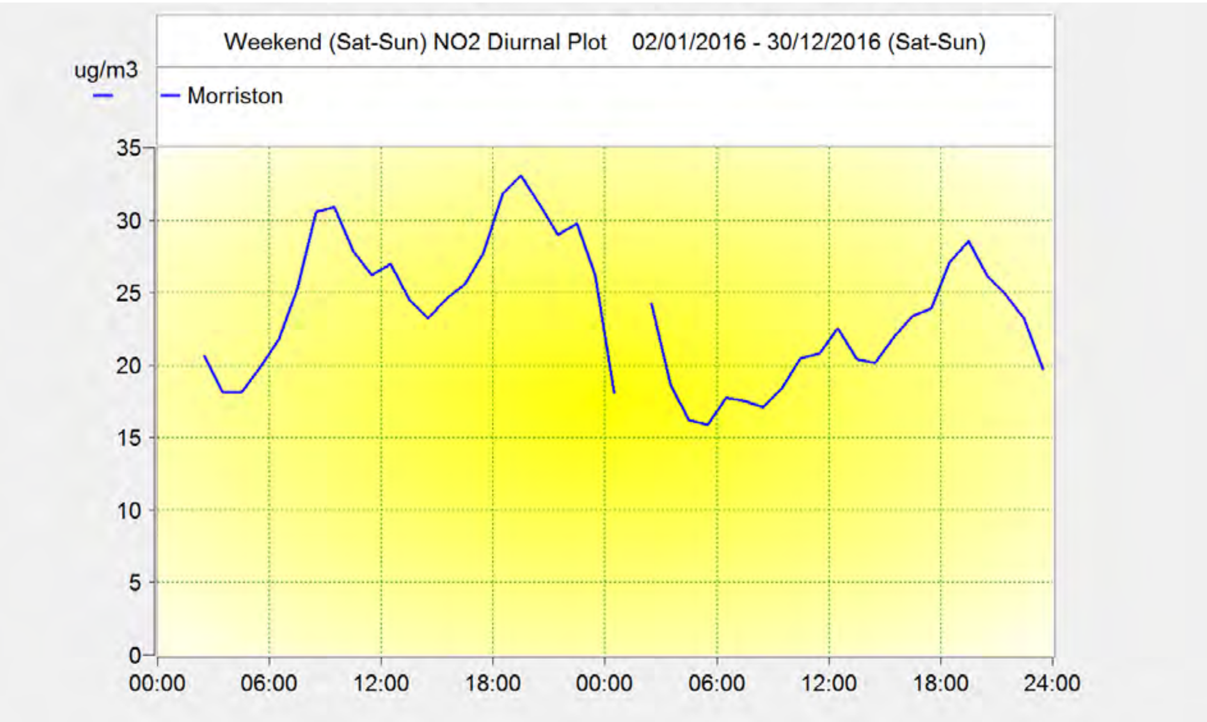


Figure 2.2.11

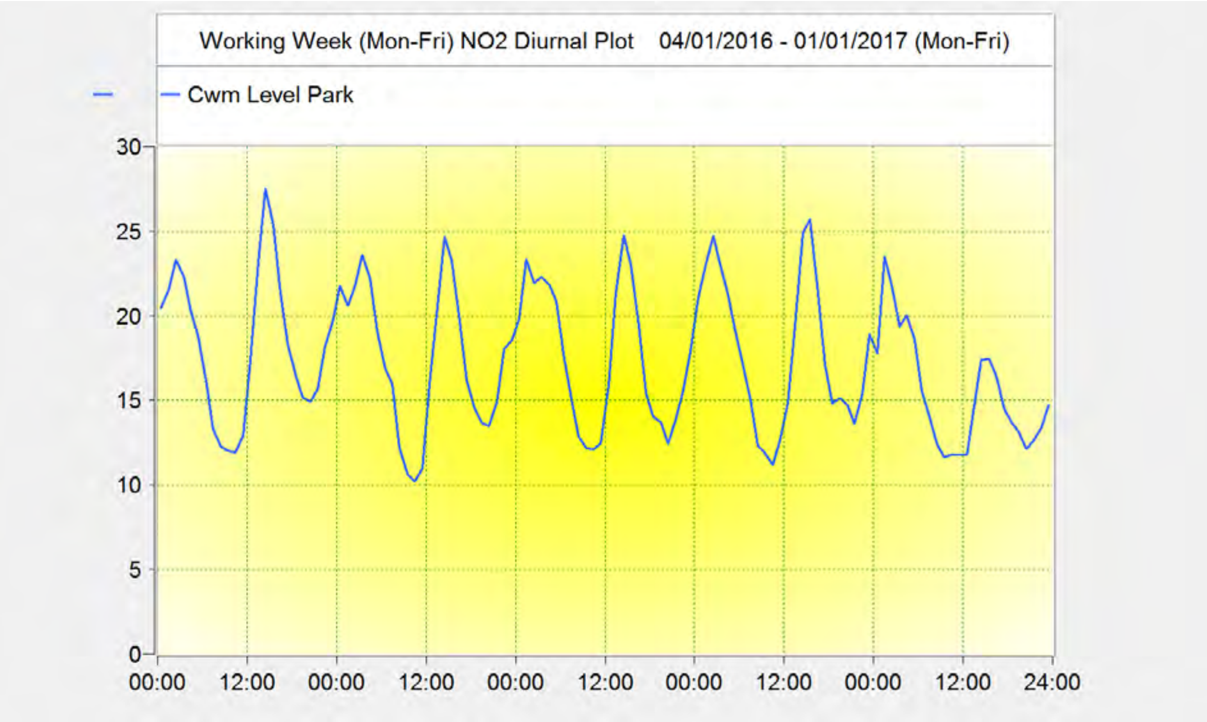


Figure 2.2.12

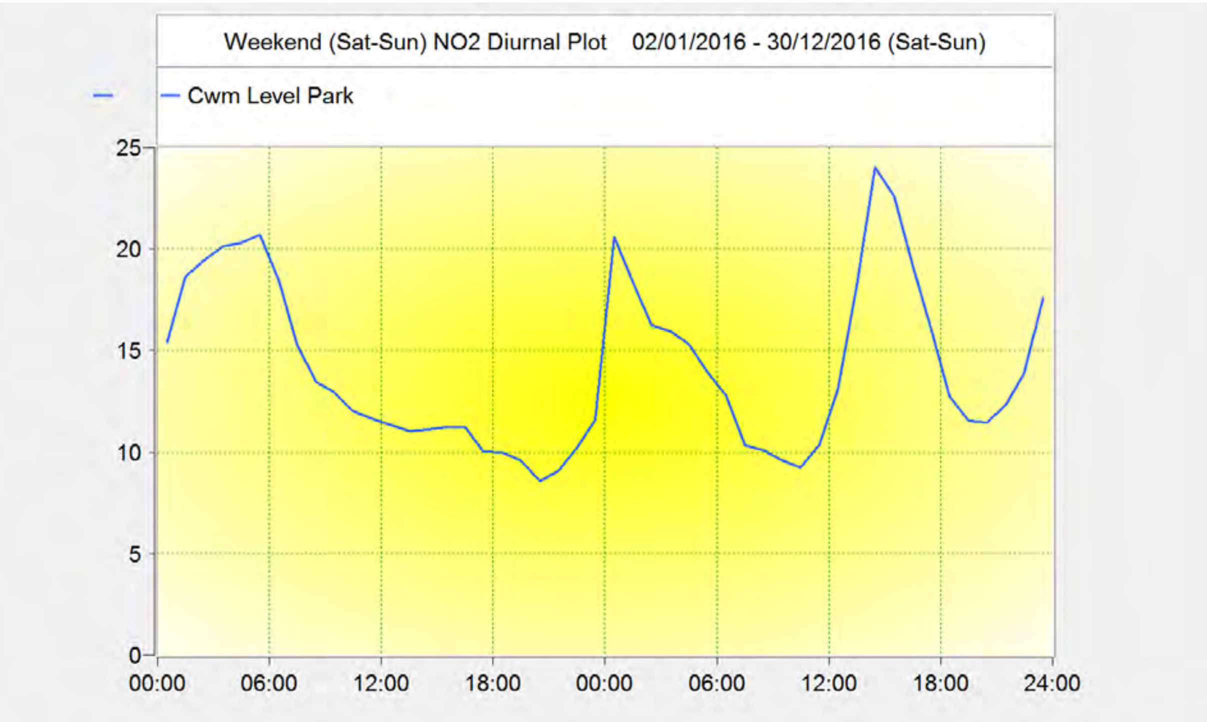


Figure 2.2.13

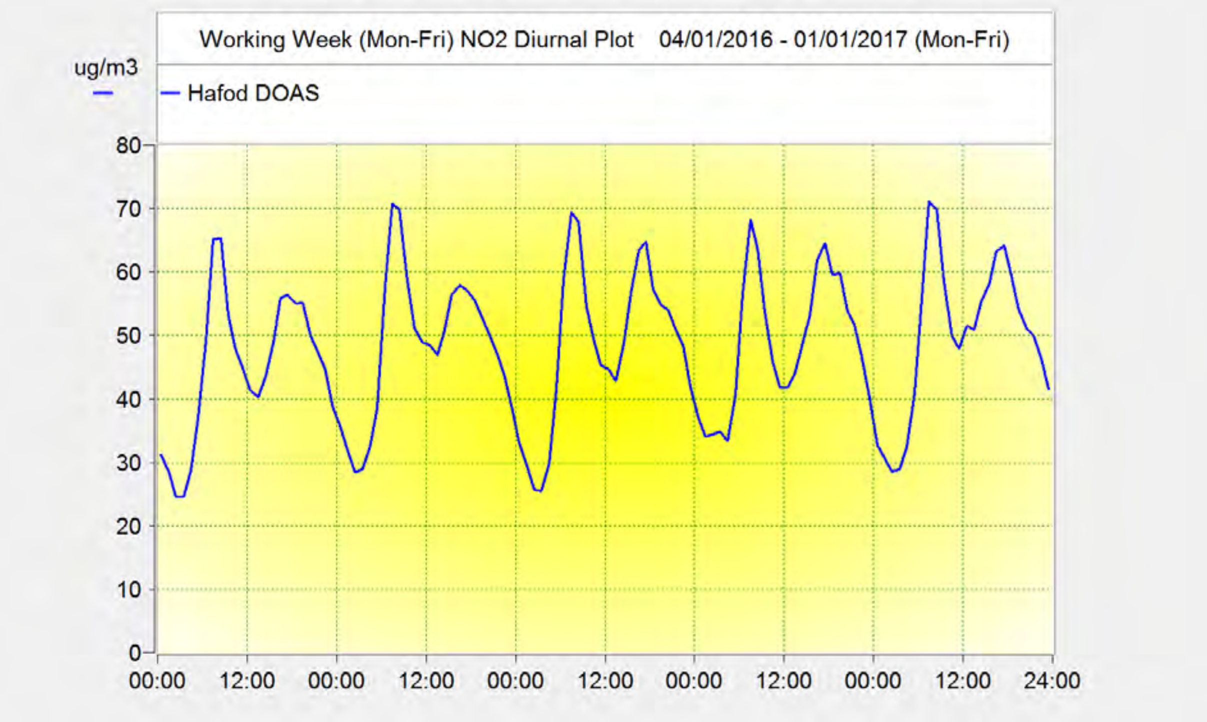


Figure 2.2.14

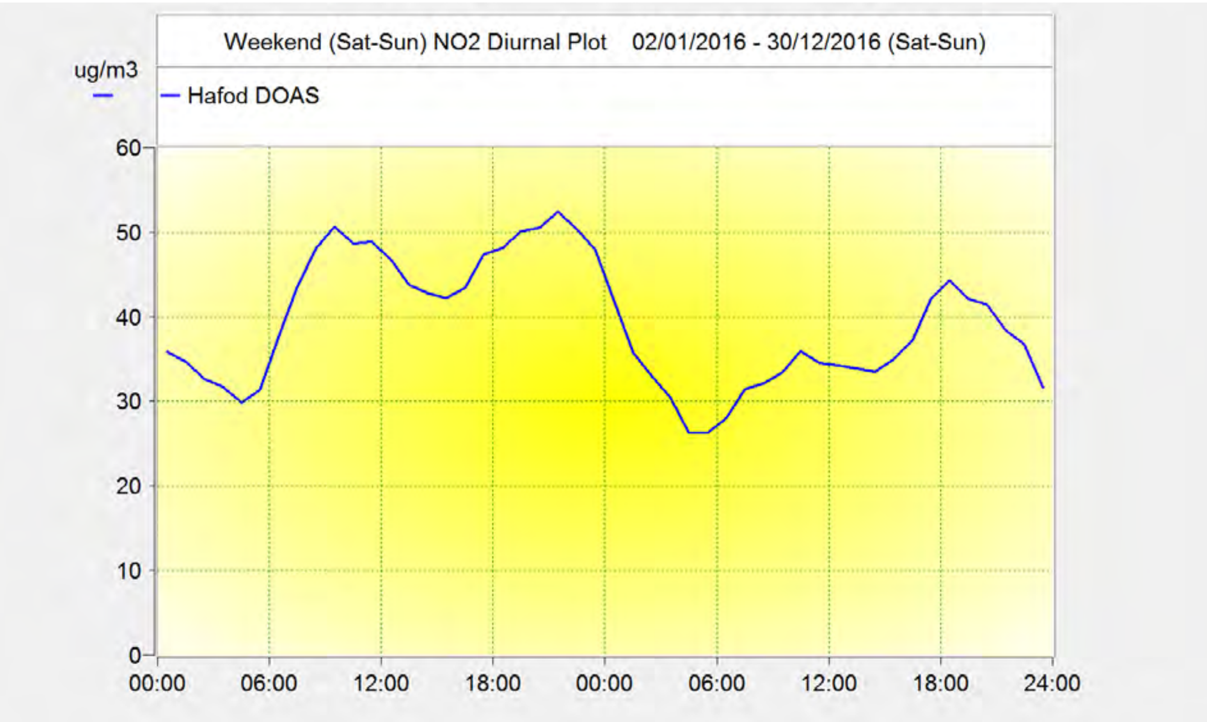


Figure 2.2.15

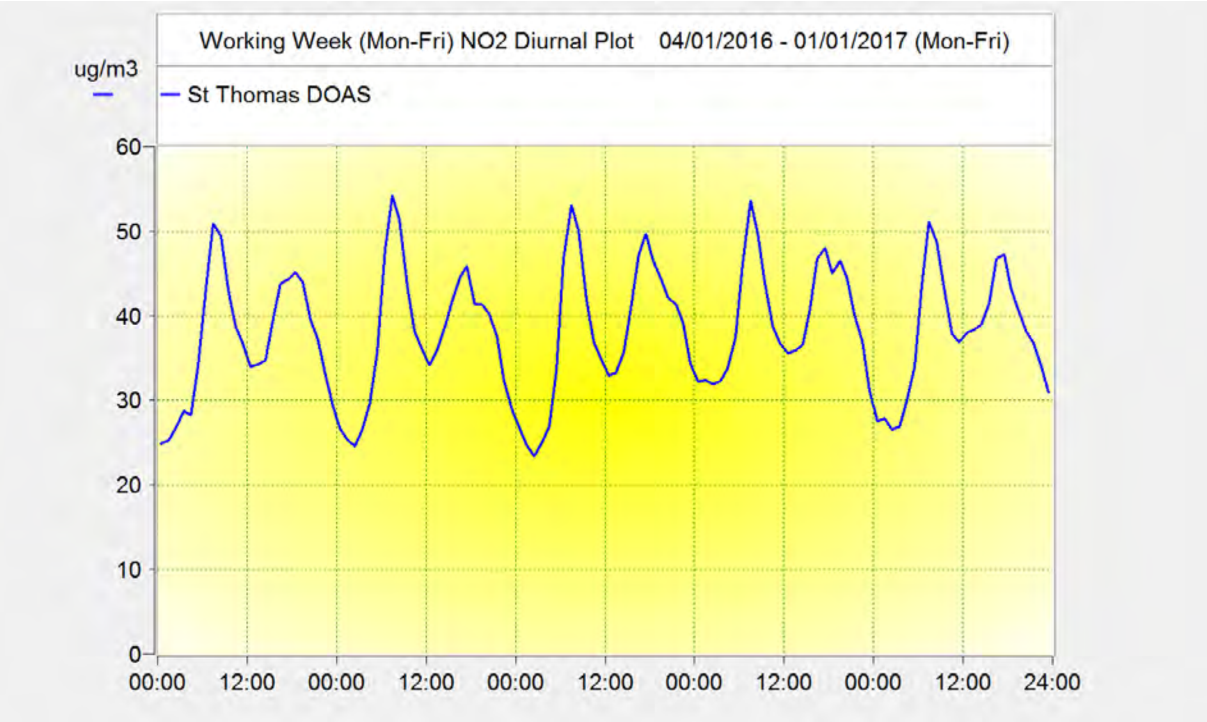


Figure 2.2.16

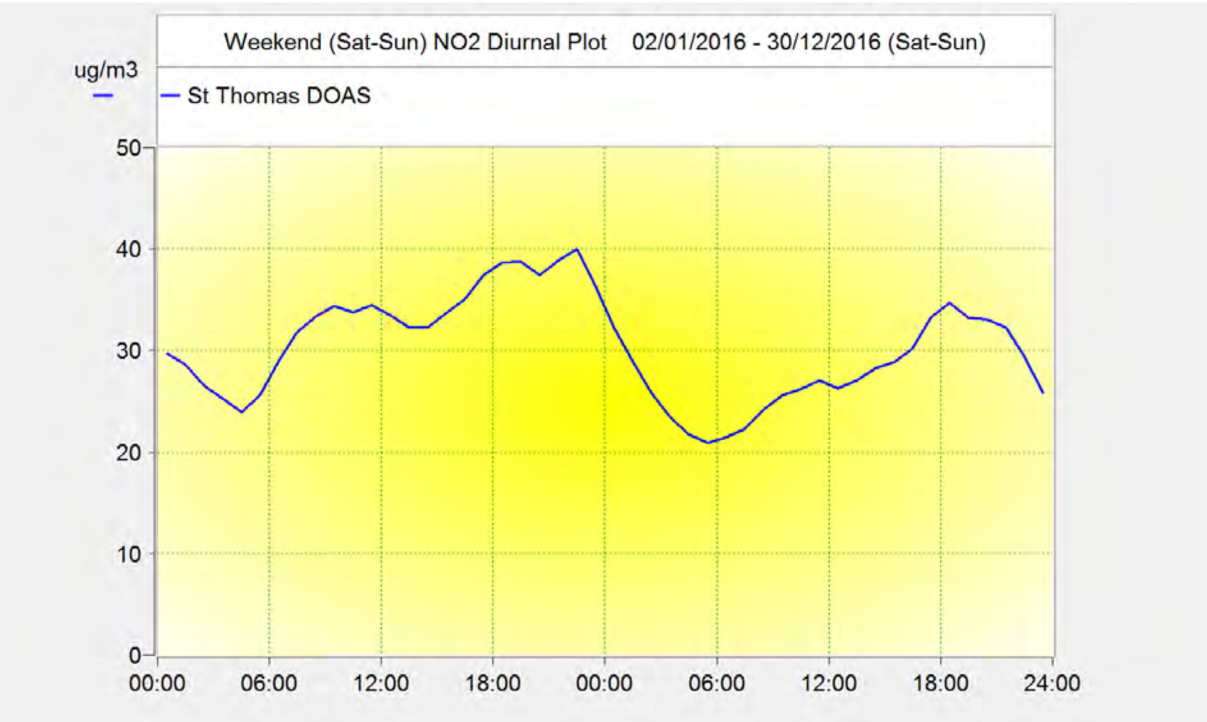


Figure 2.2.17

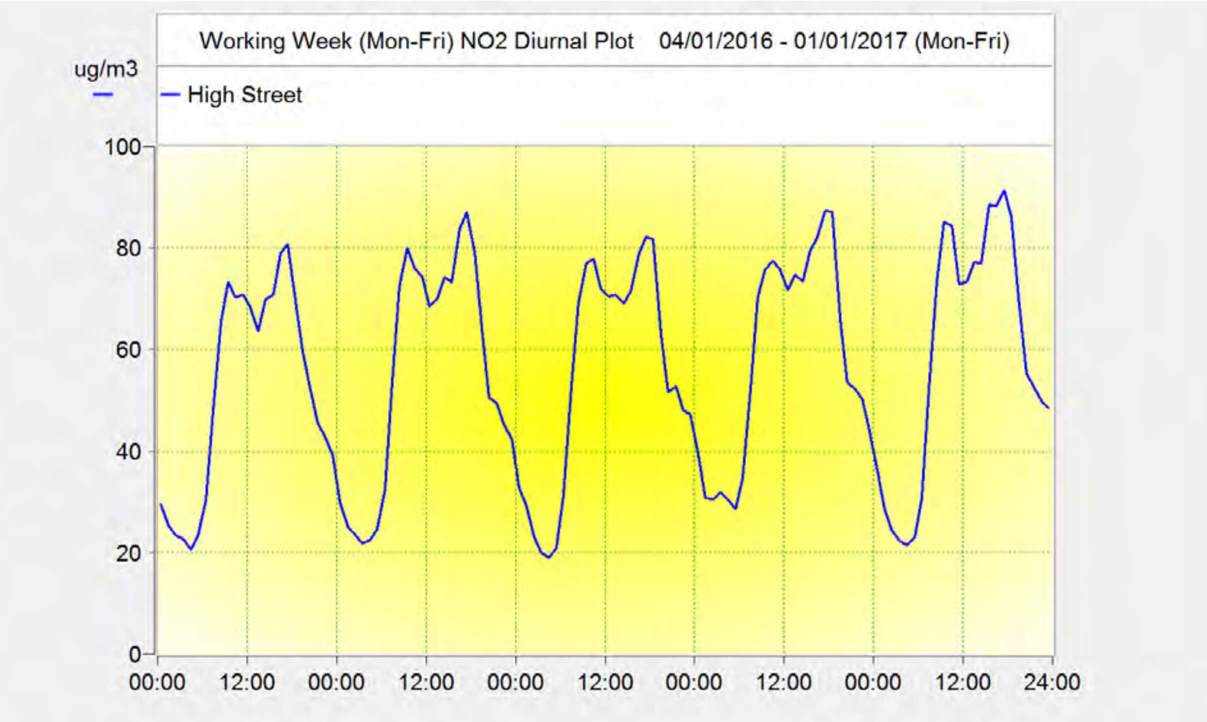


Figure 2.2.18

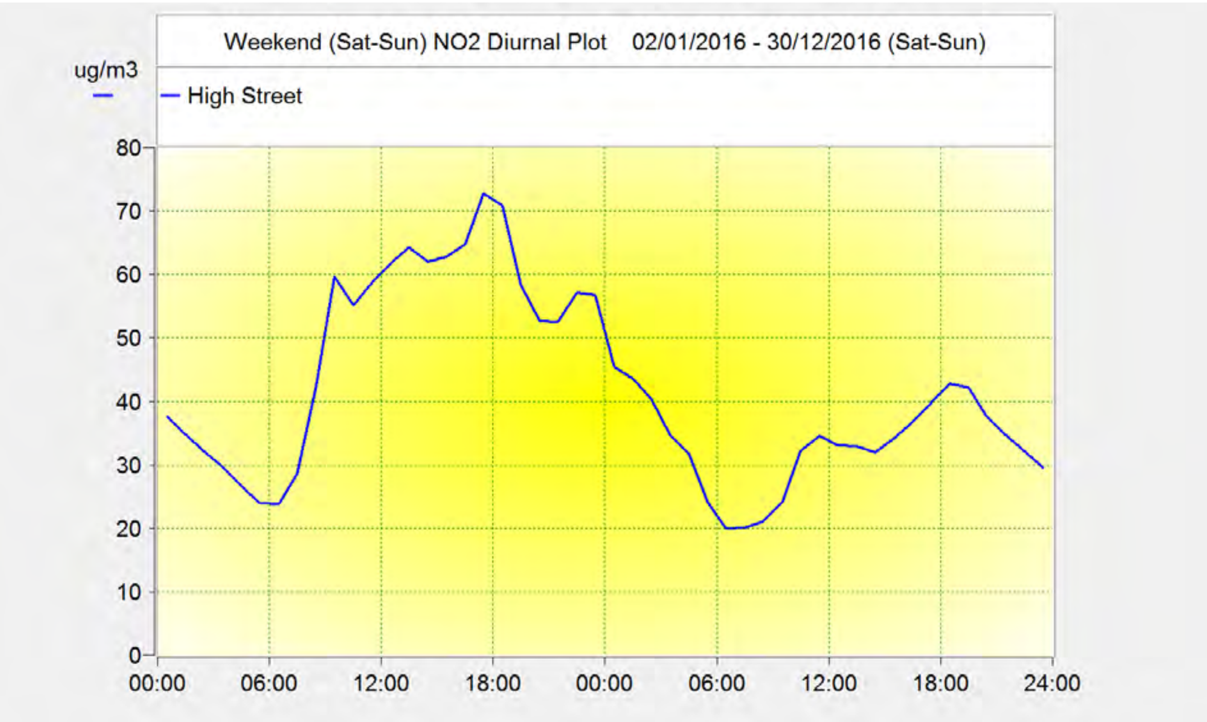


Figure 2.2.19

The diurnal profiles returned from the High Street site (CM11) shows a different trend to that returned from the other continuous monitoring sites. The concentrations remain elevated throughout the day and are higher in the afternoon period; it is envisaged that the Nowcaster System will have a part to play in assisting in traffic management measures to work towards widespread compliance with the objectives.

The diurnal weekday profiles obtained for the both the Hafod DOAS and Station Court sites are both interesting and concerning in that can these profiles be better explained and more importantly what practicable measures in the case of the Hafod DOAS site would reduce the impact of the morning rush hour along this street canyon. Early thoughts with the data from the Hafod DOAS were that it was envisaged that additional “source apportionment” would be required with specific emphasis on identifying the fuel being combusted and also the EURO classification and the adopted abatement technology employed within each vehicle. Obviously, the only way to accurately obtain this information would be via a static ANPR camera linked to the DVLA databases. When sufficient information had been gathered, thought would then have to be given as to how interventions could practicably be made with specific vehicle types within the fleet. However, budgetary restraints no longer permit this action to be considered further. It should be mentioned that in light of the annual mean returned for 2015 at the Hafod DOAS, no conclusions have been formed as it is unknown if the sharp downward annual mean concentration will be repeated in subsequent years. Should this be a real trend then the approach will need to be reassessed in light of the newly emerging evidence including the revocation of the areas as an AQMA.

If diurnal profiles are created for each individual working day at the Hafod DOAS, the same am peak trend is apparent, therefore, it could be argued that whatever interventions are decided upon would need to be applied for every morning of every working day of the week in order to make any difference to the concentrations being recorded. A weekly summary of the individual daily diurnal plots from the Hafod DOAS is given below as figure 2.2.20.

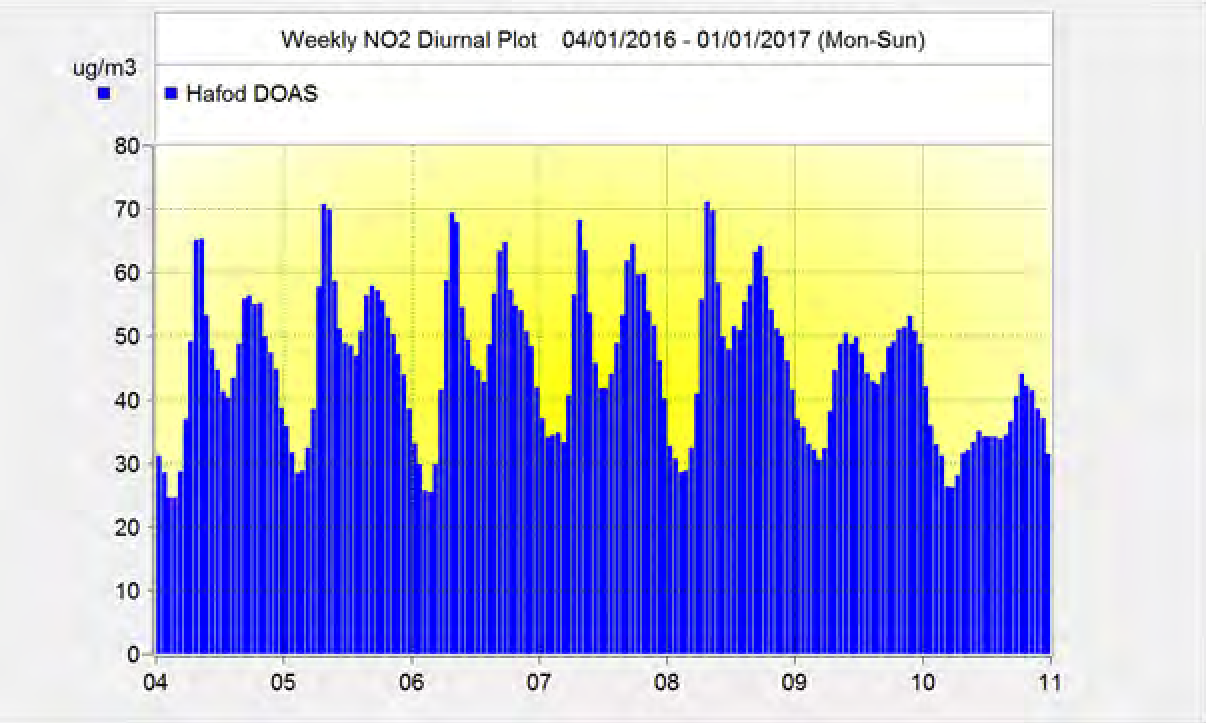


Figure 2.2.20 – Hafod DOAS – Weekly 2015

The weekly profile obtained at the Station Court site is shown below as figure 2.2.21 and presents a different challenge and scenario to that painted above for the Hafod DOAS. Visual observations confirm that congestion and a high flow of buses, together with the location of bus stops/mini roundabouts may well be contributory factors to the concentrations being seen. These high concentrations exist from early morning to early/late evening Monday to Saturday with the peak concentrations not being seen until the pm period. The only day that does not experience these conditions are Sundays.

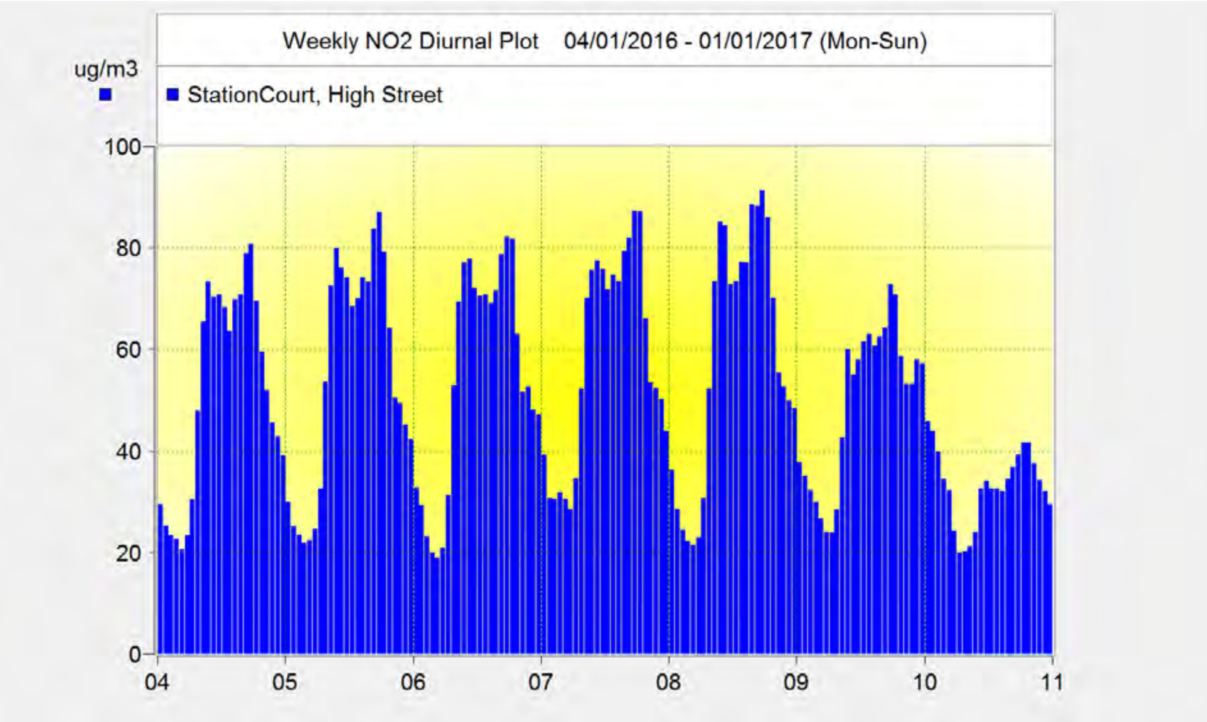


Figure 2.2.21 – Station Court High Street – Weekly 2015

Detailed traffic flow data for the authorities GPRS network of ATC's is presented in subsequent chapters. The nearest GPRS traffic counters to the Hafod DOAS are GRPS site 6 (located approximately 50m south of the Hafod DOAS transmitter and GPRS site 18 (located approx. 25m north of the Hafod DOAS receiver. The nearest traffic counters to the Station Court site are GPRS site 22 (located 330m to the North) and GPRS site 57 (located 350m to the South)

Diffusion Tube Monitoring Data

All data presented within table 2.9 below has been corrected for tube bias only. No correction for tube chemistry has been applied as a result of the tri-location study carried out at the Swansea Roadside AURN chemiluminescent analyser[18]. In any event, all passive diffusion tubes are located roadside and no correction has been made using a roadside tri-location study derived bias correction to a passive diffusion tube with an urban background classification.

Sites with data capture greater than 75% i.e. those that have the minimum 9 months exposure period and which exceed the annual mean are highlighted in bold red. Those sites that are close to exceeding the annual mean (between 37-40ug/m^3) are highlighted in bold blue. **Table 2.9 indicates the bias corrected annual means including any correction necessary for distance to nearest receptor from the sampling location - see table 2.5 for distance to nearest receptor. The relevant distance correction/background concentration (where applicable) is given within table 12 for sake of completeness.**

Annualised means in accordance with LAQM.TG(16) guidance on page 7-55 to 7-56 have been calculated for sites with data capture rates below 75% as per the method outlined in Box 7.10. Chemiluminescent NO_2 data has been used from Cwm Level Park which has an Urban Background classification.

[18] http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html

Table 2.9 – Results of NO_2 Diffusion Tubes 2016

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
4	Roadside	262497	192857	Y	N	12	29.49
5	Roadside	262548	192943	Y	N	12	31.65
6	Roadside	262612	192995	Y	N	11	27.58
7	Roadside	262691	192852	Y	N	12	**45.84**
8	Roadside	262990	195820	Y	N	12	**46.59**
9	Roadside	263190	195205		N	12	26.47
10	Roadside	263219	195513	Y	N	11	24.52
11	Roadside	263344	195474	Y	N	12	37.19
12	Roadside	263680	195103	Y	N	11	**42.72**
13	Roadside	264830	193066		N	12	27.40
14	Roadside	265285	192696		N	12	24.95
15	Roadside	265334	192608		N	12	26.39
16	Roadside	265339	192534		N	12	31.35
18	Roadside	265526	195807	Y	N	12	**46.38**
19	Roadside	265597	194061	Y	N	11	**44.11**
20	Roadside	265594	194175	Y	N	12	33.73
21	Roadside	265634	195316	Y	N	12	29.48
22	Roadside	265682	195374	Y	N	12	32.02
23	Roadside	265728	195494	Y	N	11	30.29
25	Roadside	265845	195547	Y	N	11	26.61
26	Roadside	265876	194318	Y	N	12	38.43
27	Roadside	265922	194428	Y	N	12	36.69

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
28	Roadside	265949	194891	Y	N	12	24.17
29	Roadside	265973	195222	Y	N	12	**48.42**
31	Roadside	266153	196003		N	12	30.16
32	Roadside	266209	193867		N	10	33.88
33	Roadside	266236	193488		N	12	31.69
34	Roadside	266272	196168		N	12	27.27
35	Roadside	266314	193298		N	12	33.53
36	Roadside	266455	193300		N	11	29.74
40	Roadside	266951	198278		N	11	26.17
41	Roadside	266953	198085		N	11	33.05
43	Roadside	267093	198063		N	12	34.75
44	Roadside	267639	199543		N	12	26.08
45	Roadside	267661	199451		N	12	30.92
48	Roadside	268011	193101		N	12	22.15
50	Roadside	268530	197419		N	12	38.03
54	Roadside	268693	197416		N	12	31.26
55	Roadside	268789	197420		N	11	31.21
56 *	Roadside	269306	198661		N	12	20.7
58	Roadside	264052	192884		N	10	33.8
59	Roadside	265918	194463	Y	N	12	**48.41**
60	Roadside	265036	192931		N	10	30.19
61	Roadside	264959	192878		N	11	36.75
63	Roadside	262675	192775	Y	N	12	22
64	Roadside	262719	192840	Y	N	12	32.8

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
65	Roadside	262735	192855	Y	N	10	25.77
66	Roadside	262802	192829	Y	N	12	29.48
67	Roadside	265903	193683	Y	N	12	**39.8**
68	Roadside	265573	193432		N	11	34.99
69	Roadside	265543	193450		N	12	34.9
70	Roadside	266649	195435		N	12	24.1
71 **	Roadside	266514	195485		N	12	26
72	Roadside	264091	192900		N	11	24.03
73	Roadside	264138	192868		N	12	27.39
74	Roadside	264163	192853		N	12	23.29
75	Roadside	264072	192869		N	12	34.53
76	Roadside	263968	192880		N	10	26.58
78	Roadside	263819	192948		N	12	25.59
79	Roadside	263842	192896		N	12	27.62
83	Roadside	262785	192838	Y	N	8	28.07
84	Roadside	262714	192839	Y	N	12	33.92
85	Roadside	262702	192847	Y	N	12	35.78
86	Roadside	262704	192865	Y	N	12	32.27
87	Roadside	262697	192798	Y	N	12	20.64
88	Roadside	262605	192916	Y	N	12	30.67
89	Roadside	262587	192956	Y	N	10	25.23
90	Roadside	262631	192996	Y	N	12	31.39
91	Roadside	262534	192950	Y	N	11	29.04
92	Roadside	262545	192869	Y	N	12	25.6

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
93	Roadside	263406	195534		N	12	26.89
94	Roadside	263444	195572		N	10	24.32
95	Roadside	262815	196090		N	10	24.12
96	Roadside	262922	195950		N	12	27.99
97	Roadside	262946	195902	Y	N	11	35.64
98	Roadside	263142	195548	Y	N	12	34.33
99	Roadside	263387	195332	Y	N	12	31.04
100	Roadside	263470	195250	Y	N	12	25.38
101	Roadside	263843	195047	Y	N	12	25.79
102	Roadside	266379	193307		N	12	29.77
104	Roadside	268538	197389		N	12	26.76
107	Roadside	268765	197420		N	12	30.83
108	Roadside	267608	199461		N	12	29.49
109	Roadside	267510	199487		N	12	26.07
110	Roadside	267369	199521		N	12	23.75
111	Roadside	267705	199426		N	12	30.61
114	Roadside	264622	192971		N	11	27.47
115	Roadside	265031	193097		N	12	35.09
116	Roadside	265192	193138		N	12	**37.65**
117	Roadside	265288	193211		N	12	**37.12**
⊗118	Roadside	265483	193385		N	12	28.96
119	Roadside	265522	193390		N	12	31.34
120	Roadside	265570	193366		N	12	**44.82**
121	Roadside	265706	193662	Y	N	11	**48.01**

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
122	Roadside	265694	193505		N	12	32.09
123	Roadside	265655	193423		N	8	**46.44**
⊗124	Roadside	265651	193253		N	10	**39.60**
⊗125	Roadside	265641	193162		N	12	**38**
⊗126	Roadside	265475	193144		N	12	34.91
⊗127	Roadside	265348	193110		N	11	34.1
⊗128	Roadside	265297	193085		N	12	**38.06**
⊗129	Roadside	265153	193098		N	12	**37.11**
⊗130	Roadside	265139	192912		N	10	32.02
131	Roadside	265137	192846		N	12	**42.02**
132	Roadside	265229	192753		N	12	32.29
133	Roadside	265350	192566		N	12	25.17
⊗134	Roadside	265113	192903		N	12	**42.10**
^135	Roadside	262605	192916			10	29.66
^136	Roadside	262612	192995		N	6	25.18
^137	Roadside	262631	192996		N	12	31.16
140	Roadside	266863	199009		N	12	29.06
143	Roadside	267089	198608		N	12	28.78
144	Roadside	267141	198591		N	12	26.78
145	Roadside	267139	198578		N	12	27.27
146	Roadside	267156	198571		N	12	27.89
147	Roadside	267165	198580		N	12	26.26
148	Roadside	267170	198564		N	12	28.76
149	Roadside	267204	198561		N	12	25.16

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
150	Roadside	267205	198545		N	12	28.46
151	Roadside	267192	198518		N	12	26.74
160	Roadside	269049	201744		N	8	27.39
180	Roadside	259064	197781		N	12	30.98
182	Roadside	259050	197790		N	12	28.48
183	Roadside	259036	197795		N	12	29.79
197	Roadside	258797	198701		N	12	33.54
198	Roadside	258811	198701		N	11	33.20
206	Roadside	261565	188211		N	12	**41.79**
207	Roadside	261561	188222		N	11	**37.74**
208	Roadside	261541	188215		N	12	**37.23**
209	Roadside	261534	188198		N	12	**39.21**
210	Roadside	261516	188207		N	12	33.33
211	Roadside	261501	188188		N	8	26.74
212	Roadside	261486	188200		N	12	29.00
213	Roadside	261490	188186		N	12	34.88
214	Roadside	261315	188193		N	12	23.67
215	Roadside	261299	188191		N	12	25.61
216	Roadside	261276	188190		N	12	24.50
238	Roadside	266902	197660		N	12	27.15
239	Roadside	266181	196022		N	12	28.86
240	Roadside	266169	195995		N	12	31.09
241	Roadside	266159	196013		N	12	30.83
242	Roadside	265655	193423		N	12	**43.29**

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m3) - Bias Adjustment factor = 0.89[b]
243	Roadside	265474	194949		N	10	**38.88**
244	Roadside	265466	194930		N	12	**43.19**
245	Roadside	265448	194922		N	12	**42.32**
247	Roadside	265394	194899		N	12	32.87
249	Roadside	265326	194871		N	12	31.55
251	Roadside	265263	194845		N	12	31.56
252	Roadside	265226	194830		N	12	28.58
256	Roadside	264995	194777		N	11	**37.86**
271	Roadside	266879	198078		N	10	29.71
272	Roadside	266888	198074		N	11	29.97
275	Roadside	265658	194856		N	12	22.5
276	Roadside	265610	194871		N	11	34.64
277	Roadside	265596	194875		N	12	34.73
278	Roadside	265573	194882		N	12	35.22
279	Roadside	265555	194926		N	12	**47.31**
280	Roadside	265542	194980		N	12	**38.7**
281	Roadside	265542	194872		N	12	34.8
282	Roadside	265540	194840		N	11	33.5
284	Roadside	265452	195899		N	12	30.51
285	Roadside	266955	197415		N	10	31.47
286	Roadside	266938	197377		N	12	32.30
287	Roadside	265715	193902		N	12	28.84
288	Roadside	265698	193878		N	12	30.19
289	Roadside	265702	193842		N	12	33.04

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
290	Roadside	263014	195737		N	12	27.24
291	Roadside	267952	193121		N	12	**41.05**
295	Roadside	258998	198698		N	11	31.7
296	Roadside	259054	198679		N	12	36.27
323	Roadside	266765	193224		N	12	34.30
324	Roadside	269815	197657		N	12	29.24
325	Roadside	266338	199647		N	9	21.72
326	Roadside	266299	199642		N	9	23.28
327	Roadside	266253	199637		N	9	22.21
328	Roadside	266183	199626		N	9	25.10
329	Roadside	266127	199620		N	9	28.21
330	Roadside	266363	199669		N	9	29.49
331	Roadside	265741	193545		N	12	36.26
333	Roadside	265673	193477		N	12	36.5
334	Roadside	265688	193483		N	12	31.68
335	Roadside	265682	193461		N	12	29.6
336	Roadside	265664	193395		N	10	36.64
337	Roadside	265637	193335		N	11	**37.1**
338	Roadside	265651	193331		N	11	36.03
339	Roadside	265652	193313		N	11	**37.76**
340	Roadside	265632	193292		N	12	**49.03**
341	Roadside	265635	193224		N	11	40.3
342	Roadside	265655	193197		N	12	34.7
343	Roadside	265640	193173		N	12	35.15

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
344	Roadside	265658	193169		N	12	31.1
345	Roadside	265661	193140		N	12	30.2
346	Roadside	265681	193096		N	8	34.27
347	Roadside	265562	193518		N	12	36.32
348	Roadside	265572	193549		N	12	36.04
349	Roadside	265578	193576		N	12	35.65
350	Roadside	265577	193606		N	12	**39.52**
351	Roadside	265606	193466		N	11	27.85
352	Roadside	265602	193429		N	10	29.46
353	Roadside	265596	193389		N	10	25.8
354	Roadside	265595	193377		N	12	28
355	Roadside	265574	193269		N	12	27.8
356	Roadside	265471	193359		N	12	31.52
357	Roadside	265498	193162		N	12	27.6
358	Roadside	265414	193141		N	12	30.1
359	Roadside	265396	193111		N	11	33.4
360	Roadside	265267	192750		N	7	29.57
361	Roadside	265303	192719		N	7	29.90
362	Roadside	265271	192774		N	9	**42.23**
363	Roadside	265287	192797		N	9	35.42
364	Roadside	265301	192814		N	9	**39.49**
365	Roadside	265258	193075		N	12	31.85
366	Roadside	265237	193056		N	12	35.42
367	Roadside	265189	193044		N	12	32.16

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
368	Roadside	265143	193083		N	12	28.1
369	Roadside	260356	192927		N	8	23.59
370	Roadside	260394	192938		N	8	25.20
371	Roadside	260402	192910		N	9	17.87
372	Roadside	260291	192892		N	8	29.33
373	Roadside	258859	196513		N	9	34.33
374	Roadside	258824	196435		N	9	30.94
375	Roadside	258798	196371		N	10	18
376	Roadside	258765	196368		N	9	30.40
377	Roadside	258763	196317		N	10	34.98
378	Roadside	258722	196365		N	10	21.04
379	Roadside	261714	188096		N	9	16.59
380	Roadside	261675	188060		N	9	20.52
381	Roadside	261660	188041		N	9	17.80
382	Roadside	261631	188116		N	10	23.48
383	Roadside	261694	188038		N	10	23.16
384	Roadside	261720	188015		N	8	25.02
385	Roadside	267001	198231		N	6	25.08
386	Roadside	266698	195334		N	6	26.7
387	Roadside	267990	193091		N	6	19.79
388	Roadside	267964	193076		N	6	18.67
389	Roadside	267933	193111		N	6	**46.12**
390	Roadside	267974	193132		N	6	**37.04**
391	Roadside	259467	198509		N	6	27.02

Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2016 (Number of Months or %) [a]	2016 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.89[b]
392	Roadside	257959	188908		N	6	8.21
393	Roadside	262620	192740		N	3	16.7
394	Roadside	262445	192645		N	3	16.79
395	Roadside	262413	192630		N	3	17.88
396	Roadside	262370	192609		N	3	21.00
408	Roadside	266655	193177		N	12	**40.4**

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Underlined, annual mean > 60µg/m^3, indicating a potential exceedence of the NO_2 hourly mean AQS objective

[a] Means should be “annualised” as in Boxes 7.9 and 7.10 of LAQM.TG16, if full calendar year data capture is less than 75%

[b] If an exceedence is measured at a monitoring site not representative of public exposure, NO_2 concentration at the nearest relevant exposure should be estimated based on the “NO_2 fall-off with distance” calculator (http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html), and results should be discussed in a specific section. The procedure is also explained in paragraphs 7.77 to 7.79 of LAQM.TG16.

Table 2.10 – Results of NO_2 Diffusion Tubes (2012 to 2016)

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m³) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
4	Roadside	Y	29.73	29.92	29.78	27.28	29.49
5	Roadside	Y	34.06	34.78	32.46	29.70	31.65
6	Roadside	Y	29.20	30.65	28.52	26.57	27.58
7	Roadside	Y	**49.39**	**46.74**	**48.66**	**42.69**	**45.84**
8	Roadside	Y	**41.80**	**44.77**	**41.76**	**40.36**	**46.59**
9	Roadside		26.63	30.03	27.89	24.87	26.47
10	Roadside	Y	23.40	25.29	24.97	23.94	24.52
11	Roadside	Y	34.03	**39.45**	**37.58**	33.81	**37.19**
12	Roadside	Y	**43.20**	**40.22**	**42.78**	**38.39**	**42.72**
13	Roadside		28.99	29.30	27.78	25.66	27.40
14	Roadside		25.57	28.69	24.30	23.86	24.95
15	Roadside		26.69	26.91	24.45	24.30	26.39
16	Roadside		30.41	31.63	28.61	26.80	31.35
18	Roadside	Y	**44.74**	**47.01**	**45.85**	**42.07**	**46.38**
19	Roadside	Y	**45.33**	**43.75**	**42.61**	**39.14**	**44.11**
20	Roadside	Y	36.65	36.50	**37.74**	35.42	33.73
21	Roadside	Y	30.57	30.04	27.96	26.93	29.48
22	Roadside	Y	31.23	33.89	31.43	29.91	32.02
23	Roadside	Y	33.18	30.93	28.49	28.69	30.29
25	Roadside	Y	28.83	27.88	27.06	26.47	26.61
26	Roadside	Y	**40.31**	**39.11**	**38.59**	35.44	38.43
27	Roadside	Y	**37.05**	**38.03**	**39.25**	34.78	36.69
28	Roadside	Y	30.11	28.30	28.21	25.67	24.17
29	Roadside	Y	**47.60**	**43.86**	**47.36**	**48.90**	**48.42**
31	Roadside		33.26	30.81	31.70	28.42	30.16
32	Roadside		31.53	35.24	33.38	30.15	33.88
33	Roadside		32.59	31.09	31.33	29.45	31.69
34	Roadside		31.39	31.11	29.80	27.33	27.27
35	Roadside		33.46	31.27	32.21	31.35	33.53
36	Roadside		31.65	30.12	27.49	26.49	29.74
38	Roadside		35.40	33.56	31.05	32.66	-
40	Roadside		30.47	28.19	27.42	24.83	26.17
41	Roadside		**38.32**	36.54	35.33	31.89	33.05
43	Roadside		**38.01**	**38.62**	36.22	32.16	34.75

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m³) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
44	Roadside		28.67	25.69	27.35	26.55	26.08
45	Roadside		33.84	32.06	30.78	28.19	30.92
48	Roadside		23.52	23.43	21.72	19.59	22.15
50	Roadside		33.84	32.89	36.43	33.79	38.03
54	Roadside		34.66	31.88	33.93	31.38	31.26
55	Roadside		33.36	32.39	32.31	31.04	31.21
56 *	Roadside		22.30	21.20	22.00	22.20	20.7
58	Roadside		**37.90**	32.50	29.70	28.50	33.8
59	Roadside	Y	**53.85**	**47.99**	**50.28**	**47.78**	**48.41**
60	Roadside		35.74	35.71	34.21	29.70	30.19
61	Roadside		**40.07**	36.45	**38.16**	33.93	36.75
63	Roadside	Y	21.80	22.10	21.00	19.40	22
64	Roadside	Y	**40.50**	**38.90**	**38.30**	36.10	32.8
65	Roadside	Y	24.69	22.92	24.77	21.99	25.77
66	Roadside	Y	31.62	29.11	26.45	26.53	29.48
67	Roadside	Y	35.40	36.20	35.60	**37.20**	**39.8**
68	Roadside		**39.68**	35.72	36.13	34.87	34.99
69	Roadside		**42.30**	36.70	**40.30**	35.60	34.9
70	Roadside		24.30	24.30	24.80	25.60	24.1
71 **	Roadside		23.40	29.00	25.00	24.50	26
72	Roadside		25.53	24.91	23.58	22.60	24.03
73	Roadside		33.09	28.81	29.60	28.39	27.39
74	Roadside		29.01	26.65	28.41	22.39	23.29
75	Roadside		**41.09**	**38.41**	**39.99**	34.02	34.53
76	Roadside		27.86	27.76	27.61	25.80	26.58
78	Roadside		29.80	27.88	25.69	23.47	25.59
79	Roadside		31.84	31.04	30.07	26.82	27.62
83	Roadside	Y	30.36	30.33	27.41	25.97	28.07
84	Roadside	Y	36.82	32.73	35.13	33.81	33.92
85	Roadside	Y	**39.19**	36.24	35.62	35.28	35.78
86	Roadside	Y	29.33	28.18	25.51	23.97	32.27
87	Roadside	Y	22.26	22.11	20.80	18.93	20.64
88	Roadside	Y	33.63	30.73	28.21	28.37	30.67
89	Roadside	Y	22.37	21.26	20.12	20.09	25.23
90	Roadside	Y	32.77	33.29	32.61	30.02	31.39
91	Roadside	Y	30.20	30.68	29.28	27.46	29.04

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
92	Roadside	Y	26.10	27.10	23.70	23.10	25.6
93	Roadside		27.27	29.25	29.21	25.39	26.89
94	Roadside		28.63	28.26	28.09	25.66	24.32
95	Roadside		26.57	25.85	25.23	21.38	24.12
96	Roadside		25.87	27.50	26.20	25.55	27.99
97	Roadside	Y	34.78	32.92	31.62	31.44	35.64
98	Roadside	Y	36.92	36.67	36.21	33.05	34.33
99	Roadside	Y	30.27	31.83	32.73	28.84	31.04
100	Roadside	Y	27.97	27.43	24.02	23.09	25.38
101	Roadside	Y	27.17	25.34	23.31	23.75	25.79
102	Roadside		29.66	28.70	27.96	27.87	29.77
104	Roadside		28.24	27.86	27.70	27.13	26.76
107	Roadside		33.99	31.01	32.23	29.49	30.83
108	Roadside		29.46	29.75	28.72	27.33	29.49
109	Roadside		25.85	27.14	26.43	25.01	26.07
110	Roadside		28.57	26.66	25.75	24.67	23.75
111	Roadside		30.38	29.40	27.15	30.15	30.61
114	Roadside		29.07	29.70	30.07	27.48	27.47
115	Roadside		**41.89**	**37.57**	**40.40**	35.25	35.09
116	Roadside		**41.49**	**38.43**	**38.73**	35.63	**37.65**
117	Roadside		**39.32**	36.61	35.30	33.91	**37.12**
⊗118	Roadside		31.76	29.18	29.33	28.69	28.96
119	Roadside		31.75	32.51	34.78	32.05	31.34
120	Roadside		**44.81**	**44.94**	**47.24**	**44.76**	**44.82**
121	Roadside	Y	**50.97**	**50.57**	**52.71**	**47.29**	**48.01**
122	Roadside		34.42	32.49	34.83	30.16	32.09
123	Roadside		**48.75**	**46.55**	**47.00**	**39.54**	**46.44**
⊗124	Roadside		**41.93**	36.50	**38.43**	**37.73**	**39.60**
⊗125	Roadside		**41.80**	36.20	**37.90**	**37.10**	**38**
⊗126	Roadside		**41.64**	**40.71**	**40.64**	36.91	34.91
⊗127	Roadside		**48.72**	**45.01**	**44.26**	34.70	34.1
⊗128	Roadside		**43.18**	**40.36**	**38.82**	**37.00**	**38.06**
⊗129	Roadside		34.74	36.50	32.56	32.94	**37.11**
⊗130	Roadside		**42.05**	**41.29**	**39.17**	36.30	32.02
131	Roadside		**45.86**	**44.33**	**44.79**	**44.75**	**42.02**
132	Roadside		34.97	33.81	27.11	29.66	32.29

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (μg/m³) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
133	Roadside		21.46	26.57	25.28	23.61	25.17
⊗134	Roadside		**45.67**	**44.54**	**42.65**	**44.25**	**42.10**
^135	Roadside		27.71	30.78	-	-	29.66
^136	Roadside		27.59	28.71	25.53	27.14	25.18
^137	Roadside		32.39	32.17	32.63	29.19	31.16
140	Roadside		33.92	33.43	29.12	31.41	29.06
143	Roadside		31.52	29.77	30.29	29.65	28.78
144	Roadside		27.80	27.71	27.05	24.60	26.78
145	Roadside		30.31	28.77	28.27	29.69	27.27
146	Roadside		33.13	29.10	32.28	30.27	27.89
147	Roadside		28.97	32.24	33.79	27.35	26.26
148	Roadside		29.82	31.46	32.05	29.48	28.76
149	Roadside		26.36	26.77	26.66	24.98	25.16
150	Roadside		28.45	28.45	27.63	27.85	28.46
151	Roadside		27.14	28.18	25.59	26.69	26.74
160	Roadside		34.73	32.80	31.97	30.26	27.39
180	Roadside		31.00	30.35	29.67	29.10	30.98
182	Roadside		27.58	28.15	28.71	27.04	28.48
183	Roadside		31.04	30.34	30.07	28.49	29.79
197	Roadside		35.24	32.92	34.22	29.69	33.54
198	Roadside		36.45	35.17	35.56	32.13	33.20
206	Roadside		**45.60**	**41.55**	**42.50**	**38.05**	**41.79**
207	Roadside		**41.17**	33.84	32.85	32.16	**37.74**
208	Roadside		**37.48**	36.56	35.06	34.28	**37.23**
209	Roadside		**39.40**	**41.00**	**40.72**	35.21	**39.21**
210	Roadside		34.47	33.58	32.69	29.54	33.33
211	Roadside		35.45	33.17	33.04	30.98	26.74
212	Roadside		27.18	25.63	23.93	24.06	29.00
213	Roadside		35.09	33.37	34.86	30.81	34.88
214	Roadside		25.39	26.77	25.35	22.78	23.67
215	Roadside		23.66	23.55	22.77	22.50	25.61
216	Roadside		26.07	26.38	23.80	21.41	24.50
238	Roadside		33.13	29.82	28.09	26.66	27.15
239	Roadside		31.18	30.10	30.20	27.61	28.86
240	Roadside		34.40	32.87	31.37	29.30	31.09
241	Roadside		33.21	31.60	30.31	28.76	30.83

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
242	Roadside		**44.28**	**41.47**	**40.94**	35.68	**43.29**
243	Roadside		**37.40**	35.86	35.75	33.98	**38.88**
244	Roadside		**43.78**	**40.14**	**44.02**	**42.71**	**43.19**
245	Roadside		**41.93**	**39.87**	**42.03**	**39.32**	**42.32**
247	Roadside		29.76	32.88	35.00	31.80	32.87
249	Roadside		34.74	31.91	34.95	30.54	31.55
251	Roadside		31.94	33.95	31.52	30.24	31.56
252	Roadside		30.52	29.36	29.69	27.79	28.58
256	Roadside		40.14	**37.41**	**38.21**	**37.18**	**37.86**
271	Roadside		30.44	28.24	31.59	27.44	29.71
272	Roadside		32.56	30.54	31.05	28.29	29.97
275	Roadside		25.20	24.50	22.60	22.20	22.5
276	Roadside		32.51	34.16	34.17	31.91	34.64
277	Roadside		**39.35**	34.23	36.72	34.17	34.73
278	Roadside		34.70	35.86	36.15	33.12	35.22
279	Roadside		**55.51**	**47.59**	**49.83**	**43.53**	**47.31**
280	Roadside		**40.80**	**39.60**	**41.10**	**37.70**	**38.7**
281	Roadside		36.70	36.50	33.40	34.50	34.8
282	Roadside		35.70	32.20	32.10	31.00	33.5
284	Roadside		32.62	32.49	32.14	29.51	30.51
285	Roadside		33.41	34.23	32.57	30.90	31.47
286	Roadside		34.27	31.77	34.35	30.40	32.30
287	Roadside		29.72	31.87	29.53	28.04	28.84
288	Roadside		32.86	32.29	31.48	29.69	30.19
289	Roadside		35.86	34.15	32.95	32.08	33.04
290	Roadside		27.88	29.08	26.97	26.19	27.24
291	Roadside		**45.22**	**43.73**	**39.73**	**38.54**	**41.05**
295	Roadside		29.33	29.80	30.70	28.50	31.7
296	Roadside		31.61	35.06	35.59	31.10	36.27
323	Roadside		-	32.16	33.62	30.33	34.30
324	Roadside		-	-	28.20	25.75	29.24
325	Roadside		-	-	-	22.34	21.72
326	Roadside		-	-	-	23.30	23.28
327	Roadside		-	-	-	22.79	22.21
328	Roadside		-	-	-	24.76	25.10
329	Roadside		-	-	-	26.94	28.21

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m³) - Adjusted for Bias [a] 2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
330	Roadside		-	-	-	30.57	29.49
331	Roadside		-	-	-	34.78	36.26
333	Roadside		-	-	-	33.20	36.5
334	Roadside		-	-	-	29.74	31.68
335	Roadside		-	-	-	28.23	29.6
336	Roadside		-	-	-	33.97	36.64
337	Roadside		-	-	-	35.90	**37.1**
338	Roadside		-	-	-	32.80	36.03
339	Roadside		-	-	-	**40.39**	**37.76**
340	Roadside		-	-	-	**46.67**	**49.03**
341	Roadside		-	-	-	36.50	40.3
342	Roadside		-	-	-	30.00	34.7
343	Roadside		-	-	-	34.58	35.15
344	Roadside		-	-	-	26.40	31.1
345	Roadside		-	-	-	29.50	30.2
346	Roadside		-	-	-	34.08	34.27
347	Roadside		-	-	-	31.77	36.32
348	Roadside		-	-	-	35.90	36.04
349	Roadside		-	-	-	33.39	35.65
350	Roadside		-	-	-	**38.06**	**39.52**
351	Roadside		-	-	-	27.05	27.85
352	Roadside		-	-	-	30.95	29.46
353	Roadside		-	-	-	29.10	25.8
354	Roadside		-	-	-	29.80	28
355	Roadside		-	-	-	27.90	27.8
356	Roadside		-	-	-	27.50	31.52
357	Roadside		-	-	-	28.80	27.6
358	Roadside		-	-	-	32.50	30.1
359	Roadside		-	-	-	33.70	33.4
360	Roadside		-	-	-	30.30	29.57
361	Roadside		-	-	-	35.47	29.90
362	Roadside		-	-	-	36.53	**42.23**
363	Roadside		-	-	-	35.28	35.42
364	Roadside		-	-	-	34.75	**39.49**
365	Roadside		-	-	-	30.40	31.85
366	Roadside		-	-	-	31.04	35.42

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2012 (Bias Adjustment Factor = 0.87)	2013 (Bias Adjustment Factor = 0.85)	2014 (Bias Adjustment Factor = 0.89)	2015 (Bias Adjustment Factor = 0.88)	2016 (Bias Adjustment Factor = 0.89)
367	Roadside		-	-	-	29.52	32.16
368	Roadside		-	-	-	25.80	28.1
369	Roadside		-	-	-	22.01	23.59
370	Roadside		-	-	-	20.01	25.20
371	Roadside		-	-	-	17.33	17.87
372	Roadside		-	-	-	27.73	29.33
373	Roadside		-	-	-	-	34.33
374	Roadside		-	-	-	-	25.5
375	Roadside		-	-	-	-	18.24
376	Roadside		-	-	-	-	30.40
377	Roadside		-	-	-	-	34.98
378	Roadside		-	-	-	-	18
379	Roadside		-	-	-	-	16.59
380	Roadside		-	-	-	-	20.52
381	Roadside		-	-	-	-	17.80
382	Roadside		-	-	-	-	23.48
383	Roadside		-	-	-	-	23.16
384	Roadside		-	-	-	-	25.02
385	Roadside		-	-	-	-	25.08
386	Roadside		-	-	-	-	26.7
387	Roadside		-	-	-	-	19.79
388	Roadside		-	-	-	-	18.67
389	Roadside		-	-	-	-	**46.12**
390	Roadside		-	-	-	-	**37.04**
391	Roadside		-	-	-	-	27.02
392	Roadside		-	-	-	-	8.21
393	Roadside		-	-	-	-	16.7
394	Roadside		-	-	-	-	16.79
395	Roadside		-	-	-	-	17.88
396	Roadside		-	-	-	-	21.00
408	Roadside		-	-	-	-	**40.4**

*** Site 56** is located on Ynysallan Road, Ynystawe to the frontage of a potential housing development site that would be 10-15m from the eastbound carriageways of the M4. Relevant exposure is given at present to the nearest existing dwelling within a separate development setback from the monitoring location.

**** Site 71** Copper Quarter 3 is on the frontage of an existing housing development site that will see dwellings fronting onto the access road to Morfa Retail Park and the Liberty Stadium. Relevant exposure is given at present to the nearest existing dwelling on the development site. The nearest potential dwelling within the development (setback from the monitoring location) will be within 10m of the monitoring location when construction is complete. These flats are due for completion during 2014/2015, thus site 71 has been corrected back by 10m

^Sites 135-137 are located at first floor level of properties in addition to exposure at 2.5 on the same dwelling to assess if concentrations change with height

⊗ City centre sites along busy roads – relevant exposure is given to either restaurants where there is a Café environment or to blocks of flats. Assessment where Café environment exists is for 1 hour NO_2 objective. Site 125 now corrected to relevant exposure to flats development above commercial premises.

*** **Site 295** High Street, Gorseinon is located on a lamppost outside a primary school playground. The intention here is worst case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area

^ See table 2.11 below for Correction of NO_2 for distance from road

The spreadsheet calculator has been setup to work from 0.1 to 50m only. As can be seen from table 2.11, the authority is aware of, and planning for future proposed domestic housing developments, by making measurements at the current nearest possible monitoring position to those developments. Unfortunately, an indication can at present only be gained to a distance of 50m from the measurement point due to the setup of the provided spreadsheet tool. Table 2.11 indicates two monitoring sites (site 56 and 71) that are utilised to provide an indicative annual mean to the **nearest existing/proposed dwelling** within the development sites. It could be argued that at present there is no relevant exposure at present in LAQM terms from these two monitoring locations but it is anticipated due to the developments underway that these receptor locations will be realised at some stage in the near future. Developments around site 71 continued apace during 2015 and receptor locations were present come the end of 2015 (some not yet occupied). Site 71 is therefore presented as corrected to the proposed nearest dwelling (10m) with site 56 being presented with a corrected annual mean as if it were 50m away.

The resulting calculated NO_2 annual mean at the receptor location due to fall off in concentration with distance from the road is given in bold for the year of consideration. The measured roadside concentration is given in brackets. Background 1k by 1k NO_2 concentrations (for 2016 based on Background maps base year of 2013 file name 409-no2-2016.csv) were downloaded from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013

and overlain on a GIS background map within Quantum GIS v2.4.0 (Chugiak). The background concentration required for the calculation was obtained from the nearest 1k grid square to the monitoring station. The final derived predicted annual mean concentration at the receptor location has been included within table 2.11 above.

Table 2.11 – Results of Distance Corrected NO_2 Diffusion Tubes (2016)

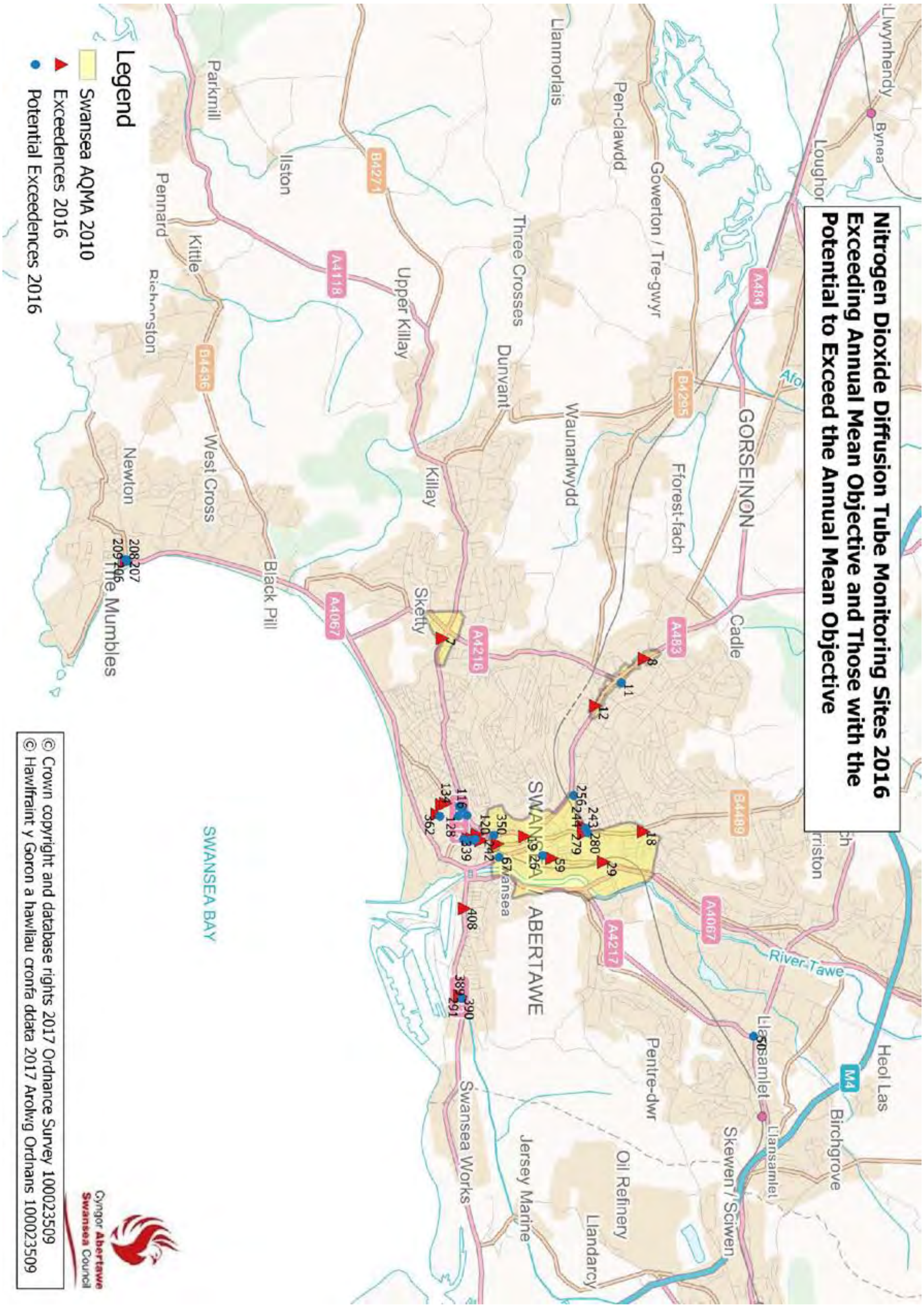
Site ID	Distance of Measurement Site from Kerb	Distance of Receptor from Kerb	NO_2 Background Map Concentration (2016 dataset) ug/m^3	Measured 2016 Annual Mean ug/m^3 UnCorrected for bias	Predicted Annual Mean at Receptor ug/m^3
*56	2	*166	15.08	37.95	20.7
58	4	8	13.48	38.67	33.8
63	2	6	10.72	25.97	22
64	1	5.5	10.72	44.41	32.8
67	2	5	15.71	46.36	**39.8**
69	2	4	15.71	38.62	34.9
70	2	7	14.31	28.21	24.1
**71	2	**10	14.31	33.14	26
92	1	3	10.72	29.77	25.6
125	1	3	15.71	44.28	38
127	0.5	4	15.71	44.78	34.1
275	1	3	14.88	24.62	22.5
280	1	2	14.88	42.62	**38.7**
281	1	3	14.88	40.50	34.8
282	1	3	14.88	38.76	33.5
295	1	1.5	10.08	33.59	31.7
333	0.5	4	15.71	48.53	36.5
337	1	3.5	15.71	44.27	**37.1**
341	1.5	3	15.71	44.68	**40.3**
342	1	3.5	15.71	41.05	34.7
344	0.5	3	15.71	38.25	31.1
345	0.5	3	15.71	36.92	30.2
353	0.5	4.5	15.71	32.29	25.8
354	1	4	15.71	32.81	28
355	0.5	3.5	15.71	34.21	27.8
357	0.5	5	15.71	35.69	27.6
358	1	6.5	15.71	38.81	30.1
359	0.5	4	15.71	43.71	33.4
368	0.5	5	15.71	36.61	28.1
374	0.5	2	8.93	30.94	25.5
378	1	3.5	8.93	21.04	18
386	1.5	3.5	15.64	29.21	26.7
393	1.5	6.5	10.71	19.61	16.7
408	1.5	2	13.83	42.17	**40.4**

Table 2.12 – Results of Annualised NO_2 Diffusion Tubes (2016)

Site ID	% Data capture	Raw mean ug/m^3	Annualised mean ug/m^3	Bias Corrected ug/m^3
83	66.67	30.33	31.54	28.07
123	66.67	51.16	52.18	**46.44**
136	50	33.28	28.28	25.18
160	66.7	32.40	30.78	27.39
211	66.67	36.20	30.04	26.74
346	66.67	39.29	38.50	34.27
360	58.33	40.03	33.22	29.57
361	58.33	40.48	33.60	29.90
369	66.67	21.91	26.51	23.59
370	66.7	23.41	28.32	25.20
372	66.67	27.24	32.96	29.33
384	66.67	26.77	28.11	25.02
385	50	28.18	28.18	25.08
386	50	32.82	32.82	29.21
387	50	22.24	22.24	19.79
388	50	20.98	20.98	18.67
389	50	51.82	51.82	**46.12**
390	50	41.62	41.62	**37.04**
391	50	30.36	30.36	27.02
392	50	9.22	9.22	8.21
393	25	32.4	22.03	19.61
394	25	27.75	18.87	16.79
395	25	29.55	20.09	17.88
396	25	34.7	23.60	21

A map of those sites failing the annual mean objective and those with the potential to exceed the annual mean objective from the 2016 passive diffusion tube data is given below as Figure 2.2.22.

Figure 2.2.22 – Exceedence and Potential Exceedence Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites



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Sites 118,120,124,125,126,127,128,129, and 134 were sited with the main intention of assessing concentrations against the NO_2 1-hour objective within the city centre. Swansea city centre has seen significant change in the road network to accommodate the Metro Service. This service has now terminated but the road infrastructure established for the service remains for present. Due to the aspirations to rejuvenate the city centre it is highly likely that the road infrastructure within the city centre will be significantly altered during the coming years. With the intention of the authority to increase the number of dwellings within the city centre to aid the regeneration of the shopping centre, additional monitoring locations continue to be established to provide the evidence required to feed into the planning process for this initiative. This additional monitoring is now reflective of the results obtained during 2016 which shows numerous failing and sites with the potential to exceed the NO_2 annual mean within the city centre area.

It is thought reasonable to assess existing exposure to the 1 hour objective to the general population within the city centre area especially where this exposure can be related to existing external café area type environments. This process will provide valuable information for the limited number of dwellings that already exist within the city centre. These café environments are not set back at a distance from the kerb/road where the measurement has been made but are on the same road, at the same distance from the kerb as the measurement site, albeit at a distance either right or left from the monitoring point. Due to some siting issues, measurements were not always directly possible at the café environment.

From the advice on using passive diffusion tube annual mean results[19] to assess compliance with the 1 hour objective for NO_2 it is clear from the results within table 2.10 above, that it is unlikely that the 1 hour objective has been exceeded at any site during 2016 as all bias corrected means are below 60ug/m^3. However, certain sites assessed as part of this process showed an exceedance of the annual mean objective. This information will be relevant to inform the preliminary discussions and task groups that are meeting to produce design briefs for interested developers; further work is ongoing regarding a detailed assessment within the city centre as identified by the auditor from the 2016 Progress Report.

[19] http://laqm.defra.gov.uk/documents/NO2relationship_report.pdf

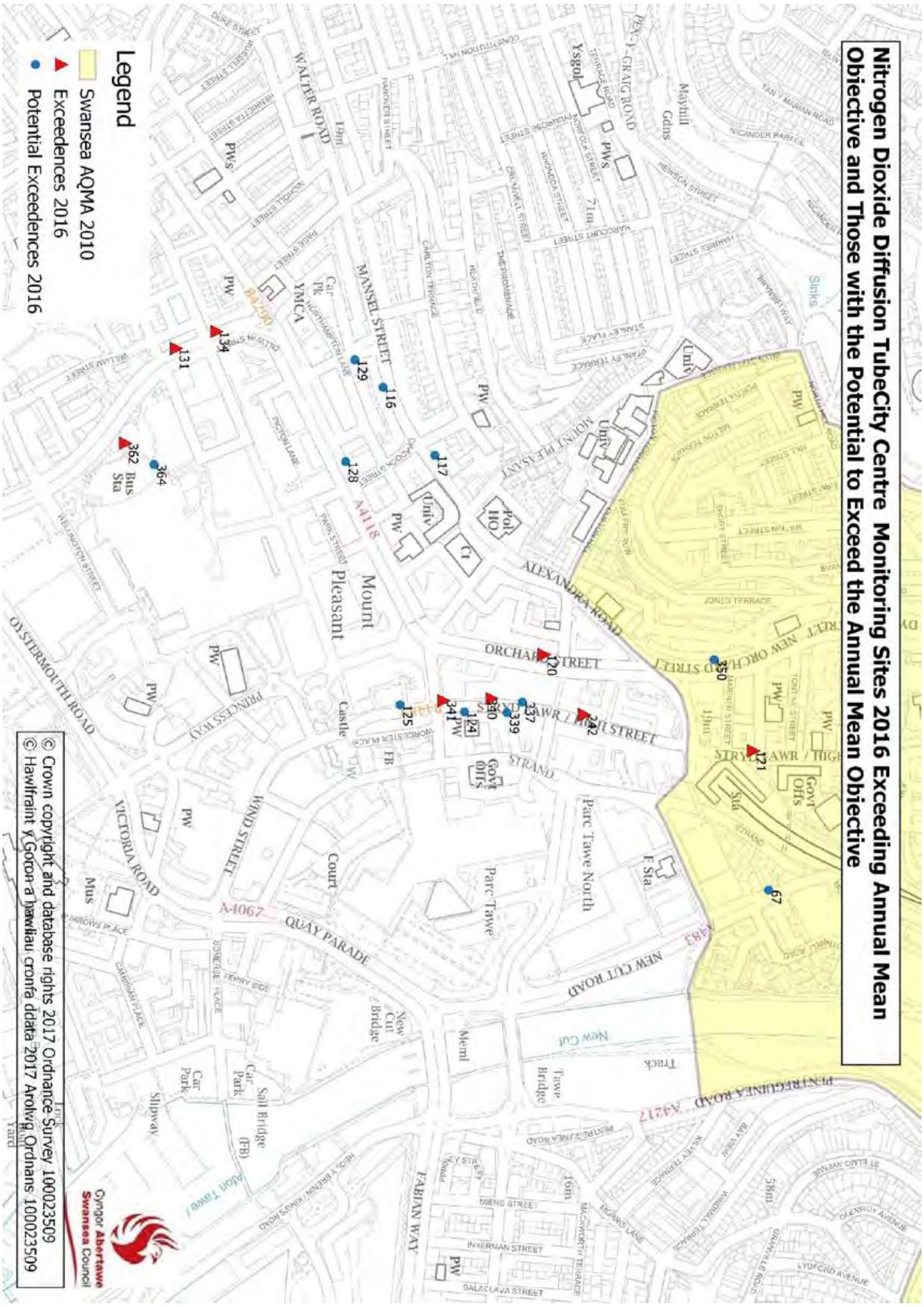

Figure 2.2.23

Sites 131 and 134 are located on the facades of business premises primarily to assess for the 1 hour exposure objective concentration; both have returned concentrations below 60ug/m^3 and so the 1hour objective concentration is deemed to not have been exceeded. We have since learned that there is now accomodation to the first floor of site 134 and so a diffusion tube has been sited at the first floor level since January 2017.

Site 362 and 364 are both located along the pedestrian access for the bus station and have both returned annual mean concentrations below 60ug/m^3 and so the 1hour objective concentration is deemed to not have been exceeded.

Figure 2.2.24

Sites 123 and 242 are both located on the façade of a ground floor commercial and first floor residential block on High Street in the city centre; site 123 is located approx 2.5m high and site 242 is located at approx 4m high to represent the first floor receptor. Site 123 has returned an annual mean of 46.44ug/m^3 which is below the 1 hour objective level however, Site 242 has returned an annual mean concentration of 43.29ug/m^3. There is an Automatic Traffic Counter (ATC 57) located approximately

80m to the south of the monitoring location and reports an AADT of 8,400 in 2016; a 10.06% increase from 2015 with the percentage of HDV traffic flow being 11.2%; this route is a well used link for the bus network serving the Railway Station and the heart of the City. Whilst we are aware of ongoing construction work and road works along this area of High Street, further invetigation work will be carried out to look at the increase in concentration at these sites.

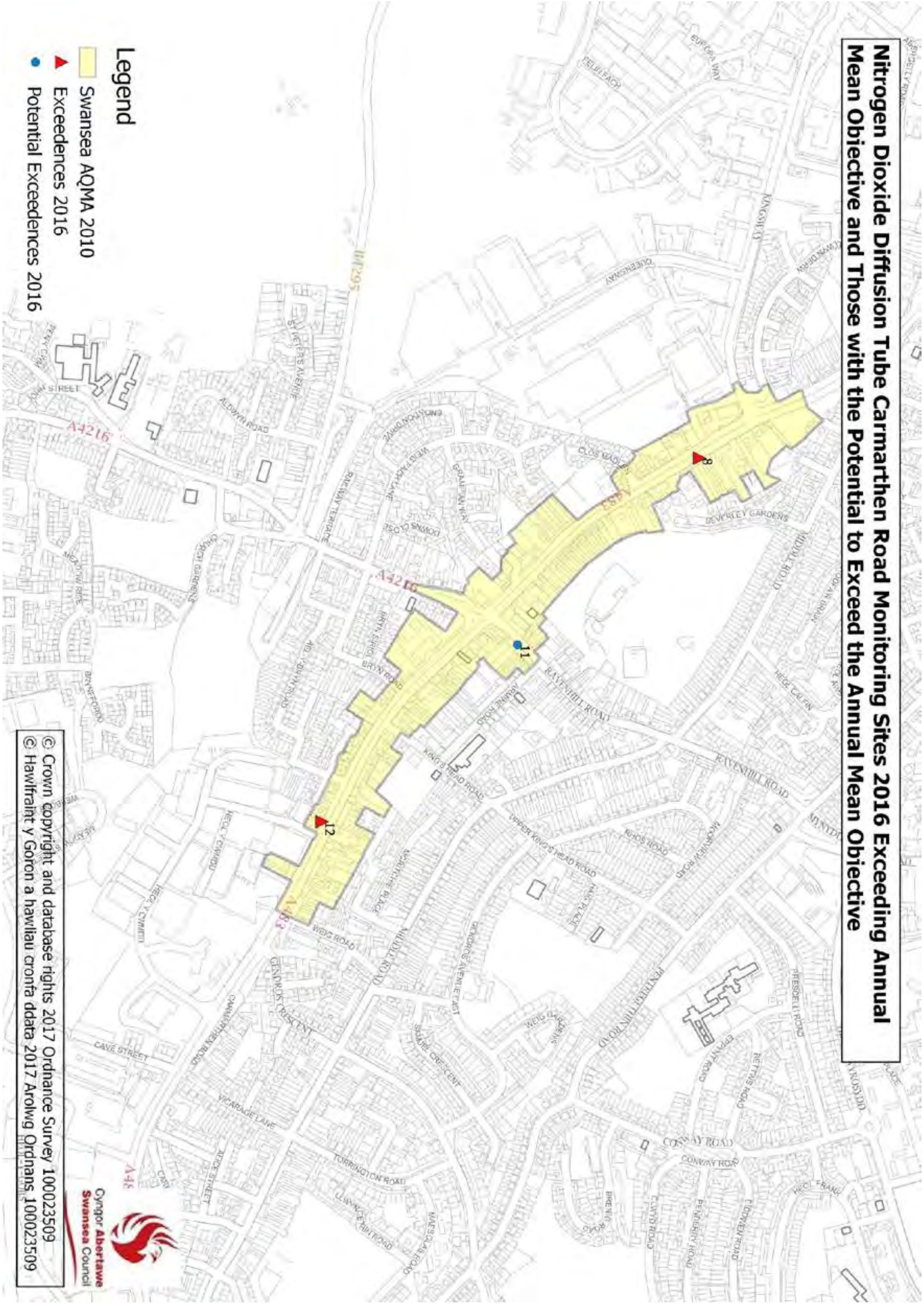

Figure 2.2.25

Site 8 is sited inbound on Carmarthen Road (A483) and site 12 is sited outbound on Carmarthen Road (A483); both are within the Swansea Air Quality Management Area 2010. In-line with sites across Swansea, both sites have returned elevated annual mean concentrations for 2016. Site 8 is located on the façade of a resdiential property on an incline as the traffic acclerates way from the traffic light controlled junction to the immediate North West. Site 12 is located at the top of an incline on the façade of a residential property again as traffic accelerates away from a traffic light controlled junction to the South East; site 12 had shown a reduction in concentration below the annual mean objective in 2015 but both areas will be subject to further investigation.

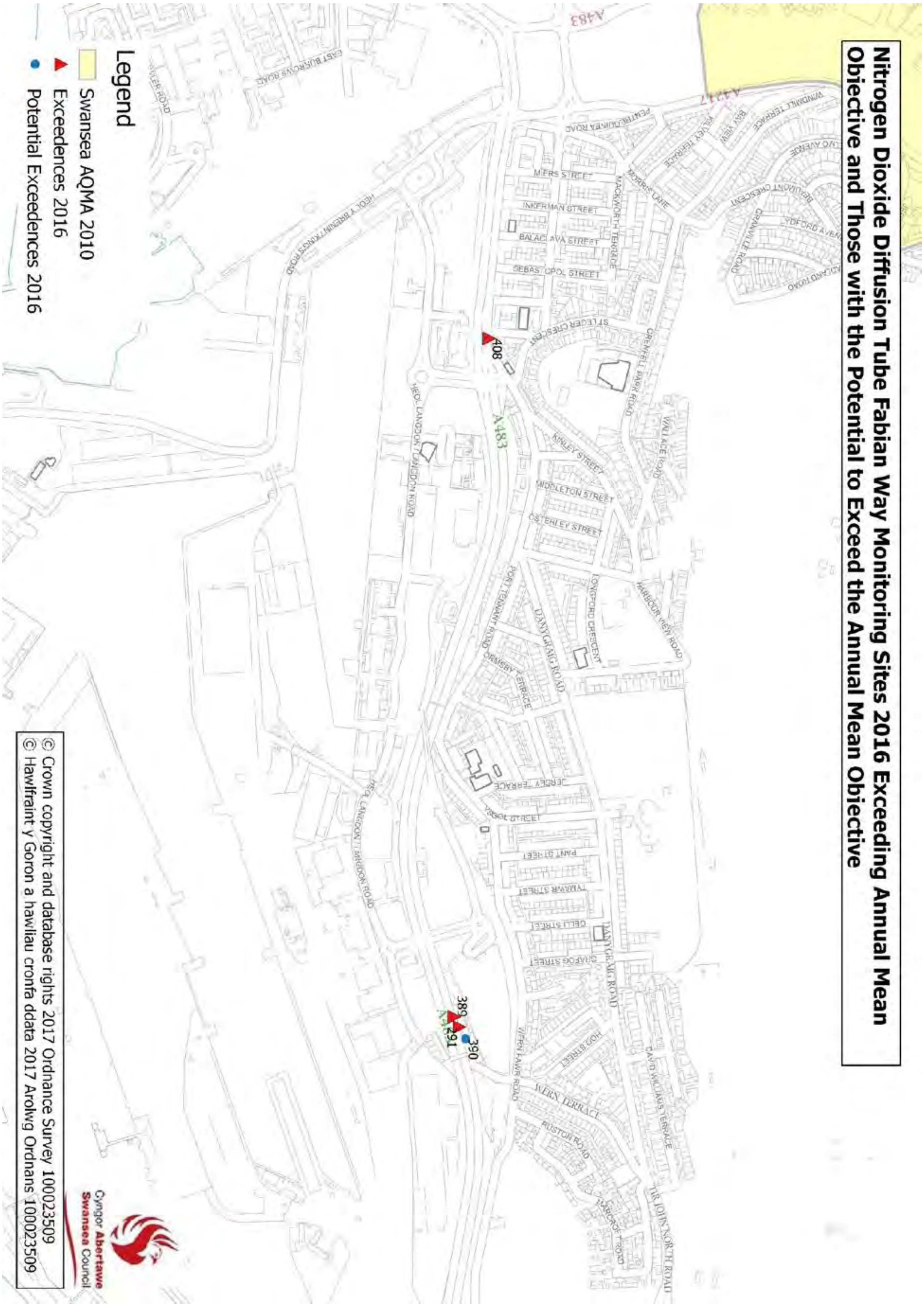
Nitrogen Dioxide Diffusion Tube Fabian Way Monitoring Sites 2016 Exceeding Annual Mean Objective and Those with the Potential to Exceed the Annual Mean Objective
Legend
Swansea AQMA 2010
Exceedences 2016
Potential Exceedences 2016
408
389
390
391
A483
© Crown copyright and database rights 2017 Ordnance Survey 100023509
© Hawlfraint y Goron a hawliau cronfa ddata 2017 Arolwg Ordnans 100023509
Cyngor Abertawe
Swansea Council

Figure 2.2.26

Site 408 was created in 2015 due to the removal of the diffusion tube at site 38; the site was relocated to lamppost outside the first property in the terrace (previously not an occupied premises). This site is now closer to the highway, shown in the figure 2.2.26 above; the premises are adjacent to the traffic light controlled juntion of Fabian Way and Port Tennant Road. The site has reported an annual mean of 40.4µgm^{-3} for 2016 with an AADT 34,776; further investigation will be carried out regarding concentrations at this location.

Site 408:

Figure 2.2.27

Site 291 and 389 are located on the outbound A483 towards junction 42 of the M4, front facade of a terraced property that is within 2 and 4 meters of the A483 and close to a bus stop and is shown below within photo **. Site 291 was created in 2011 and has returned exceedences over the annual mean objective up to 2013. Data from 2014 indicated marginal compliance with a bias corrected annual mean of 39.73ug/m^3 and data from 2015 also indicates marginal compliance with an annual bias corrected mean of 38.54ug/m^3. However, in-line with other sites across Swansea, the concentration returned for 2016 has shown an increase to 41.05ug/m^3. Site 389 was created in July 2016 and has collected six monthly means for 2016, the annualised mean for site 389 has returned a concentration of 46.12ug/m^3; further investigation at this location.

Figure 2.2.28

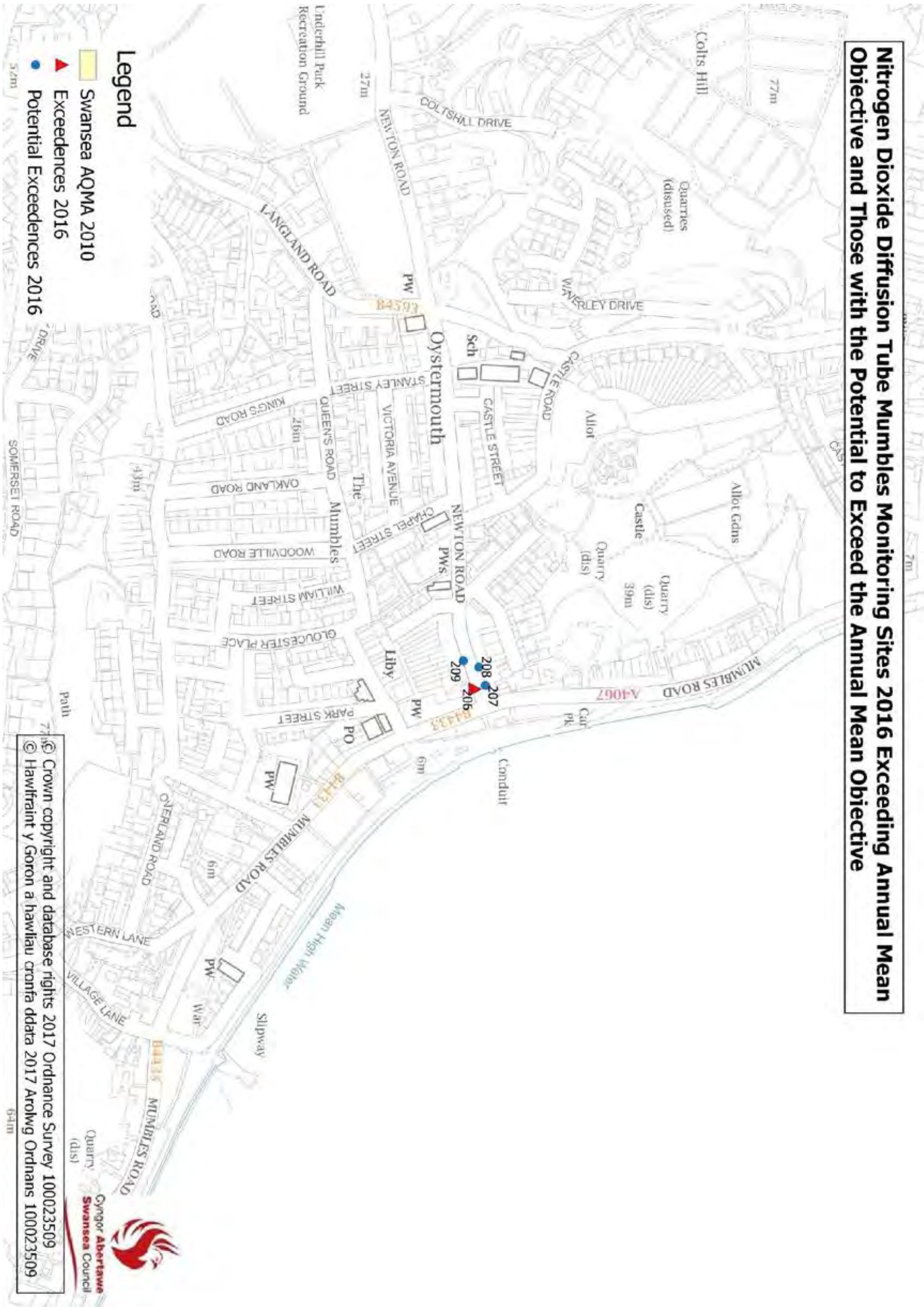

Figure 2.2.29

As discussed in previous reports, the situation within Newton Road, Mumbles had continued to improve. However there is now one site exhibiting an exceedence of the annual mean objective, site 206. This site has returned an annual mean of 41.79µgm^{-3} which is a slight increase in concentration; site 206 is approx. 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 be met; however, there has been some major redevelopment on the sea front (Oyster Wharf) that has taken approximately 18months and has involved the queueing of traffic back towards this location (Figure below). This work has now completed and it is envisaged that the ongoing improvements will continue.

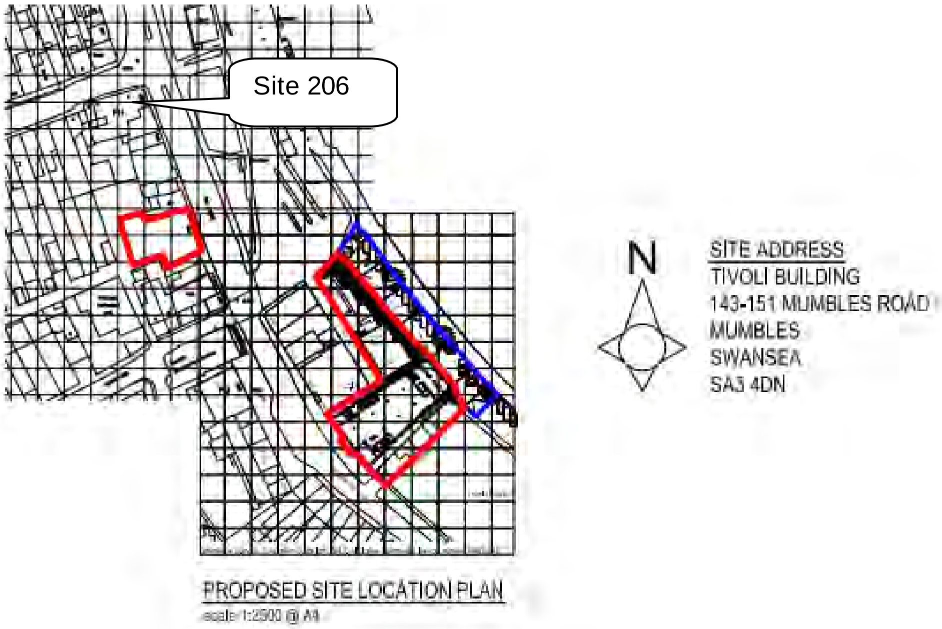

Figure 2.2.30

Figure 2.2.31

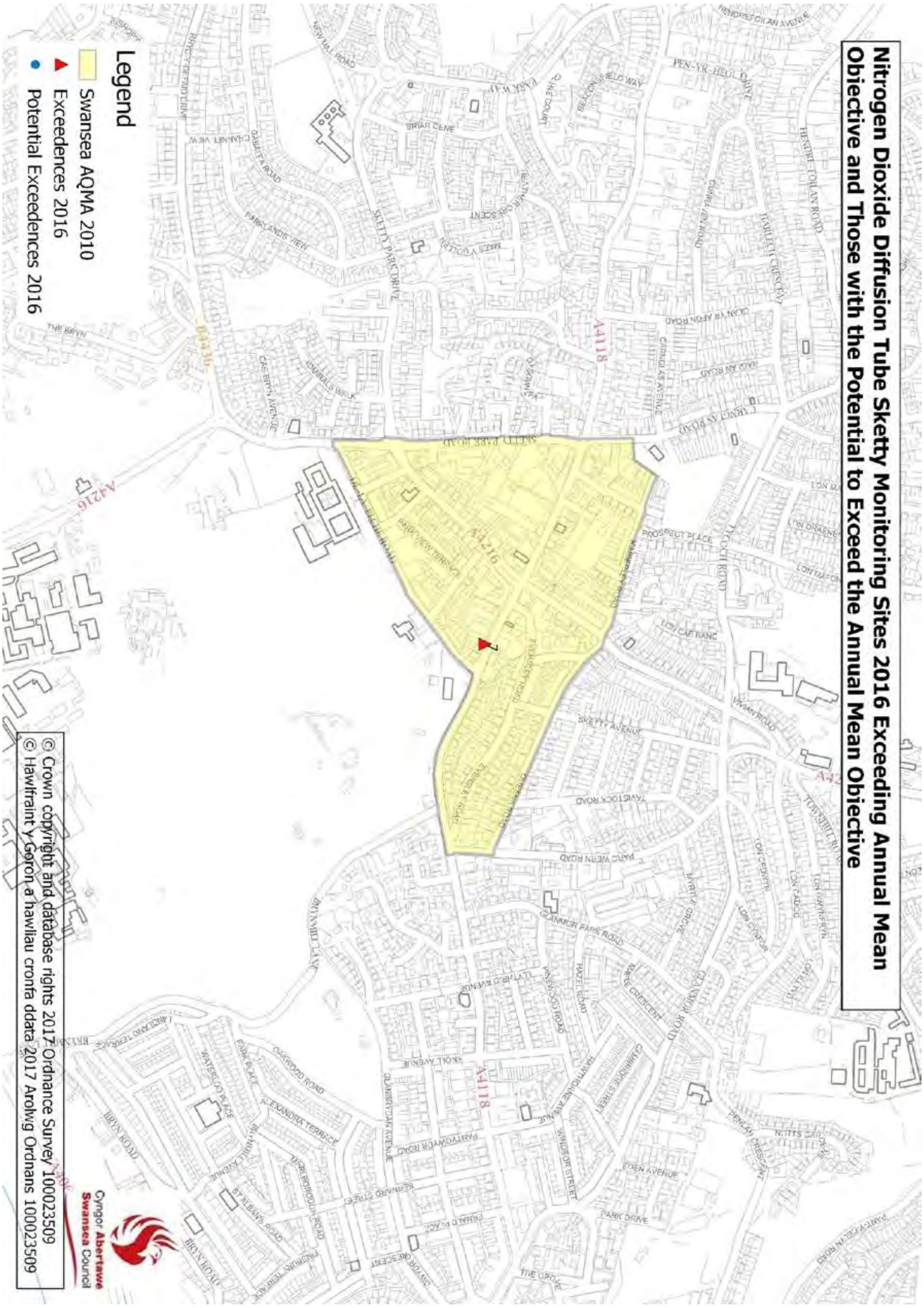

Figure 2.2.32

Site 7 is located on the façade of a residntial property on Gower Road; the site is within the Swansea Air Quality Management Area 2010. The site has shown an overall downward trend in concentration over the last few years however, in-line with other site across Swansea, an elevation in concentration has been returned in 2016: 45.84ug/m^3. This are will be further investigated as part of the review of the Air Quality Action Plan by years end.

2.2.2 Particulate Matter (PM_{10})

Thermo PM_{10} FDMS system were installed at all 3 sites (Swansea AURN, Morfa and Morriston Groundhogs), during part of 2011 providing equivalency with the EU reference gravimetric method[20]. However, significant issues arose with the operation of the FDMS units at the Swansea AURN. Despite numerous, costly repairs, data quality and thus data capture were continually being questioned by Bureau Veritas. Following another unsuccessful repair of both the PM_{10} and $PM_{2.5}$ FDMS units at the Swansea AURN they were removed completely from site on the 16th November 2011 and replaced with Met One BAM 1020 PM_{10} and $PM_{2.5}$ units on the 28th November 2011. Data capture since the replacement has increased significantly with all particulate monitoring at the AURN site.

However due to budgetary concerns the FDMS unit remained operational at the Morriston Groundhog site despite ongoing data quality concerns and data capture concerns. However, the situation became untenable during 2014/2015 with the vast majority of data being rejected due to these data quality concerns. The decision was therefore made to remove the FDMS system at the Morriston Groundhog during late December 2015 and to replace it with a MetOne Bam1020 PM2.5 (SmartBAM).This has resulted in virtually no valid PM_{10} data for the whole of 2015 from the Morriston Groundhog. Therefore no PM10 data for the Morriston Groundhog is reported here.

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 the application of a 1.211 offset. 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

[21] DEFRA and devolved administrations report UK Equivalence Program for Monitoring of Particulate Matter section 5.5.2 dated 5th June 2006 at http://www.airquality.co.uk/archive/reports/cat05/0606130952_UKPMEquivalence.pdf

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 2015 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.[21]

The datasets collected from the FDMS / Met One BAM PM_{10} systems are not directly comparable to the historical R&P PM_{10}TEOM datasets even given that the use of the advised interim default correction factor (1.3) was advised to estimate the EU reference gravimetric method. This correction factor has been called into dispute by various studies at diverse locations throughout the UK each deriving differing correction factors. These TEOM PM_{10} data pre 2006 have last been reported within the authorities Progress Report during May 2008. The date that the PM_{10} FDMS systems were installed / removed from the Swansea AURN site are given below within table 2.12 for information. Similarly, the date of provision of the BAM1020 units at the Swansea AURN and Morriston Groundhog sites are provided for information and clarity on the instrument composition of this dataset

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 2013-2016 are now reported here. It is important to again highlight, that the MetOne EBam has not demonstrated equivalency with the EU reference gravimetric method. However, as

[21] *LAQM.TG(16) Paragraph 7.160 page 7-47*

the intention is only to provide an ongoing screening assessment, their use is judged to be appropriate.

The 90th percentile's of the daily means of measurements made during 2011-2016 are presented in bold within brackets in table 2.12 where appropriate, as the data capture rates fall below the required 90%[22] 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%[23]. This new approach has now been adopted from 2016 but as the data capture rates are all above 85%, the 90.4% percentile has not been presented / calculated for 2016.**

[22] LAQM TG(09) Annexe A1 – A1.157 page A1-34
[23] LAQM.TG(16) General Considerations paragraph 7.163 page 7-48

Table 2.12 – Results of Automatic Monitoring for PM_{10}: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m³)				
					2012* [c]	2013* [c]	2014* [c]	2015* [c]	2016 [c]
CM1	Swansea AURN	Y	96.2	Y	17.79	19.03	20.29	20.20	19.14
CM2	Morriston Groundhog	N	-		13.86	15.30	13.18	-	-
CM6	Fforestfach Cross	Y	97.38	N	-	18.03	19.02	16.25	12.91
CM7	Uplands Crescent	N	97.86	N	-	18.26	17.18	14.76	13.2
CM8	Sketty Cross	Y	98.84	N	-	19.74	18.28	18.72	15.28
CM9	Westway Quadrant Bus Station	N	95.42	N	-	18.91	17.27	16.62	14.4
CM10	SA1 Junction Port Tennant	N	97.88	N	-	17.65	14.49	11.98	11.93

In bold, exceedence of the PM_{10} annual mean AQS objective of 40µg/m³

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" as in Boxes 7.9 and 7.10 of LAQM.TG16, if valid data capture is less than 75%

* Annual mean concentrations for previous years are optional

Table 2.13 – Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m³				
					2012* [c]	2013* [c]	2014* [c]	2015* [c]	2016 [c]
CM1	Swansea AURN	**Y**	96.2	Y	4	2	2	2	0
CM2	Morriston Groundhog	**N**	-	Y	8 (30.3)	0	0	1 (19.7)	-
CM6	Fforestfach Cross	**Y**	97.38	N	-	2	5 (27.9)	1	0
CM7	Uplands Crescent	**N**	97.86	N	-	2 (28.5)	1 (25.2)	1	0
CM8	Sketty Cross	**Y**	98.84	N	-	4 (34.0)	3	1	1
CM9	Westway Quadrant Bus Station	**N**	95.42	N	-	4	4	2	0
CM10	SA1 Junction Port Tennant	**N**	97.88	N	-	4	2	0	1

In bold, exceedence of the PM_{10} daily mean AQS objective (50µg/m³ – not to be exceeded more than 35 times per year)

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] if data capture for full calendar year is less than 85%, include the 90.4th percentile of 24-hour means in brackets

* Number of exceedences for previous years is optional

2.2.3 Sulphur Dioxide (SO_2)

SO_2 is now only monitored at one location within Swansea - the St.Thomas DOAS (see sec 2.1.7 above). 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[24]. 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[25]

The data capture rates are presented within table 2.14 and, where applicable, the percentile value corresponding to the objective exceedance value is given should the data capture rate fall below 85%[26]. Under LAQM.TG(16) data capture requirement was 85%

Figures 2.2.33 - 2.2.35 are presented below, representing time series measurements made during 2015 with the accompanying Breuer figure 2.2.36 providing an insight into the more likely source direction.

Table 2.14 – Results of Automatic Monitoring for SO_2: Comparison with Objectives

Site ID	Site Type	Within AQMA?	Valid Data Capture 2016 % [b]	Number of: [c]		
				15-minute Means > 266µg/m³	1-hour Means > 350µg/m³	24-hour Means > 125µg/m³
CM5	Roadside	N	91.29	0	0	0

[24] LAQM.TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62
[25] LAQM.TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62
[26] LAQM TG(16) SO2 monitoring – paragraph 7.204 pages 7-61 – 7-62

Looking at the data capture rates for 2016 within table 2.14 above, it could mistakenly be taken that there were operational issues with the equipment at the site. However, this impression would be incorrect. The reason for the quoted data capture rates is due to the QA/QC formulae used (see section 2.1 above). The SO_2 concentrations being measured during certain periods were very close to zero and therefore the detection limit and thus the measurement period has a standard deviation greater than twice the measured SO_2 concentration for that measurement period. Due to the standard deviation being greater than twice the measured concentration the period is rejected within the QA/QC rules due to the inherent uncertainty of the measurement.

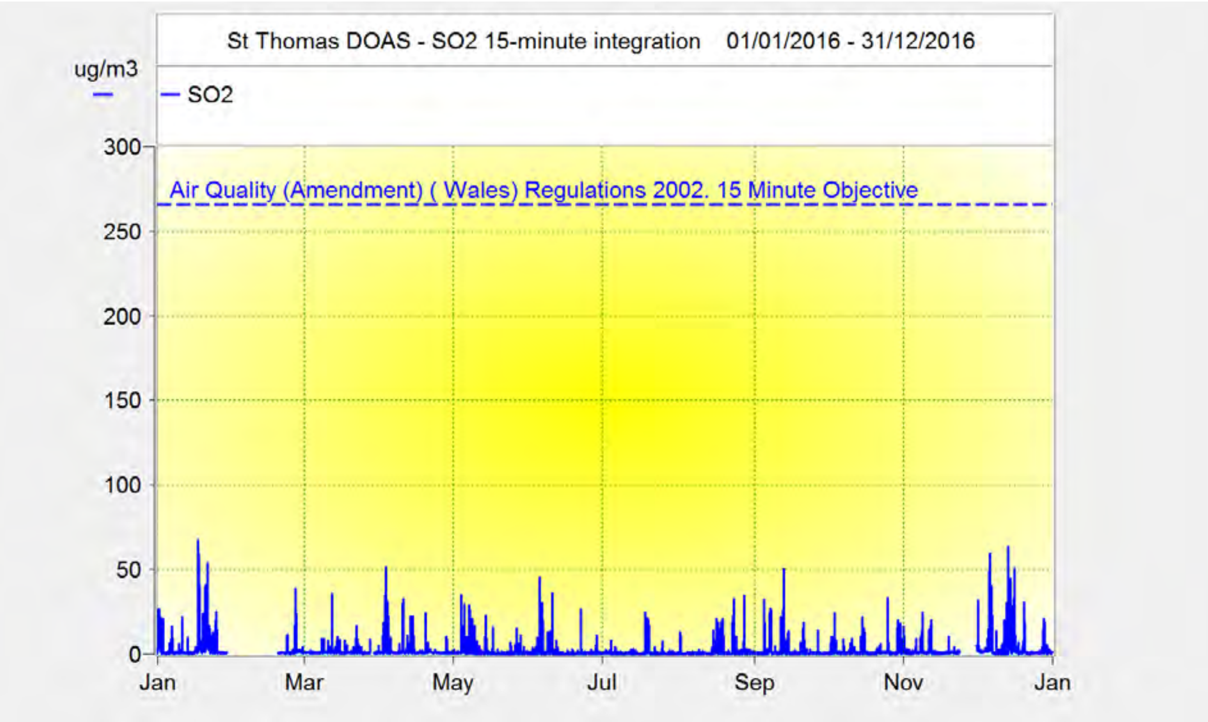

Figure2.2.33 – 15-minute SO_2 means – St Thomas DOAS 2016

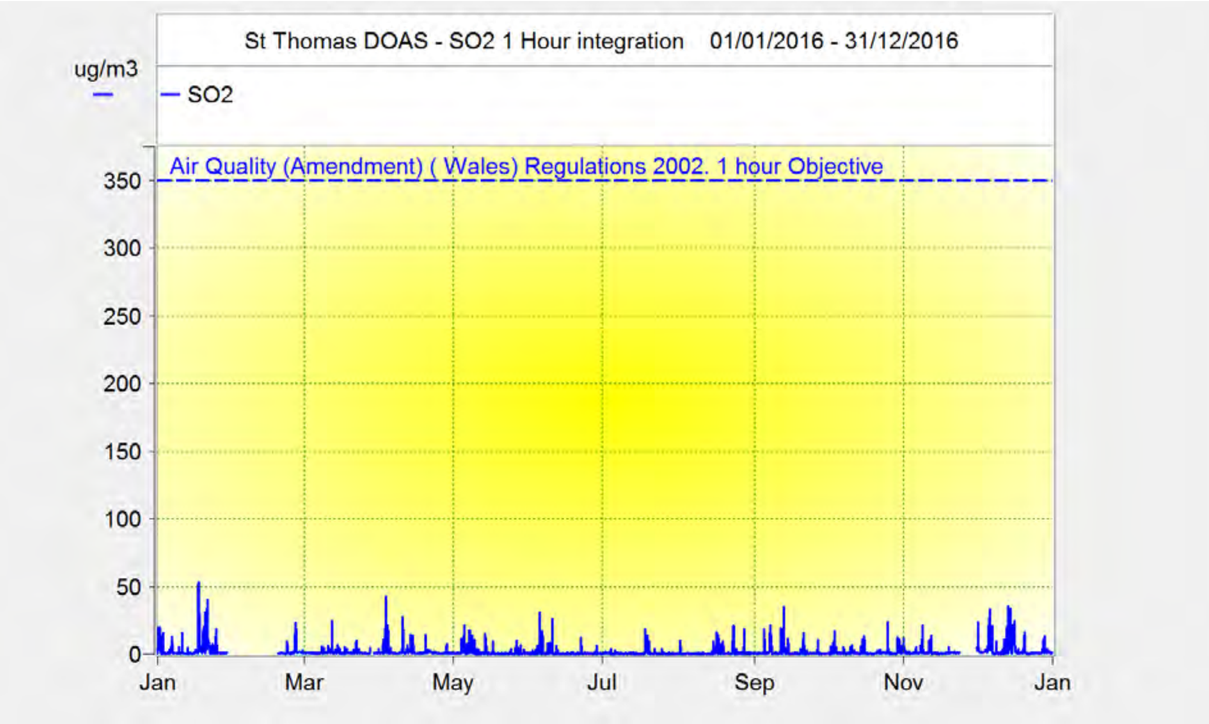

Figure2.2.34 – 1-Hour SO_2 means – St Thomas DOAS 2016

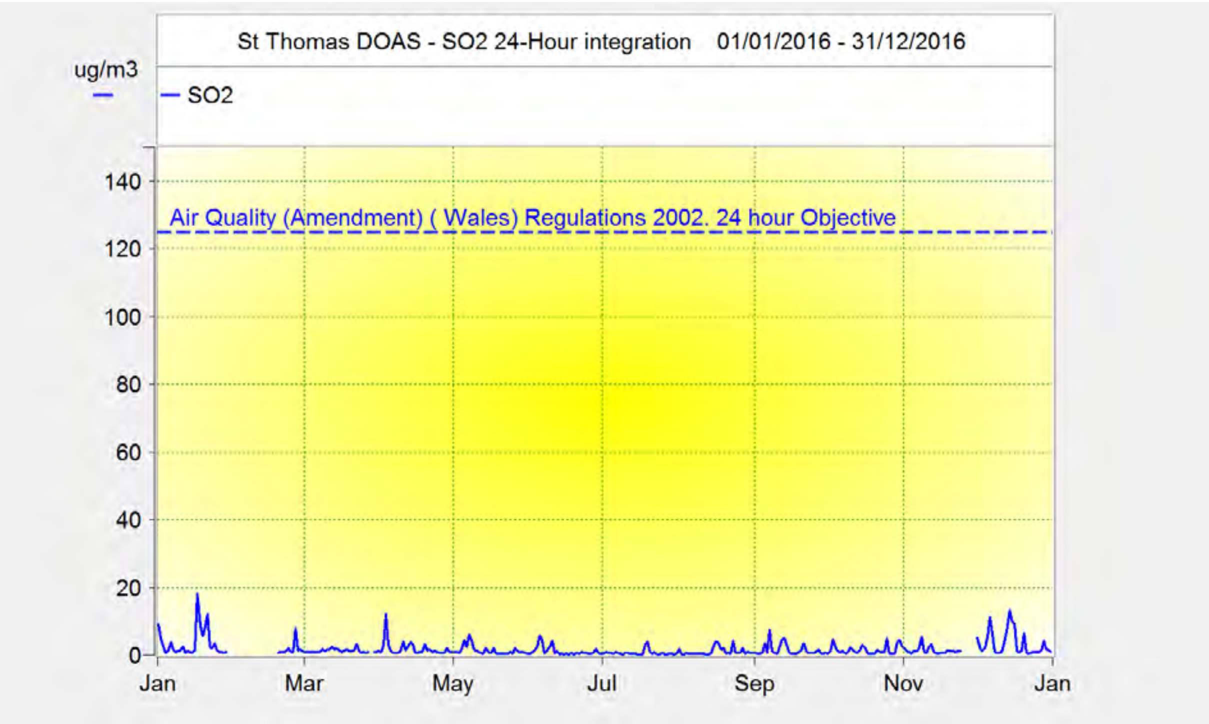

Figure2.2.35 – 24-Hour SO_2 means – St Thomas DOAS 2016

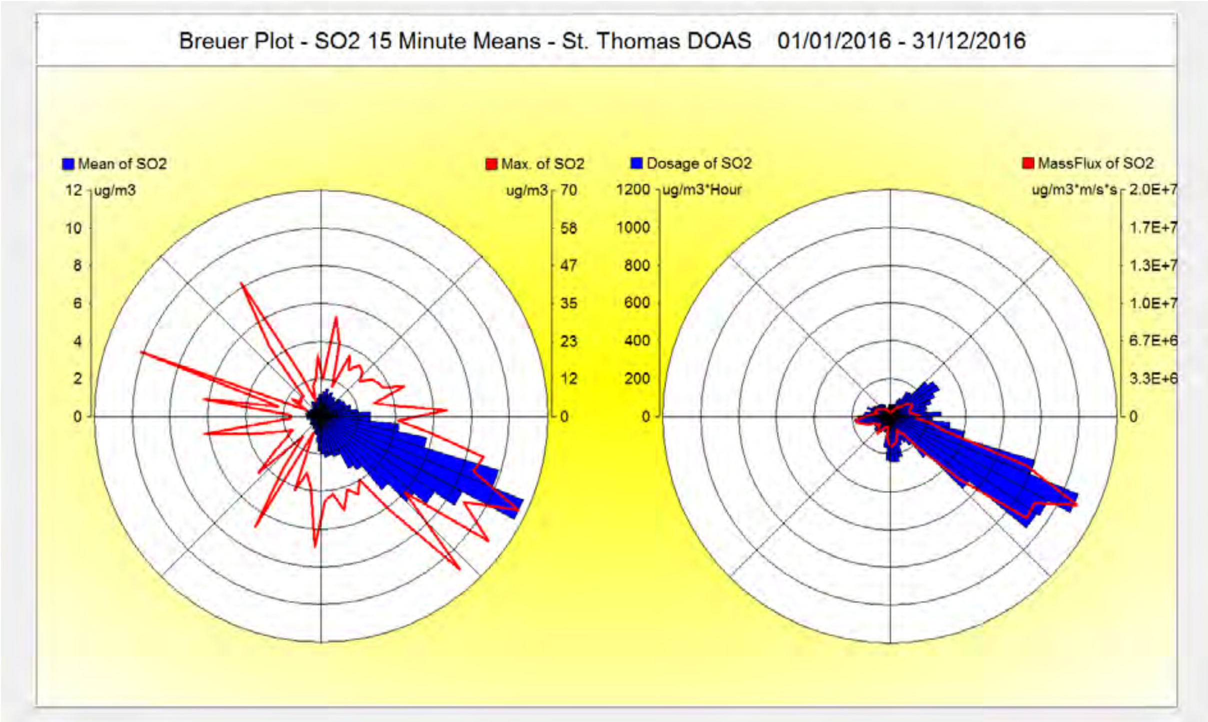

Figure2.2.36 – St.Thomas DOAS 15-minute SO_2 concentrations 2016

From figure 2.2.36 it is evident that whilst low SO_2 concentrations are seen in Swansea, it is clear that the south-easterly direction still dominates (as has been seen during previous years) as the source of the measured concentrations.

Quay Parade bridges/A483 and the city centre are to the west of the ST Thomas DOAS. The St Thomas DOAS station is approximately half a mile from the docks area, (in a more south-south easterly direction) so it would seem likely that the docks activities contribute to the frequency and maximum concentrations seen from that direction. Whilst there may be more local influences, it should be noted that there is heavy industry located to the south east of Swansea Bay in the form of the Tata Steelworks at Port Talbot. This has been the traditional dominant source of SO_2 seen within Swansea since measurement of SO_2 commenced during the late 1970's. From 2016 data this remains the case and is reinforced by examination of the dosage and Mass Flux plots within figure 2.2.36. Dosage is taken to be the accumulated time multiplied with the average value of SO_2. This is useful for calculations of likely exposure at these locations. Mass Flux is also indicated and is taken to be: Flux - the wind speed multiplied with the operand distributed over the wind direction. All data that has valid integrated data for all three positions are included in this calculation. (Note: The average distributed wind speed and the average distributed parameter

[SO_2] are not used to calculate the result). The result is presented in the multiplied units of the wind speed and the parameter (SO_2). Mass flux is the same as flux, but the result is multiplied with the accumulated integration time. This gives the mass transport in different directions.

2.2.4 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 2011-2016 are provided below within table 2.15.

Site ID	Location	Within AQMA	Data Capt. 2011 %	Data Capt. 2012 %	Data Capt. 2013 %	Data Capt. 2014 %	Data Capt. 2015 %	Data Capt. 2016 %	Annual mean concentrations (µg/m^3)					
									2011	2012	2013	2014	2015	2016
5	Hafod DOAS	Y	75%	74%	73%	70%	73%	63%	3.10	2.66	2.23	2.01	2.33	2.63
6	St.Thomas DOAS	N	81%	76%	73%	74%	70%	93%	3.09	2.55	2.30	2.56	2.20	2.75

Table 2.15 Benzene annual means 2011-2016

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 2016 has once again produced data capture rates below 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[27]. However, this 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.

Graphs 16 and 17 below illustrate some high hourly “spikes” of benzene throughout the year for short periods of time at both sites, and importantly around the same time, indicating a likelihood of the same source. However, these spikes during 2015 are much reduced from hourly spikes seen in recent years. Figure 2.2.38 and figure 2.2.40 provide additional information as to the source direction of measured concentrations.

[27] LAQM.TG(16) Benzene and 1,3 Butadiene Monitoring paragraph 7.215 page 7-65 to 7-66

Both sites show an overall reduction trend over the last 5 years. Concentrations continue to remain below the annual mean objective level of 5µg/m^3. An influence on the annual mean concentrations during 2011 (and numerous exceptionally high hourly spikes) is thought to have been the tyre flock fire at a disused factory unit at Fforestfach which lasted for several weeks. No such incidents occurred during 2016 that could account for the numerous hourly spikes.

Figure2.2.37– Hafod DOAS Benzene 1-hour means 2016

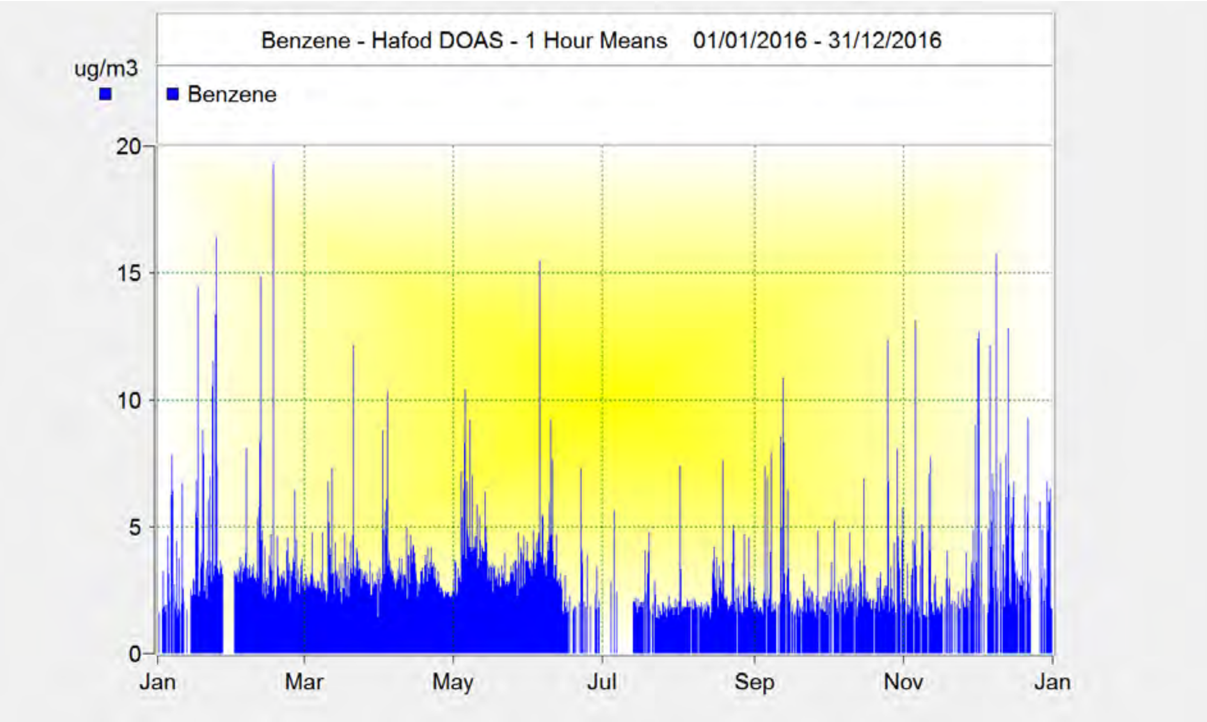

Figure 2.2.38 below is fairly conclusive as to the dominant prevailing source of benzene being to the south-east, with the concentrations also being seen from a more southerly/south-westerly origin. This would suggest that these sources are the Tata Steelworks at Port Talbot and Swansea docks respectively.

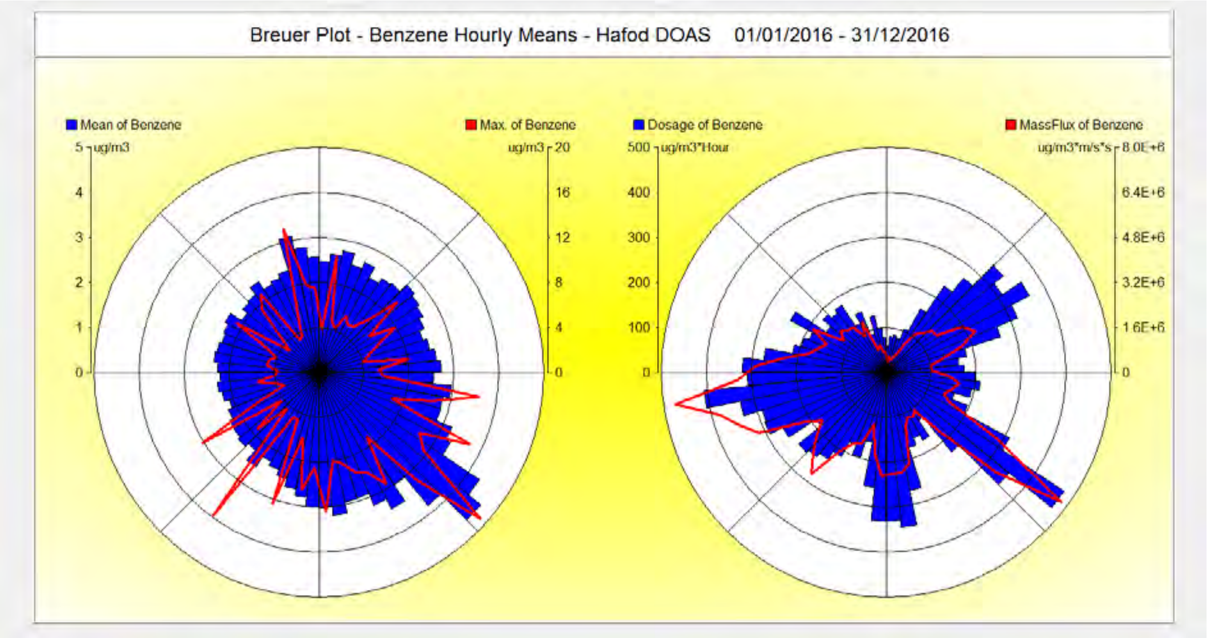

Figure 2.2.38 Hafod DOAS Benzene hourly concentrations 2016

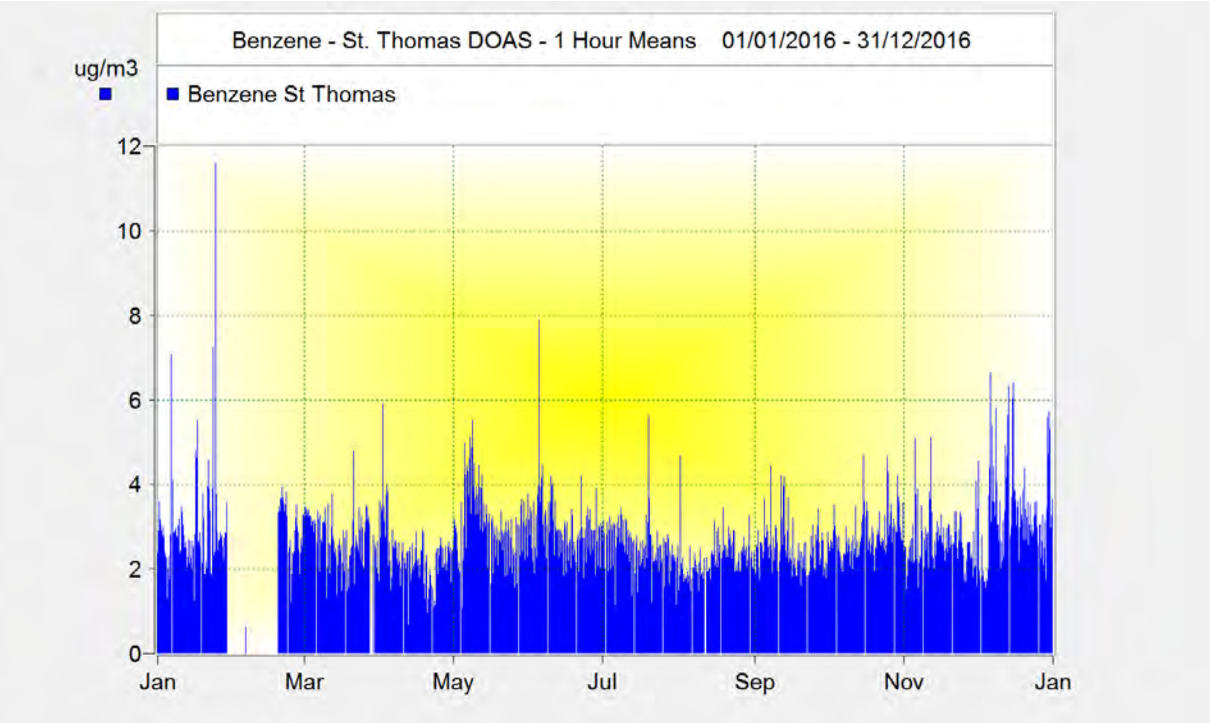

Figure 2.2.39 – St.Thomas DOAS Benzene 1-hour means 2016

Figure 2.2.40 below from St Thomas indicates and confirms the primary source of mean and maximum hourly concentrations are likely to be from the source(s) mentioned above i.e. the heavy industry located to the south-east of Swansea Bay at Tata Steelworks and Swansea docks to the south of the monitoring site.

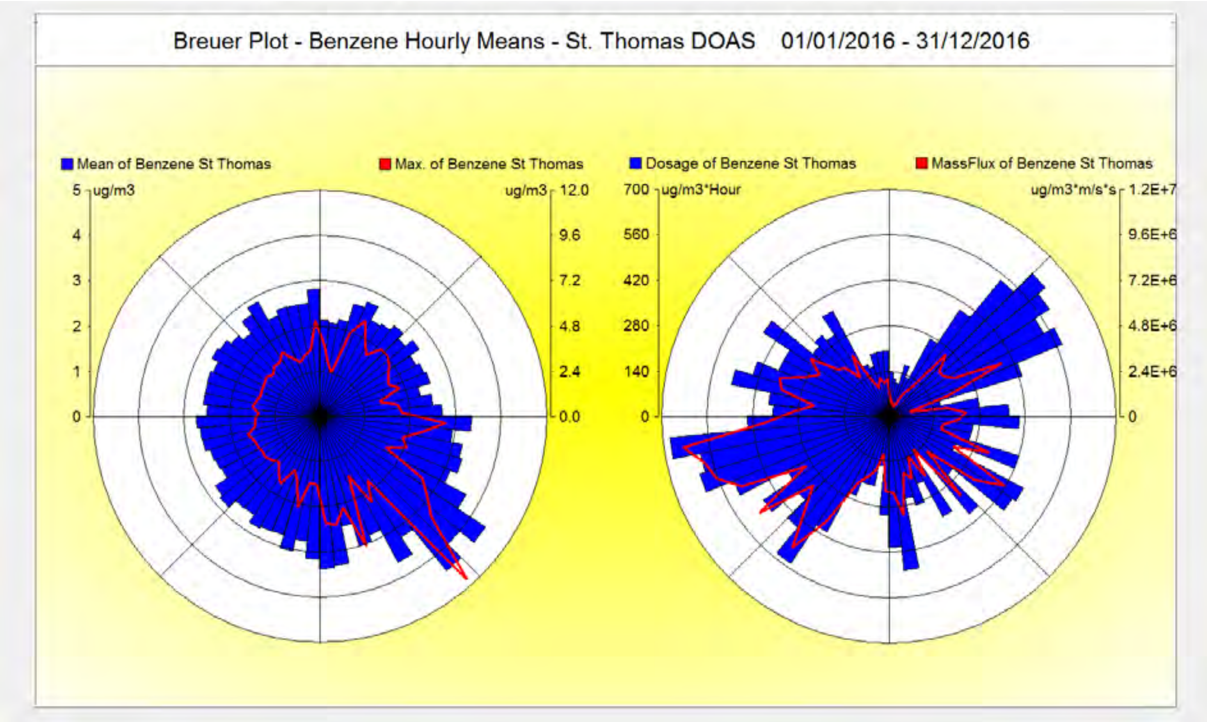

Figure 2.2.40 St Thomas DOAS Benzene hourly concentrations 2016

From table 2.15 above it can be seen that no annual mean exceeds 5ug/m^3 at either site and compliance is, therefore, being achieved at both sites.

Other Pollutants Monitored

The authority has previously monitored additional pollutants (carbon monoxide and ozone) at the majority of the automatic sites. However, due to the financial restraints that the authority is now operating under, all carbon monoxide monitoring has ceased at the Swansea AURN, and Morriston Groundhog sites, resulting in no roadside carbon monoxide monitoring being undertaken within Swansea since 2009. Ozone monitoring ceased at the Swansea AURN site on the 27th November 2008 with the analyser being transferred to the Cwm Level Park monitoring site following the reorganisation of the UK Network. Ozone continues to be measured at the Morriston Groundhog and the Hafod and St Thomas DOAS sites. Lastly, $PM_{2.5}$ was measured at the Swansea AURN Roadside station by way of the Thermo TEOM FDMS system (co-located with Thermo TEOM FDMS PM_{10}) until November 2011 when due to continued operational issues the FDMS systems were replaced with Met One Bam 1020 PM_{10} and $PM_{2.5}$ units. As mentioned above within section 2.1 the authority replaced the FDMS PM_{10} unit at the Morriston Groundhog site with a MetOne Bam1020 $PM_{2.5}$ monitor due to the ongoing poor data capture rates being obtained from the FDMS units. The Bam1020 $PM_{2.5}$ went live at Morriston during late December 2015 so no meaningful data is available for presentation within this reporting cycle.

In addition, the authority participate in the UK Heavy Metals Monitoring Network with The Department of the Environment, Transport and the Regions (DETR) 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 Europe being located within the authority's area at Clydach. Further details and information can be found within section 2.1. The analysed parameters are: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Magnesium (Mn), Nickel (Ni), Lead (Pb), Platinum (Pt), Vanadium (V), Zinc (Zn) and Mercury (Hg).

Ozone

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)[28] (chapter 1 section 1.3.5 page 62) was for the 8-hour means not to exceed 100μg/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.

[28] https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-2

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. Tables 2.16 – 2.19 detail the monitoring undertaken during 2016 along with previous year's results.

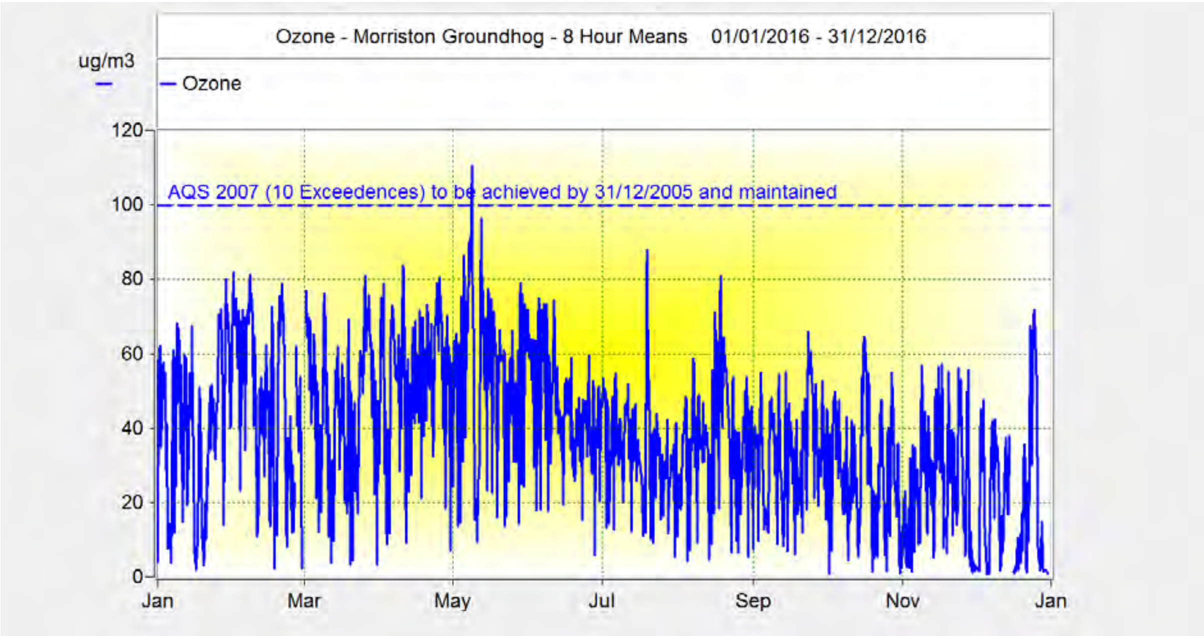

Figure 2.2.41 – Morriston Groundhog – 8-hour Ozone means 2016

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

Table 2.16– Moriston Groundhog – 8-hour Ozone means 2002-2016

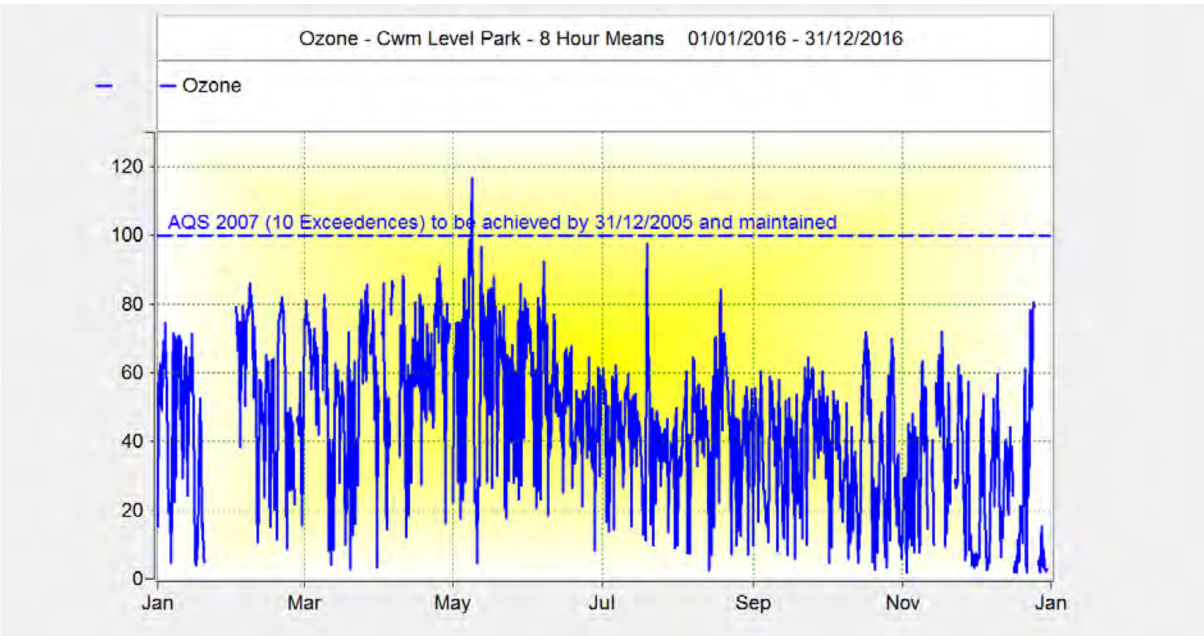

Figure 2.2.42 – Cwm Level Park – 8-hour Ozone means 2016

Cwm Level Park	Max 8-hour Mean (µg/m^3)	Data capture	Exceedances of 8-hour objective 100µg/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

Table 2.17 – Cwm Level Park – 8-hour Ozone means 2009-2016

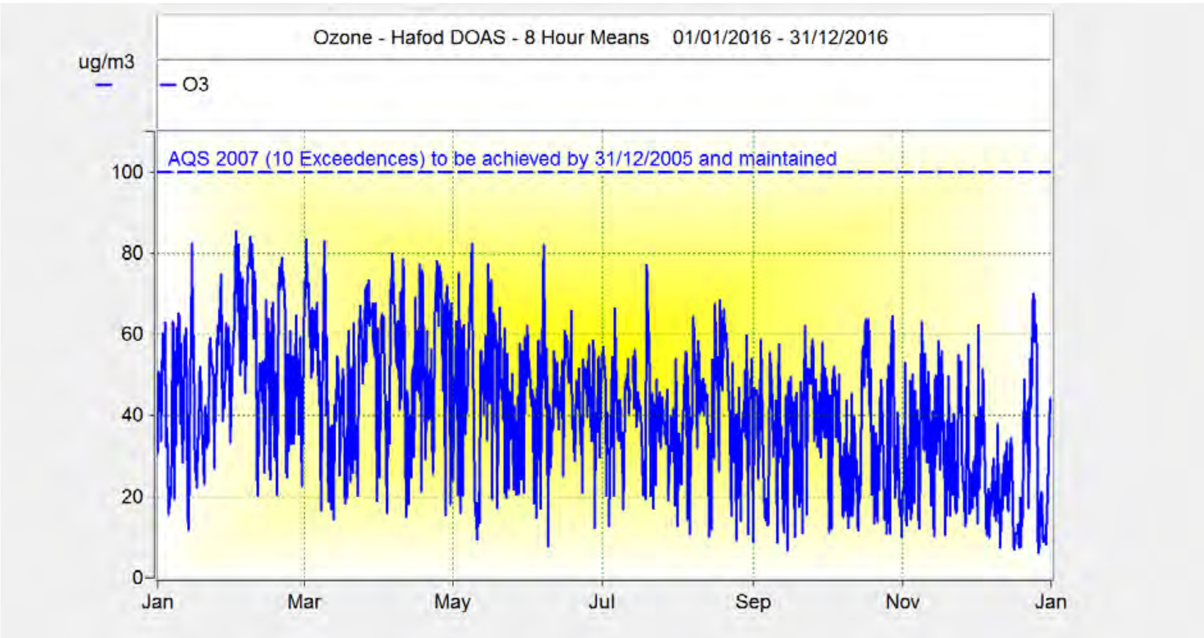

Figure 2.2.43 – Hafod DOAS – 8-hour Ozone means 2016

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

Table 2.18 – Hafod DOAS – 8-hour Ozone means 2006-2016

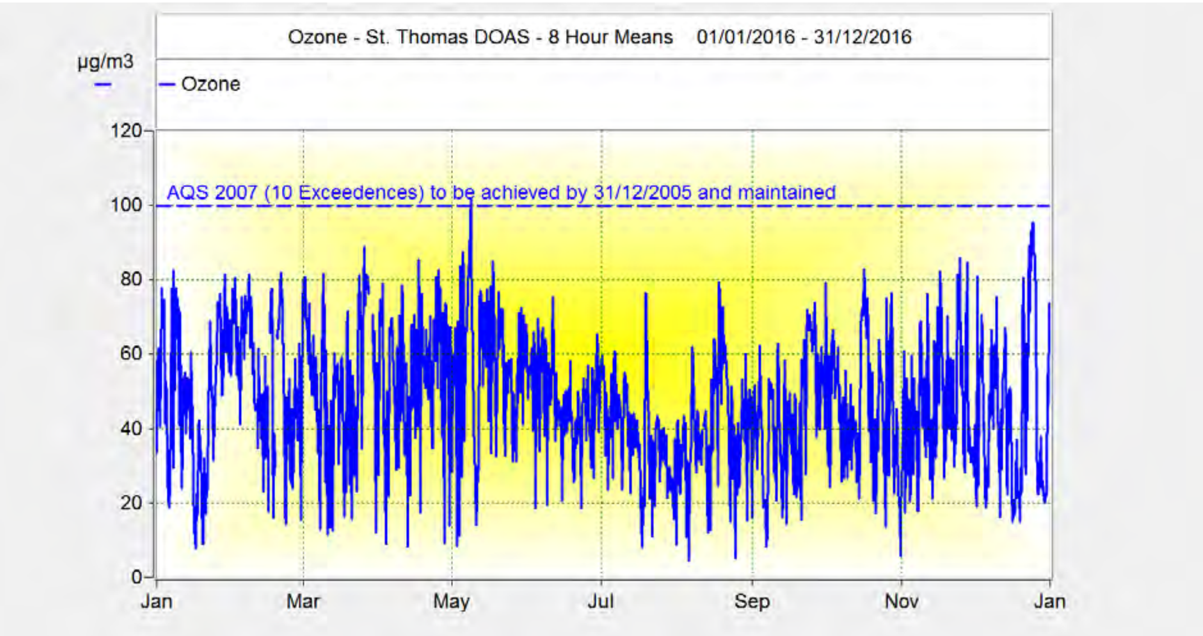

Figure 2.2.44 – St Thomas DOAS – 8-hour Ozone means 2016

St Thomas DOAS	Max 8-hour Mean ($\mu g/m^3$)	Data capture	Exceedances of 8-hour objective $100\mu g/m^3$ (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

Table 2.19– St Thomas DOAS – 8-hour Ozone means 2006-2016

Compliance during 2016 has been achieved at all monitoring locations with no site exceeding the 10 permitted 8-hour exceedances.

Particulate Matter $PM_{2.5}$

The Thermo FDMS $PM_{2.5}$ system was installed upon commissioning of the relocated Swansea Roadside AURN site, and went live on the 26th September 2006.

The data collected for 2006 from the FDMS $PM_{2.5}$ unit amounts to just over two months at best and is not reported here as the period was fraught with breakdowns and other issues. Brief operational issues that have been identified are outlined here for information as the operation of the FDMS units differs substantially from that of its predecessor the R&P Teom units.

The FDMS units are required to operate within an ambient enclosure temperature range between 18-22°C[29]. Opinions vary as to the exact optimum temperature but Swansea's experience indicates around 18-20°C to be adequate and one that is capable of being maintained relatively stable by the installed air conditioning system.

[29] UK Equivalence Program for Monitoring of Particulate Matter dated 5th June 2006 section 5.5.2

The FDMS unit provided hourly integration data and had been configured as per DEFRA's FDMS parameter protocol (as amended during February 2008). The RS232 port on the FDMS control unit allows the collection of up to 8 parameters via telemetry. The parameters collected from the FDMS units are: Volatile Mass, Non Volatile Mass, External Dew Point, Sample Dew Point, Filter loading, Pressure, Status, External Ambient Air temperature. The control unit referred to these parameters in different terminology. However, the FDMS unit would not directly produce a $PM_{2.5}$ mass concentration. The $PM_{2.5}$ mass concentration was obtained via post processing of the volatile and non-volatile mass parameters by creating a calculated channel the software package Opsis Enviman ComVisioner.

Data collected from the FDMS unit had an integration period of 1-hour. $PM_{2.5}$ mass concentration is obtained via post processing of the volatile and non-volatile mass parameters by the software package Opsis Enviman ComVisioner. 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[30]. LAQM.TG (16) provides no direct guidance on $PM_{2.5}$, except for paragraphs 3.50 – 3.53.

There had been numerous problems since the commissioning of the site in September 2006 with the installation of the Thermo Inc FDMS $PM_{2.5}$ analyser, resulting in significant periods of data loss. During 2007, there were several periods where data has been removed from the dataset. There are: 1st – 5th January 2007; 16th - 18th January 2007; 24th – 26th January 2007; 1st -2nd March 2007; 7th – 21st May 2007(leak test failure and uncertainty in data due to swap out of loan/replacement sensor units). These issues resulted in a ratified data capture rate of 90.7% for 2007.

Operation during 2008 saw a data capture rate of 94.81% with far fewer operational issues arising. However, significant issues were again seen within the data for 2009. Significant data has either been rejected or is absent during January, February, May-August, October and December 2009. The resulting data capture rate for 2009 is a disappointing 49.86% (daily means with 75% of 1 hour means present). During 2010,

30 LAQM.TG(16) General Considerations paragraph 7.160 to 7.162 page 7-47 to 7-48

the operation of the $PM_{2.5}$ FDMS had been queried on many occasions as the $PM_{2.5}$ unit was reporting higher concentrations of $PM_{2.5}$ than PM_{10}. Both FDMS units have been investigated for leaks, dryer issues, pump vacuum issues during. However, problems continued with the reliability of the FDMS from late December 2010 and throughout 2011. Data has been rejected by the UK network from the 21st December 2010 to the 14th September 2011 at 15:00.

Due to the ongoing reliability and data quality issues from the $PM_{2.5}$ (and also PM_{10}) FDMS systems a decision was made during the summer of 2011 to remove both FDMS units. Both FDMS units were removed from site on the 16th November 2011. Met One BAM 1020 $PM_{2.5}$ (smart Bam) and PM_{10} units were installed on the 28th November 2011.

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.[31] [32]
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.

Due to the problems experienced during 2011 the combined FDMS $PM_{2.5}$ and BAM1020 $PM_{2.5}$ hourly integrated data capture rate was 28.66%. Graph 22 below present's daily mean data for 2015. Table 2.20 summarises $PM_{2.5}$ data at the Swansea AURN between 2007 and 2015

[31] http://www.metone.com/documents/Met_One_Letter_5.pdf
[32] http://uk-air.defra.gov.uk/reports/cat05/0606130952_UKPMEquivalence.pdf

As mentioned elsewhere the authority replaced the FDMS PM_{10} unit at the Morriston Groundhog with a heated MetOne 1020 $PM_{2.5}$ (SmartBam) during late December 2015 due to the poor performance of the FDMS system. There is very little meaningful $PM_{2.5}$ data for 2015 from the Morriston Groundhog and as such, none is reported here.

It should be stated that following installation of the Bam 1020 $PM_{2.5}$ unit that data capture since installation and throughout its operation since, has vastly improved. This is true at the Swansea AURN and now also during the early stages of 2016, at the Morriston groundhog site.

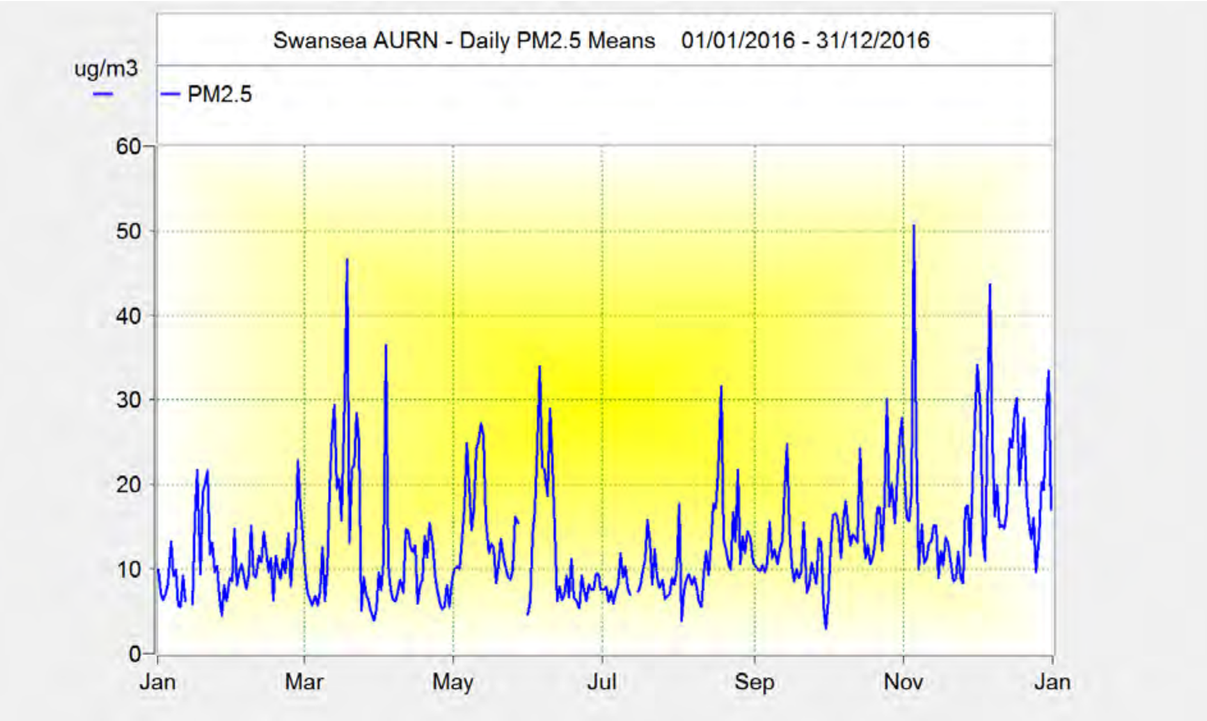

Figure2.2.45 – Daily $PM_{2.5}$ means – Swansea AURN 2015

Swansea Roadside AURN $PM_{2.5}$	Data capture %	Annual Mean ($25\mu g/m^3$)	Max Daily Mean ($\mu g/m^3$)	Max 1-hour mean ($\mu g/m^3$)
2007	90.7	13.84	68.9	262
2008	94.81	12.53	70.42	202
2009	**49.86**	11.84	60.54	91
2010	94.52	8.97	33.63	102
2011	**28.66**	10.33	32.04	230 *
2012	97.27	11.45	56.17	199 *
2013	97.26	11.90	48.50	121
2014	94.25	12.80	61.92**	327*
2015	96.44	12.80	62.67	116
2016	95.37	13.37	50.61	257.77*

Table 2.20 – Swansea AURN $PM_{2.5}$ daily means 2007-2016

Max 1-hour means 2011, 2012, 2014 and 2016 all occurred on 5th November

** ***Max 24-hour mean 2014 occurred on 5th November***

Morriston Groundhog $PM_{2.5}$	Data capture %	Annual Mean ($25\mu g/m^3$)	Max Daily Mean ($\mu g/m^3$)	Max 1-hour mean ($\mu g/m^3$)
2016	89.31	10.14	46.39	239.88*

Table 2.21 – Morriston Groundhog $PM_{2.5}$ daily mean

Max 1-hour means 2016 all occurred on 5th November

The $PM_{2.5}$ monitoring recorded elevated levels during the 18th - 20th March 2015. Back trajectories performed by Ricardo-AEA indicated that the air arriving in southern regions of the UK was of European origin and was affecting the whole of southern UK. This was compounded in some regions by poorly dispersed local emissions due to low wind speeds. This episode lasted for two to three days and is also evident within the PM_{10} monitoring within graphs 7 and 8 above.

Guidance within LAQM.TG (16) relating to $PM_{2.5}$ and Action Planning only relates to England and Scotland[33]

The Air Quality Strategy 2007 focuses attention on $PM_{2.5}$ particulate matter to that of an exposure reduction approach. Between 2010 and 2020 for UK Urban Areas there is a target of 15% reduction in concentrations at urban background. The $25\mu g/m^3$ is a cap to be seen in conjunction with the 15% reduction. The current policy framework

[33] LAQM.TG(16) PM2.5 and Action Planning paragraph 2.51 page 2-8

and the legislative requirement to meet EU air quality limit values everywhere in the UK tends to direct LAQM attention to localised hotspot areas of pollution. There is clear and unequivocal health advice that there is no accepted threshold effect, i.e. no recognised safe level for exposure to fine particles $PM_{2.5}$. For $PM_{2.5}$, the current policy framework is therefore not going to generate the maximum improvement in public health for the investment made, as it focuses attention on localised hotspots only, despite much more widespread adverse effects on health being likely.

Therefore, an exposure reduction approach has been adopted for $PM_{2.5}$ to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas, where the costs of reducing concentrations are likely to be exceedingly high. These measurements will act to make policy measures more cost-effective and is more likely to maximise public health improvements across the general population.

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 2.22.

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

Table 2.22 - 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 ❸** and the **Morriston Groundhog ❺** site during 2015 is presented below within table 2.23 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}

Year	* Glais Primary School ❷	Coed-Gwilym Cemetery ❸	** YGG Gellionnen ❹	Morriston Groundhog ❺
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

Table 2.23 – Swansea Nickel Annual Means 2002 – 2016

** Site ceased monitoring April 2013*

*** Site ceased monitoring January 2014*

The debate on what impacts the newly identified nickel sources further up the Swansea Valley within Pontardawe have on the monitoring stations within Swansea is still ongoing but the effect of the improved abatement at the high discharge point within the Vale was visible year on year up to 2014. However, it is not clear at present why the previously confirmed downward trend ceased during 2014 as this upward trend has again been noticed within the 2015 annual mean returned for Coed-Gwilym Cemetery site. There remains an overall downward trend within the 2015 annual mean from the Morriston Groundhog site. The 2016 annual mean shows a reduction from 2015.

Figure 2.2.46 below shows the meteorological conditions recorded during 2016 at Cwm Level Park in the lower Swansea Valley.

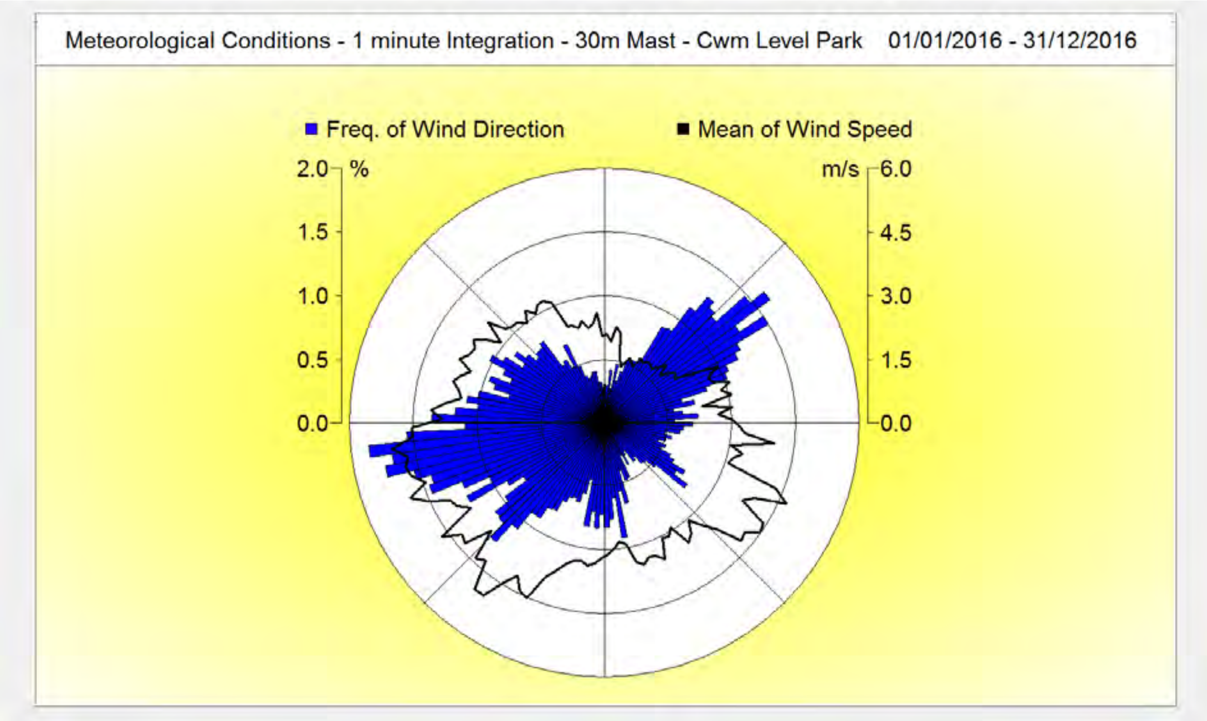

Figure 2.2.46 – meteorological Condition – Cwm Level Park 2016 – 1 minute integration

Conditions seen here broadly represent the wider area and indicate a prevalence of predominantly south-westerly/westerly winds. As in previous years, there is also an indication of north-easterly winds (primarily during the winter months) which would blow down the alignment of the Swansea valley, taking any concentrations from the release point(s) at Clydach and Pontardawe down to the Morriston site.

From the data available within table 2.23 it is clear that nickel compliance has been achieved at all UK Network monitoring sites during 2016 and at all sites since 2008.

Annual mean data between 2008 and 2016 for **arsenic (As) and cadmium (Cd)** are presented below within table 2.24**.** All results are expressed in ng/m^{-3}

Year	Glais Primary School ❷		Coed-Gwilym Cemetery ❸		YGG Gellionnen ❹		Morriston Groundhog ❺	
	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

Table 2.24 – Annual Mean Arsenic and Cadmium data 2008-2016

*** Data capture 19%**

From table 2.24 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 2016 for **lead** is presented within table 2.25 below**. All results are expressed in ng/m^{-3}**

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

Table 2.25 – Annual Mean Lead data 2008-2016

***** Data capture 19%

From the data available within table 2.25, it is clear that annual mean concentrations for lead at all monitoring locations fall well below the 0.25ug/m^3 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 2016. Results of all compounds measured from 2007 to December 2016 can be found by following link at:

http://uk-air.defra.gov.uk/data/non-auto-data?site_id=SWALP&network=paha&s=View+Site#site_id=SWALP&view=data - select the year i.e. 2016 and the pollutant of interest from the drop down list – each pollutant is displayed individually. Please note that PAH Digitel (solid phase) should be selected in the PAH Network dropdown box. 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.

Summary of Compliance with AQS Objectives

Swansea Council has examined the results from monitoring in the Local Authority's Area. Concentrations of PM10, SO2 and Benzene are all below the objectives, therefore there is no need to proceed to a Detailed Assessment.

Swansea Council has examined the results from monitoring in the Local Authority's Area.

Concentrations within the AQMA still exceed the <Annual Mean> for <Nitrogen Dioxide> at <Fforestfach, Hafod and Sketty> and the AQMA should remain.

Swansea Council has measured concentrations of Nitrogen Dioxide above the Annual Mean objective at relevant locations outside of the AQMA, and **will need to proceed to a Detailed Assessment**, for High Street, Fabian Way and Mumbles.

3 New Local Developments

3.1 Road Traffic Sources

Whilst the report guidance/template indicates that details should only be provided of new road traffic sources identified since the last Updating and Screening Assessment, it is thought worthwhile to repeat and update these details from those contained within the City & County of Swansea's USA 2012. This view is substantiated by the knowledge that over the past years, numerous enquiries have been received from developers and other professionals requesting sight of the latest Updating Screening Assessment. Given this view, the details presented have been updated from those submitted within all USA's 2012 onwards. This rational is also followed elsewhere within this Progress Report.

3.1.1 Narrow Congested Streets with Residential Properties Close to the Kerb

In order to consider which streets fell within the definition of narrow congested streets with a traffic flow of 5000 vehicles per day,[34] the emissions database (EDB) which has been under development over the last several years was first examined. All road links within the EDB (circa 15,000) were exported into an Excel worksheet and index by the Annual Average Daily Traffic flow (AADT). Details held were examined where the AADT for individual road links was above 4,500 vehicles. This approach was taken as numerous counts from temporary or short duration surveys were held i.e. 1 week duration, where, underestimates of the flow could feasibly be possible due to the time of the year the survey was undertaken i.e. during the school holidays. Once individual road links were identified they were then cross referenced with those roads within the then Hafod Air Quality Management Area and discounted[35] from further consideration.

[34] LAQM.TG(09) USA Checklist Box 5.3 – A1 Narrow congested streets with residential properties close to the kerb
[35] LAQM.TG(09) USA Checklist Box 5.3 – (A) Overview

Numerous road links were identified with flows in excess of an AADT of 4,500 but, these roads were discounted as they did not fit the fit the definition of a narrow congested street with residential properties within 2m of the carriageway on at least one side of the road.

Following this exercise, the streets listed below within table 3.1 were identified. These roads were not previously thought likely to present problems with the nitrogen dioxide annual mean objective but were brought back into the scope of assessment due to the AADT requirement. The identified roads suffer congestion as defined within LAQM [36] to one extent or another mainly due to parked vehicles and restricted movements.

Road Name	Area
Hebron Road	Clydach
High Street	Clydach
Lone Road	Clydach
Vardre Road	Clydach
Chemical Road	Morriston / Cwmrhydyceirw
Cwmrhydyceirw Road	Cwmrhydyceirw
Alexandra Road	Gorseinon
Belgrave Road	Gorseinon
Courtney Street	Manselton
Clyndu Street	Morriston
Morfydd Street	Morriston
Parry Road	Morriston
Newton Road	Mumbles
Highpool Lane	Newton
Parkmill Road	Parkmill
Beach Road	Penclawdd
Blodwen Terrace	Penclawdd
Sea View	Penclawdd
Station Road	Penclawdd
Bolgoed Road	Pontarddulais
St Teilo Crescent	Pontarddulais
Water Street	Pontarddulais
Carnglas Road	Tycoch

Table 3.1 – Identified narrow Streets with AADT > 5000

Monitoring has found that annual mean concentrations are below the objective level at the majority but not at all of the identified locations for the complete years of monitoring undertaken. Therefore, further monitoring has ceased at those sites that

[36] LAQM.TG(09) USA Checklist Box 5.3 – A1 Narrow congested streets approach page 5-10

had exhibited bias corrected annual means concentrations consistently below 30ug/m^3.

However, there were some notable exceptions, mainly Newton Road in Mumbles. The situation at Newton road has been discussed within previous reporting and the situation has been updated within this report.

Monitoring within the Pontarddulais area has ceased as from the returned annual means it is apparent that the major retail store development has not created conditions where any site has exceeded the nitrogen dioxide annual mean objective of 40ug/m^3.

3.1.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Assessments within the city centre have already commenced following the introduction of the Metro scheme and associated changes to the city centre road network and policy initiatives' to attract people to live within the city centre. The monitoring details are included within section 2 above and the results contained within table 2.10.

From the passive NO_2 tube survey work undertaken within the city centre during 2010/2011, several locations were showing the potential to exceed the 1-hour mean objective. In particular, sites 126 and 127 along The Kingsway, Swansea indicated during 2010 annual mean concentrations exceeding 60ug/m^3 and therefore exceedances of the 1-hour NO_2 objected were thought likely.[37] These locations are either close to, or adjacent to, café environments situated on the pavement area alongside the busy roadway. However, during 2016, whilst concentrations remain above the annual mean objective at numerous sites within the city centre (see figure 2.2.23 above) there has been no indication that exceedance of the 1-hour objective was likely to have been observed. The authority has increased the number of monitoring locations along High Street, Orchard Street, Castle Street and the Kingsway during 2014 and 2015 due to the regeneration proposals for the city centre.

[37] Laxen et al July 2003 - Analysis of the Relationship Between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites

This initiative intends to provide additional dwellings within the city centre to provide additional footfall and therefore economic activity within the city centre.

In terms of LAQM it could therefore now be argued, that relevant exposure no longer exists at these locations along the Kingsway. This view is tempered by the knowledge that relevant exposure does exist at locations along the Kingsway in the form of a development comprising of student flats opposite the café environment and another block of flats approximately 50 meters on the same side of the dual carriageway that are yet to be occupied. It has proved impossible to directly monitor at the student flats location as the development has taken place above an existing retail food outlet and directly outside a series of bus stops that presents no ideal monitoring points.

Concerns also exist for sections of High Street that fall outside of the existing Swansea AQMA 2010 exceeding the NO_2 annual mean objective. Numerous café type environments also now exist along The Kingsway and Westway where the 1-hour exposure objective may be relevant.

Planning Applications received and those proposed for numerous sites along High Street are focusing on introducing residential dwellings in the form of flats into this once commercial area. Other proposals along High Street have not as yet progressed to the application stage to convert former office/vacant commercial premises mainly at 1st floor level into living accommodation.

The city centre will see considerable change in the coming years following the review into the road network/layout currently being undertaken. The probable outcome will see considerable alteration of the recently modified road network – in particular along the Kingsway / Orchard Street and High Street routes. It is too early in the process to comment further as all options remain open at present. This review is looking into the commercial activities within the city centre and aims to increase footfall within the city centre by increasing the number of dwellings within the city centre

3.1.3 Roads with a High Flow of Buses and/or HGV's.

The authority now operate 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 3.2. These tend to be within the lower Swansea Valley area in and around the Swansea AQMA 2010 but latest deployment have 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.

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

Table 3.2 – EUR6 Classification scheme

Data from the ATC network has been analysed for the years 2006 – 2016 for the basic three categories from the EUR6 classification employed that are required to produce the composition of flow. These details are provided separately for EUR6 classification categories 4-6 below within tables 3.3-3.5. Table 3.6 summarises the total % HDV flows.

Class 4 L/M/HGV	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Site 1	5.1	4.8	4.1	3.5	3.6	3.8	**4.1**	4.4	4.4	4.4	4.4
Site 2	6.4	6.1	6.6	6.1	6.2	6.4	**6.2**	6.3	6.4	6.6	7
Site 3	4.3	4.5	7.4	16.2	4.7	4.8	**5.0**	5.2	5.4	6	6.1
Site 4	4.4	4.4	4.4	4.4	4.5	4.7	**4.7**	4.9	4.8	4.9	5
Site 5	5.6	5.8	5.9	5.4	5.6	5.5	5.8	5.5	5.9	6	6.2
Site 6	6.9	7.4	7.4	7.2	7.5	7.4	7.4	7.5	7.5	7.6	7.9
Site 7	4.2	4.5	4.8	4.6	4.7	4.8	4.9	5.2	4.9	4.8	5
Site 8	29.9	29.8	30.3	29.8	29.9	30.6	30	30.3	31.3	27.2	27.5
Site 9	6.4	6.6	6.2	5.8	6	6.2	6.2	6.5	6.8	6.5	6.4
Site 10	4.8	4.8	4.6	4.3	4.3	4.4	4.4	4.5	4.5	4.5	4.6
Site 11	6	6.5	6.9	6.3	6.9	6.5	6.9	6.9	7.1	7.5	7.9
Site 12	5.1	4.9	4.8	4.6	4.7	4.6	4.6	4.9	5	4.7	5.2
Site 13	4.7	4.6	4.5	4.3	4.6	4.5	4.3	4.5	4.6	4.7	4.8
Site 14	5.6	5.7	5.9	5.4	5.6	5.6	5.7	5.8	5.9	6	6.2
Site 15	8.4	14.4	6.1	6.1	6	6.2	6.1	6	6	6.1	6
Site 16	4.6	4.8	4.8	4.6	4.6	4.7	4.7	4.8	5	5.3	5.5
Site 17	4.3	4.1	5.3	5.1	5.3	5.4	5.4	5.5	5.7	5.9	6.1
Site 18	6.7	6.4	6.3	6.5	6.5	6.5	6.5	6.7	6.4	6.1	6.2
Site 19	5.6	5.7	5.7	5.4	5.6	5.7	5.6	5.7	5.7	5.7	5.7
Site 20	4.9	4.6	4.3	3.9	4.2	4.3	4.2	4	4.3	4.2	4.1
Site 21	6.4	6.5	6.7	6.5	6.5	6.7	6.8	6.8	6.9	7.1	7.3
Site 22	6.9	7	6.9	6.7	6.1	5.8	5.3	5.2	5.1	5.5	5.4
Site 23	4.8	5	4.9	4.5	4.6	4.7	4.8	4.9	5	5	7.1
Site 24	5.7	5.7	5.5	5.5	5.9	6.1	6	6.1	6	6.3	6.5
Site 25	4.5	6.2	6.0	5.6	5.9	6.0	5.8	6.1	6.2	6.5	6.8
Site 26	5.5	5.7	5.6	5.4	5.6	5.9	5.9	6.1	6.2	6.4	6.7
Site 27	5.1	5.5	5.7	15.6	4.5	4.6	4.4	4.5	4.7	4.8	5.1
Site 28	4.8	4.9	4.9	4.6	4.4	4.6	4.6	4.8	4.9	5	5.2
Site 29	4.7	4.9	4.7	4.7	4.8	5	4.8	4.8	5.2	5.2	10.1
Site 30	6.6	4.1	4.2	3.9	4.2	4.1	4.2	4.4	4.3	4.5	5
Site 31	4.4	4.6	4.7	4.7	4.8	5.1	5.1	4.7	4.7	5	5
Site 32	8.2	3.8	3.8	3.9	3.9	3.9	4.1	4.3	4.1	4.4	4.6
Site 33	4.2	4.4	4.4	4.5	4.6	4.5	4.6	4.6	4.6	4.7	4.9
Site 34	6.8	4.3	4.4	4.4	4.2	4.1	4.1	4	4.1	4.2	4.6
Site 35	13.9	5.3	5.7	4.8	5	5.1	5.2	5.4	5.7	5.4	5.7
Site 36	-	-	-	-	-		-	-			
Site 37	3.4	3.8	3.9	3.5	3.6	3.8	3.5	3.6	5.2	7.5	7.6
Site 38	6.4	6.5	6.3	5.8	8.6	18.8	7	6	6.4	6.1	6.1
Site 39	4.7	4.6	5.2	4.9	5.2	5	4.8	4.7	4.5	4.7	4.7
Site 40	3.5	3.8	3.9	4.0	3.8	3.9	3.9	4	4.1	4.4	4.6
Site 41	2.9	2.7	3.4	3.0	3.1	3.2	3.1	3.1	3.2	3.1	3.2
Site 42	6.9	5.2	5.1	5.0	4.8	4.9	5	5.1	5.3	5.2	5.3
Site 43	5.1	5.6	5.6	5.3	5.5	5.8	6	6.1	5.9	6	5.9
Site 44	-	6.1	6.1	5.8	6.0	6.1	6.0	6.2	6.1	6.5	6.6
Site 50	-	-	-	-	-	-	-	3.7	3.6	3.6	3.5
Site 51	-	-	-	-	-	-	-	4.2	4.3	4.5	4.8
Site 52	-	-	-	-	-	-	-	4.5	4.4	4.2	4.4
Site 53	-	-	-	-	-	-	-	4.7	4.5	4.7	5
Site 54	-	-	-	-	-	-	-	6.2	6.2	6.4	6.2
Site 55	-	-	-	-	-	-	-	7.0	7.1	7.1	8
Site 56	-	-	-	-	-	-	-	-	-	6.1	6.1
Site 57	-	-	-	-	-	-	-	-	-	6.6	6.6
Site 58											3.2

Table 3.3– EUR6 Classification scheme 2006-2016 Class 4

Comments - **Site 8** located on Morfa Road, The Stand is directly outside the access road to the main City & County of Swansea transport depot and also to a small industrial estate further up Morfa Road, hence the consistent high percentage composition for this classification. **Site 35** suffered configuration problems during 2005/2006 which failed to take into account the possibility of parked vehicles affecting the classification. This was identified but not fully understood as to why the configuration issues with loop tuning only affected this Class 4 scheme until sometime later. **Site 38** – it is not clear why the sudden increase during 2011 occurred but major gas main replacement works were undertaken along Carmarthen Road (outbound) causing significant delays along Carmarthen Road with traffic possibly diverting to avoid delays.

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

Class 5 Artic HGV + Trailer	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Site 1	0.2	0	0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0	0
Site 3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0	0	0
Site 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Site 5	0.3	0.3	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.3	0.3
Site 6	0.8	0.8	0.8	0.7	0.4	0.6	0.5	0.5	0.4	0.4	0.4
Site 7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Site 8	1.9	1.1	1.8	2.1	2.3	2.4	2.2	1.5	0	1.1	11
Site 9	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Site 10	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 11	0	0	0	0.0	0	0	0	0	0	0	0
Site 12	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Site 13	0.4	0.4	0.2	0.2	0.2	0.4	0.2	0.2	0.2	0.2	0.2
Site 14	0.3	0.3	0.1	0.2	0.3	0.3	0.2	0.2	0.3	0.1	0.3
Site 15	0.1	0.3	0.1	0.2	0.5	0.4	0.4	0.5	0.4	0.3	0.1
Site 16	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 17	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 18	0.2	0.4	0.2	0.5	0.6	0.6	0.5	0.5	0.4	0.5	0.3
Site 19	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 20	0.7	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 21	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 22	0.4	0.4	0.4	0.2	0.4	0.3	0.2	0.2	0.2	0.2	0.2
Site 23	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.2
Site 24	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Site 25	0.5	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Site 26	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 27	0.3	0.2	0.4	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.2
Site 28	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.3
Site 29	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3
Site 30	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Site 31	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 32	0.1	0	0	0.0	0	0	0.2	0.2	0	0	0
Site 33	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Site 34	0.3	0.2	0.1	0.1	0.8	0.1	0.1	0.1	0.1	0.1	0.1
Site 35	0.7	0.2	0.4	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4
Site 36	-	-	-	-	-	-	-	-	-	-	
Site 37	0.4	0.5	0.5	0.5	0.5	0.6	0.3	0.4	0.8	1.3	1.2
Site 38	0.3	0	0.3	0.3	0.3	0.5	0.3	0.3	0.3	0.3	0.3
Site 39	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3
Site 40	0	0	0	0.0	0	0	0	0	0	0	0
Site 41	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2
Site 42	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 43	0.9	0.9	1	0.8	1	0.9	1	1	1	1.1	1.2
Site 44	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 50	-	-	-	-	-	-	-	0.0	0	0	0.0
Site 51	-	-	-	-	-	-	-	0.4	0.4	0.3	0.1
Site 52	-	-	-	-	-	-	-	0.2	0.2	0.2	0.2
Site 53	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1
Site 54	-	-	-	-	-	-	-	0.0	0.2	0.2	0.2
Site 55	-	-	-	-	-	-	-	1.2	1.1	1.2	2
Site 56	-	-	-	-	-	-	-	-	-	0	0
Site 57	-	-	-	-	-	-	-	-	-	0.3	0.3
Site 58											0.2

Table 3.4 – EUR6 Classification scheme 2006-2016 Class 5

Comments - Again, **Site 8** is located on Morfa Road, The Stand directly outside the access road to the main City & County of Swansea transport depot and also to a small industrial estate further along Morfa Road, hence the consistent high percentage composition for this classification.

There are some sites (Sites 2,3, 4,11,32 and Site 40 that see consistent negligible artic trailer flow – these sites tend to be within areas that have no reason to see these type of vehicles within the area

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

Class 6 Bus	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Site 1	1.2	1.6	1.4	1	0.8	0.6	0.4	0.2	0.2	0.2	0.2
Site 2	0.2	0.2	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.2	0.2
Site 3	0.5	0.5	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0	0
Site 4	0.5	0.7	0.7	0.7	0.7	0.5	0.2	0.0	0	0	0
Site 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
Site 6	1.8	1.9	1.7	1.0	0.6	0.3	0.2	0.2	0.1	0.1	0.1
Site 7	0.6	0.8	1	0.7	1.4	0.6	0.5	0.4	0.2	0.4	0.4
Site 8	0	1.1	0	0.0	0	0	0	0	0	1.1	1.1
Site 9	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.4	0.5
Site 10	0.7	0.9	0.5	0.2	0.2	0.2	0.4	0.5	0.6	1.1	1
Site 11	2.7	2.9	3.4	2.9	2.9	2.9	2.9	3.4	3.5	3.5	3.4
Site 12	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.4	0.4
Site 13	0.2	0.2	0.4	0.4	0.2	0.2	0.2	0.2	0.4	0.4	0.4
Site 14	2	2.2	1.9	1.3	1	0.9	0.8	0.6	0.6	0.7	0.7
Site 15	1.1	1.2	1.1	0.9	0.6	0.5	0.5	0.5	0.4	0.7	0.8
Site 16	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.4	0.2
Site 17	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 18	2.1	2.1	1.7	1.3	1.3	1	0.9	0.9	1.1	0.8	1.1
Site 19	2.5	3.3	3.6	3.3	3.1	2.9	3	3	3	3	2.7
Site 20	1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1.2
Site 21	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3
Site 22	6.7	8.4	8.7	7.4	6.5	5.6	5.3	5.9	6.4	6.4	6.1
Site 23	0.7	0.9	0.9	0.8	0.8	0.8	0.9	1.1	1.3	1.3	0.9
Site 24	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8
Site 25	0.5	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.7
Site 26	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4
Site 27	0.5	0.6	0.6	0.6	0.4	0.4	0.3	0.4	0.4	0.4	0.4
Site 28	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Site 29	1.3	1.7	1.7	1.7	1.6	1.4	1.2	1.8	1.2	1.5	1.8
Site 30	0.8	0.8	0.8	0.8	0.6	0.7	0.7	0.7	0.7	0.8	0.9
Site 31	0.4	0.4	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3
Site 32	1.3	1.4	1.4	1.2	1.2	1	1	1	0.9	0.9	1.1
Site 33	1.1	1.5	1.3	1.3	1.3	1	1.1	0.9	1	1	1.2
Site 34	1.5	1.7	1.7	1.6	0.9	0.3	0.3	0.3	0.4	0.4	0.6
Site 35	1.6	1.5	1.4	1.2	1	0.9	1	1	0.9	1.2	1.4
Site 36	-	-	-	-	-	-	-	-	-	-	
Site 37	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.8	1.2	1.6	1.6
Site 38	1.6	2.1	1.8	1.0	1.2	1.8	0.8	0.8	0.8	1.1	1.3
Site 39	0.4	0.7	0.8	0.8	0.9	0.7	0.8	0.9	0.9	0.9	0.7
Site 40	0.7	0.7	0.7	0.7	0.8	0.5	0.5	0.5	0.5	0.5	0.5
Site 41	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.4	0.5
Site 42	1	1.1	1.1	1.1	1	0.8	0.8	0.9	0.8	0.9	0.9
Site 43	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.5
Site 44	-	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.7
Site 50	-	-	-	-	-	-	-	0.4	0.4	0.4	0.4
Site 51	-	-	-	-	-	-	-	0.7	0.8	1	1.3
Site 52	-	-	-	-	-	-	-	1.1	1.3	1.3	1.3
Site 53	-	-	-	-	-	-	-	0.3	0.3	0.3	0.3
Site 54	-	-	-	-	-	-	-	0.7	0.9	0.7	0.7
Site 55	-	-	-	-	-	-	-	0.4	0.3	0.6	0.7
Site 56	-	-	-	-	-	-	-	-	-	0	0
Site 57	-	-	-	-	-	-	-	-	-	4.1	4.3
Site 58											0.2

Table 3.5 – EUR6 Classification scheme 2006-2016 Class 6

Comments –

Site 11 exhibits a relatively low AADT but it is evident that the fraction of class 6 buses is “significant” within the overall flow. This increased following the opening of the Liberty Stadium and Morfa Shopping complex nearby.

Site 22 has shown increased composition of buses following the developments mentioned above and the fact that all bus services now use High Street (stopping outside the main railway station) as the primary access route leading into the city centre. This effect can also be seen at **site19** Carmarthen Road which leads directly into High Street

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

HDV as % of Traffic Flow	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Site 1	4.3	6.5	6.4	5.5	4.7	4.6	4.6	4.7	4.8	4.8	4.8
Site 2	6.3	6.6	6.3	6.9	6.4	6.6	6.7	6.4	6.7	6.8	7.2
Site 3	3.4	4.8	5	8	17	5.3	5.4	5.2	5.4	5.6	6.1
Site 4	4.2	4.9	5.1	5.1	5.1	5.2	5.2	4.9	4.9	4.8	5
Site 5	5.3	5.9	6.1	6.2	5.7	5.9	5.5	6.1	5.8	6.2	6.5
Site 6	8.2	9.5	10.1	9.9	8.9	8.5	8.3	8.1	8.2	8	8.4
Site 7	4.3	4.9	5.4	5.9	5.4	6.2	5.5	5.5	5.7	5.2	5.5
Site 8	34.3	31.8	32	32.1	31.9	32.2	33	32.2	31.8	31.3	39.6
Site 9	7	7.4	7.4	7	6.6	6.8	7	6.8	7.1	7.4	7.2
Site 10	5.5	5.7	5.9	5.3	4.7	4.7	4.8	5	5.2	5.3	5.8
Site 11	6.6	8.7	9.4	10.3	9.2	9.8	9.4	9.8	10.3	10.6	11.3
Site 12	5.5	5.4	5.2	5	4.8	4.9	4.8	4.8	5.3	5.3	5.8
Site 13	5.3	5.3	5.2	5.1	4.9	5	5.1	4.7	4.9	5.2	5.4
Site 14	6.7	7.9	8.2	7.9	6.9	6.9	6.8	6.7	6.6	6.8	7.2
Site 15	14.8	9.6	15.9	7.3	7.2	7.1	7.1	7	7	6.8	6.9
Site 16	5.1	5.1	5.3	5.4	5.1	5	5.1	5.1	5.3	5.5	5.9
Site 17	2.4	4.9	4.7	5.9	5.6	5.7	5.8	5.8	5.9	6.1	6.5
Site 18	13.4	9	8.9	8.2	8.3	8.4	8.1	7.9	8.1	7.9	7.6
Site 19	7	8.3	9.2	9.4	8.9	8.9	8.8	8.8	8.9	8.9	8.6
Site 20	7.6	6.6	6	5.7	5.2	5.5	5.6	5.5	5.3	5.7	5.7
Site 21	6.4	7.1	7.2	7.2	7	7	7.2	7.2	7.2	7.3	7.8
Site 22	10	14	15.8	16	14.3	13	11.7	10.8	11.3	11.7	11.7
Site 23	5.1	5.7	6.1	6	5.4	5.6	5.7	5.8	6.1	6.5	8.2
Site 24	6.1	6.6	6.6	6.4	6.6	7	7.2	7.2	7.2	7.1	7.6
Site 25	5.9	5.5	7.4	7.1	6.7	7.2	7.3	7.1	7.4	7.5	8
Site 26	5.9	6.2	6.5	6.4	6	6.3	6.6	6.6	6.7	6.8	7.3
Site 27	5.2	5.9	6.3	6.7	6.5	5.3	5.2	4.9	5.1	5.3	5.7
Site 28	4.9	5.5	5.6	5.6	5.4	5.2	5.4	5.4	5.6	5.7	6
Site 29	5	6.2	6.8	6.6	6.6	6.6	6.6	6.2	6.9	6.6	12.2
Site 30	13.7	7.6	5	5.1	4.8	5	4.9	5.1	5.3	5.2	6.1
Site 31	4.6	5.1	5.3	5.4	5.4	5.5	5.8	5.6	5.2	5.2	5.5
Site 32	18.1	9.6	5.2	5.2	5.1	5.1	4.9	5.3	5.5	5	5.7
Site 33	4.6	5.5	6.1	5.9	6	6.1	5.7	5.9	5.7	5.8	6.2
Site 34	15.3	8.6	6.2	6.2	6.1	5.9	4.5	4.5	4.4	4.6	5.3
Site 35	40.7	16.2	7	7.5	6.2	6.2	6.4	6.6	6.8	7	7.5
Site 36	-	-	-	-	-	-	-	-	-	-	
Site 37	5.1	4.6	5	5.2	4.8	4.8	5.2	4.4	4.8	7.2	10.4
Site 38	6.6	8.3	8.6	8.4	7.1	10.1	21.1	8.1	7.1	7.5	7.7
Site 39	4.9	5.4	5.6	6.3	6	6.4	6	5.8	5.8	5.7	5.7
Site 40	3.4	4.2	4.5	4.6	4.7	4.6	4.4	4.4	4.5	4.6	5.1
Site 41	3.3	3.3	3.1	3.8	3.5	3.7	3.8	3.7	3.8	4.1	3.9
Site 42	12.1	8.1	6.5	6.4	6.3	6	5.9	6	6.2	6.3	6.4
Site 43	6.3	6.4	6.9	7	6.5	6.9	7	7.3	7.4	7.3	7.6
Site 44	-	-	7.4	7.4	7.1	7.4	7.4	7.3	7.5	7.4	7.7
Site 50	-	-	-	-	-	-	-	-	4.1	4	3.9
Site 51	-	-	-	-	-	-	-	-	5.3	5.5	6.2
Site 52	-	-	-	-	-	-	-	-	5.8	5.9	5.9
Site 53	-	-	-	-	-	-	-	-	5.1	4.9	5.4
Site 54	-	-	-	-	-	-	-	-	6.9	7.3	7.1
Site 55	-	-	-	-	-	-	-	-	8.6	8.5	10.7
Site 56											6.1
Site 57											11.2
Site 58											3.6

Table 3.6 – HDV composition from EUR6 Classification scheme 2006-2016

During October 2014 a further two ATC sites were established at:

- Site 56 Courtney Street, Manselton
- Site 57 Lower High Street, City Centre

No data is presented for these two new during 2014 but data is presented where a full year of monitoring has been undertaken for 2015.

LAQM.TG(16) mentions a threshold of 2500 HDV's/day where exposure is within 10m from the kerb or 20m from the kerb in conurbations >2 million inhabitants In order to begin a screening assessment[38].

The authority calculate the AADT (annual average daily traffic) as well as the AWDT – which can be described as the annual working week(ly) average traffic i.e. Monday-Friday.

In order to calculate the requirement to assess the likely number of HDV's the AWDT is used and multiplied by the total HDV % presented in table 3.6 above to approximate the number of daily HDV vehicles. The AWDT has been used as it is thought that this would be more representative of working day conditions rather than inclusion of weekends where HGV content is thought to be lower. The approximate number of HDV vehicles for 2016 is presented within table 3.7 below.

[38] LAQM.TG(16) Table 7.1 – Screening Assessment of Road Traffic Sources page 7-4

2016	HDV as % of Traffic Flow	AADT	AWDT	Approx. Number of HDV's from AWDT
Site 1	4.8	**11544**	**12312**	591
Site 2	7.2	**14088**	**15168**	1092
Site 3	6.1	**13440**	**14328**	874
Site 4	5	**10488**	**11160**	558
Site 5	6.5	**7392**	**7896**	513
Site 6	8.4	**16152**	**17016**	1429
Site 7	5.5	**20040**	**21504**	1183
Site 8	29.7	**2208**	**2832**	841
Site 9	7.2	**13824**	**14668**	1056
Site 10	5.8	**21360**	**22752**	1320
Site 11	11.3	**4248**	**4464**	504
Site 12	5.8	**20112**	**21696**	1258
Site 13	5.4	**11952**	**13440**	726
Site 14	7.2	**16536**	**17400**	1253
Site 15	6.9	**22224**	**23688**	1634
Site 16	5.9	**26592**	**28248**	1667
Site 17	6.5	**29688**	**31512**	2048
Site 18	7.6	**15960**	**16848**	1280
Site 19	8.6	**21192**	**22056**	1897
Site 20	5.7	**34776**	**36864**	2101
Site 21	7.8	**30720**	**32904**	2567
Site 22	11.7	**11064**	**11112**	1300
Site 23	8.2	**21984**	**23376**	1917
Site 24	7.6	**9168**	**9816**	746
Site 25	8	**13368**	**14088**	1127
Site 26	7.3	**22344**	**23736**	1733
Site 27	5.7	**21744**	**23256**	1326
Site 28	6	**8832**	**9360**	562
Site 29	12.2	**9528**	**10200**	1244
Site 30	6.1	**20352**	**21792**	1329
Site 31	5.5	**13992**	**14544**	800
Site 32	5.7	**14784**	**15672**	893
Site 33	6.2	**19488**	**20568**	1275
Site 34	5.3	**16056**	**17064**	904
Site 35	7.5	**12192**	**12840**	963
Site 36				
Site 37	10.4	**44424**	**46632**	4850
Site 38	7.7	**9456**	**10176**	784
Site 39	5.7	**21696**	**22728**	1295
Site 40	5.1	**9312**	**9936**	507
Site 41	3.9	**30120**	**32112**	1252
Site 42	6.4	**15336**	**16368**	1048
Site 43	7.6	**30768**	**33432**	2541
Site 44	7.7	**13056**	**13848**	1066
Site 50	3.9	**6792**	**6888**	269
Site 51	6.2	**32880**	**35232**	2184
Site 52	5.9	**10896**	**11616**	685
Site 53	5.4	**21048**	**22224**	1200
Site 54	7.1	**10944**	**11352**	806
Site 55	10.7	**19536**	**20928**	2239
Site 56	6.1	**4752**	**5088**	310
Site 57	11.2	**8400**	**8208**	919
Site 58	3.6	**13344**	**13752**	495

Table 3.7– Approximate number of HDV vehicles from EUR6 Classification scheme 2016

Using this approach the only ATC sites that come near to the assessment threshold during 2015 are sites 21 and site 43. (site 37 has no relevant exposure that satisfies the criteria) Site 21 is on the Ffordd Cwm Tawe dual carriageway between Landore and Morriston. Site 43 is on the A483 link up to/from junction 47 of the M4. There are no receptor locations within 10m of the kerb at either site but there are receptor locations within 20m of the kerb at both sites. However, the population criteria (>2 million) does not apply to Swansea. There are therefore no qualifying receptor locations where the number of HDV's exceeds 2500.

Morfa Road falls within the development proposals of The Tawe Riverside Development Corridor. These proposals include residential developments northwards along the banks of the river Tawe, encompassing Morfa Road. These proposals have already seen the purchase and demolition of several commercial/industrial units in preparation for parts of the privately funded scheme. The economic downturn has not seen construction works commence but it is inevitable that works will commence at some stage in the coming years. It is open to debate at present as to how long the whole scheme will take to complete as it is inevitable that some commercial/industrial units will remain whilst development proceeds along Morfa Road.

As part of the aspiration to provide a "Morfa Distribution Route", forming part of the Tawe Riverside Corridor developments, the lower section of Morfa Road from the entrance to the authorities Pipehouse Wharf depot to its junction with New Cut Road has been widened and upgraded to a signal controlled junction, being completed during the early part of 2014. This work has meant that the ATC at site 8 has been removed during late 2013 and it was relocated during June 2014. Care has been taken to ensure the new chosen location is representative of its current location so that fair comparisons to the past/present traffic flows can be made whilst ensuring high data quality. This ATC will allow monitoring of the composition during the transition of the area from a commercial/industrial area to primarily, a residential area. Phase 2 of the Morfa Distributor Road commenced early spring 2014.

Site 22 High Street was approaching the 20% threshold in previous years but it should be noted that whilst relevant exposure exits within 10m along this section of High Street, the area already lies within the Hafod Air Quality Management Area as described above within section 3.3. However, again as described in section 3.3, concerns are growing in regard to the lower sections of High Street that fall outside of the Hafod AQMA that forms part of The Swansea Air Quality Management Area 2010.

Since the completion of the redevelopment works at the Quadrant Bus Station along Westway in the city centre, all bus routes now enter and egress the terminal along Westway. Residential properties exist along this route but due to funding restrictions there are no finances available to install ATC counters along Westway. Site 36 had already been identified as the proposed site at Westway but a recent investigation into real-time ATC provision has indicated that a minimum of three ATC sites will be required to monitor all lanes and movements.

The City and County of Swansea confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.1.4 Junctions

Guidance within LAQM.TG(09) box 5.3 Section A4 page 5-15 required the identification of all “busy” junctions. A busy junction was defined within LAQM.TG(09) as one with more than 10,000 vehicles per day. An additional requirement was to determine if there is relevant exposure within 10m of the kerb (Swansea’s population of approx. 240,000 does not take it into the major conurbation category where relevant exposure would be within 20m of the kerb). LAQM.TG(16) mirrors these requirements within Table 7.1 Screening Assessment of Road Traffic sources – Road Source Category 4 – Junctions page 7-4.

Whilst as stated within the 2nd round of review and assessment there were several junctions that it was thought would meet the traffic volumes required, it was not thought there were receptor locations within 10m of the kerb. However, this situation has now changed with the construction of the new SA1 junction along Fabian Way and the construction of the new Tesco access road /junction following the reconstruction and expansion of its outlet at Nantyffin Road, Llansamlet
Passive nitrogen dioxide measurements are already being made around several junctions mentioned within previous reporting and these data are included within

section 2 above. However, following a review of the data monitoring has been scaled back around the Nantyffin Road area of Llansamlet as numerous sites have consistently returned bias corrected nitrogen dioxide annual means below 30ug/m^3. It is thought that to measure PM_{10} at these locations would provide more meaningful data in preference to DMRB calculations. It has proved to be not economically viable or practical to deploy Thermo FDMS PM_{10} analysers at these locations. Therefore, alternative real-time instruments had been sourced to undertake the monitoring works that are desirable. The instruments chosen were Met One Instruments Inc. E-Type sampler (http://www.metone.com/documents/esamplerParticulate.pdf) It is recognised that these were not true gravimetric or type approved instruments for use on the UK network but current guidance indicates that use of the near forwards light scattering technique was suitable for screening assessments. This coupled with their ease of deployment made them an ideal alternative in these situations. It has not been possible to progress this matter since the original comments within the 2nd round USA due to technical difficulties with the operation of the monitoring equipment. Whilst the infrastructure for the monitoring is now in place, the ETypes samplers proved unreliable in operation. Major problems have been experienced with pump failures and other operational issues. The plans to utilise these samplers has now changed and funding was provided to source a different analyser.

The unit chosen was the MetOne EBam PM_{10} [39] (similar in operation to the MetOne PM_{10} Bam1020) but not referenced for equivalency to the EU gravimetric method. As outlined within section 2.1 five EBam PM_{10} units have been installed at :-

- Fforestfach Cross
- Uplands Crescent
- Sketty Cross
- Westway
- SA1 Junction Port Tennant Road

[39] http://www.metone.com/documents/E-BAM_Datasheet_Rev_Aug09.pdf

The remaining junctions with combined traffic volumes likely to be >10,000 AADT flow to be monitored by way of passive nitrogen dioxide diffusion tubes and/or PM_{10} measurements are:

a) Oystermouth Road
b) Llansamlet Cross
c) Quay Parade Bridges
d) Dyfatty Junction

Whilst it has been possible to report the results of the NO_2 monitoring around these junctions, reliable long term PM_{10} monitoring has not proved possible due to the issues described above. It is not known if/when funding will be available to permit installation of EBams at the four remaining locations listed above.

3.1.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

With the exception of the information provided above in section 3 in relation to the developments with the Morfa Distributor/Relief road the authority confirms there are no new//proposed roads within the authority's area.

The City and County of Swansea confirms that there are no new/proposed roads within the authority's area.

3.1.6 Roads with Significantly Changed Traffic Flows

Data is available from 2006-2016 but only data from 2013 is presented below within tables 3.8-3.11 to assess trends with the composition of the traffic flows being measured. Class 0 is intended to provide evidence of data capture as should problems be experienced within the traffic counter with classification then vehicles would manifest within this category. As can be seen within tables 3.8-3.11 very few operational issues have been experienced. This does not account for downtime where the loops have been completely severed by either resurfacing works or gas main replacement works. In these situations data loss at the ATC site is total.

LAQM.TG(16) mentions a definition of roads with significantly changed traffic flows as those with a 25% increase on roads with greater than 10,000 vehicles per day, where exposure is within 10m from the kerb or 20m from the kerb in conurbations >2 million inhabitants[40]. In order to begin a screening assessment the above criteria has to be satisfied. The Swansea conurbation does not exceed 2 million inhabitants so the assessment is taken to be within 10m of the kerb. From the data summarised within table 3.12 below for sites not affected by operational issues, no site has seen this rate of growth.

[40] LAQM.TG(16) table 7.1 road source category 6 page 7-5

2013	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	1	93.9	0.2	4.4	0.2	0.2	**11424**	**12192**
Site 2	0.0	0.8	92.4	0.2	6.3	0.2	0.2	**14184**	**15240**
Site 3	0.0	0.4	94.1	0.2	5.2	0.0	0.2	**13008**	**13848**
Site 4	0.0	0.7	94.4	0.0	4.9	0.0	0.0	**9840**	**10440**
Site 5	0.0	1.0	93.2	0.0	5.5	0.3	0.0	**7416**	**7920**
Site 6	0.0	1.4	90.3	0.2	7.5	0.5	0.2	**15336**	**16176**
Site 7	0.0	0.8	93.4	0.1	5.2	0.1	0.4	**20376**	**21792**
Site 8	0.0	6.1	62.1	0	30.3	1.5	0	**1584**	**2040**
Site 9	0.0	0.8	92	0.2	6.5	0.4	0.2	**12552**	**13368**
Site 10	0.0	0.4	93.6	0.8	4.5	0.2	0.5	**20376**	**21720**
Site 11	0.0	0.6	89.1	0	6.9	0	3.4	**4200**	**4368**
Site 12	0.0	0.7	93.9	0.1	4.9	0.1	0.3	**18072**	**19488**
Site 13	0.0	0.8	94.1	0.2	4.5	0.2	0.2	**12192**	**13848**
Site 14	0.0	0.9	92.2	0.3	5.8	0.2	0.6	**15648**	**16488**
Site 15	0.0	0.9	91.9	0.1	6	0.5	0.5	**18096**	**19272**
Site 16	0.0	0.7	93.8	0.2	4.8	0.2	0.3	**26496**	**28032**
Site 17	0.0	0.7	93.2	0.2	5.5	0.2	0.2	**29064**	**30816**
Site 18	0.0	2.5	89.3	0.2	6.7	0.5	0.9	**15504**	**16416**
Site 19	0.0	0.8	90.2	0.1	5.7	0.2	3	**21048**	**22032**
Site 20	4.5	1	89	0.2	4	0.4	0.9	**32232**	**34128**
Site 21	0.0	0.7	91.9	0.2	6.8	0.2	0.2	**29736**	**31896**
Site 22	0.0	0.5	88.2	0	5.2	0.2	5.9	**9792**	**9936**
Site 23	0.0	0.6	93.2	0.1	4.9	0.1	1.1	**21168**	**22584**
Site 24	0.0	2.1	90.6	0	6.1	0.3	0.8	**8976**	**9624**
Site 25	0.0	0.9	91.6	0.2	6.1	0.4	0.9	**13464**	**14280**
Site 26	0.0	0.4	92.6	0.2	6.1	0.2	0.4	**22056**	**23472**
Site 27	0.0	0.3	93.8	0.7	4.5	0.2	0.4	**21456**	**22944**
Site 28	0.0	0.4	93.5	0.6	4.8	0.4	0.4	**12600**	**13368**
Site 29	1.3	0.8	91.3	0.3	4.8	0.3	1.8	**9408**	**10008**
Site 30	0.0	0.9	93.5	0.2	4.4	0.2	0.7	**20256**	**21624**
Site 31	0.0	0.8	93.7	0.3	4.7	0.2	0.3	**14784**	**15336**
Site 32	0.0	0.5	93.9	0.2	4.3	0.2	1	**14568**	**15288**
Site 33	0.0	0.8	93.3	0.1	4.6	0.2	0.9	**20640**	**21576**
Site 34	0.0	0.4	93.9	1.2	4	0.1	0.3	**16632**	**17664**
Site 35	0.0	1.3	92	0	5.4	0.4	1	**12528**	**13128**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0.0	1.1	93	1	3.6	0.4	0.8	**37824**	**39528**
Site 38	0.0	0.5	91	1.4	6	0.3	0.8	**8760**	**9432**
Site 39	0.0	1.1	92.9	0.2	4.7	0.2	0.9	**22032**	**23112**
Site 40	0.0	0.7	94.8	0	4	0	0.5	**9744**	**10416**
Site 41	0.0	0.6	95.4	0.3	3.1	0.3	0.4	**28292**	**30168**
Site 42	0.0	0.8	92.9	0.2	5.1	0.2	0.9	**15168**	**16296**
Site 43	0.0	1.3	90.7	0.5	6.1	1	0.3	**28224**	**30672**
Site 44	0.0	0.9	91.4	0.2	6.2	0.4	0.9	**12792**	**13608**
Site 50	0.0	1.5	93.8	0.7	3.7	0.0	0.4	**6576**	**6552**
Site 51	0.0	0.9	93.7	0.1	4.2	0.4	0.7	**32184**	**34416**
Site 52	0.0	0.6	93.3	0.2	4.5	0.2	1.1	**11112**	**11832**
Site 53	0.0	0.7	93.7	0.5	4.7	0.1	0.3	**20904**	**22152**
* Site 54	0.0	2.9	90.1	0.0	6.2	0.0	0.7	**6600**	**6792**
* Site 55	0.0	0.6	90.7	0.2	7.0	1.2	0.4	**12408**	**13272**

Table 3.8 – GPRS ATC Classification split 2013

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 3.9 – GPRS ATC Classification split 2014

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 3.10 – GPRS ATC Classification split 2015

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 3.11 – GPRS ATC Classification split 2016

* Site shutdown for several months due to gas leak

To assess if the AADT has changed significantly over the period 2013-2016, data is presented below in table 3.12.

Site	AADT 2013	AADT 2014	AADT 2015	AADt 2016	% Diff 2016 over 2013	% Diff 2016 over 2014	% Diff 2016 over 2015
1	11424	11496	11424	11544	1.05	0.42	1.05
2	14184	14208	14112	14088	-0.68	-0.84	-0.17
3	13008	12984	13296	13440	3.32	3.51	1.08
4	9840	9984	10368	10488	6.59	5.05	1.16
5	7416	7344	7224	7392	-0.32	0.65	2.33
6	15336	16272	16152	16152	5.32	-0.74	0.00
7	20376	20400	20520	20040	-1.65	-1.76	-2.34
8▲	1584		2208	2208	39.39	#DIV/0!	0.00
9	12552	12288	13320	13824	10.13	12.50	3.78
10	20376	20184	21192	21360	4.83	5.83	0.79
11	4200	4104	4152	4248	1.14	3.51	2.31
12	18072	19392	19872	20112	11.29	3.71	1.21
13	12192	12024	11832	11952	-1.97	-0.60	1.01
14	15648	16656	16416	16536	5.67	-0.72	0.73
15◆	18096	22008	21312	22224	22.81	0.98	4.28
16	26496	26256	26424	26592	0.36	1.28	0.64
17	29064	29256	29424	29688	2.15	1.48	0.90
18▲	15504		15864	15960	2.94	#DIV/0!	0.61
19	21048	21120	20328	21192	0.68	0.34	4.25
20	32232	31824	32640	34776	7.89	9.28	6.54
21	29736	30288	30840	30720	3.31	1.43	-0.39
22	9792	10824	10560	11064	12.99	2.22	4.77
23	21168	20904	22104	21984	3.85	5.17	-0.54
24	8976	9144	9192	9168	2.14	0.26	-0.26
25	13464	13512	13320	13368	-0.71	-1.07	0.36
26	22056	22248	22248	22344	1.31	0.43	0.43
27	21456	21528	21528	21744	1.34	1.00	1.00
28	12600	12696	12552	8832	-29.90	-30.43	-29.64
** 29	9408	10080	7920	9528	1.28	-5.48	20.30
30	20256	20592	20328	20352	0.47	-1.17	0.12
31	14784	14424	13968	13992	-5.36	-3.00	0.17
32	14568	15984	15264	14784	1.48	-7.51	-3.14
33	20640	21408	20736	19488	-5.58	-8.97	-6.02
34	16632	17472	16392	16056	-3.46	-8.10	-2.05
35	12528	13104	11928	12192	-2.68	-6.96	2.21
37▲	37824		42888	44424	17.45	#DIV/0!	3.58
38	8760	8952	8952	9456	7.95	5.63	5.63
39	22032	21840	22536	21696	-1.53	-0.66	-3.73
40	9744	9408	9312	9312	-4.43	-1.02	0.00
41	28292	26160	26808	30120	6.46	15.14	12.35
42	15168	15288	15624	15336	1.11	0.31	-1.84
43	28224	27600	30216	30768	9.01	11.48	1.83
44	12792	12888	12912	13056	2.06	1.30	1.12
50	6576	6696	6720	6792	3.28	1.43	1.07
51	32184	31008	32544	32880	2.16	6.04	1.03
52	11112	11520	11424	10896	-1.94	-5.42	-4.62
53	20904	21840	22152	21048	0.69	-3.63	-4.98
54	6600	10392	10440	10944	65.82	5.31	4.83
55	12408	18864	20616	19536	57.45	3.56	-5.24
56	-	-	5136	4752	#DIV/0!	#DIV/0!	-7.48
57	-	-	7632	8400	#DIV/0!	#DIV/0!	10.06
58	-	-	-	13344			

Table 3.12 AADT Percentage Growth 2013-2016

◆Site recut following resurfacing works 2013 ▲Sites affected by highway improvements/resurfacing during 2014

** Site shutdown for several months in 2015 due to mains gas leak

No significance should be taken from the data presented within table 39 above for sites 18, 29 data comparisons as these sites were affected by either gas main replacement works or resurfacing works with total data loss for significant periods. Similarly, site 37 data for 2012 and 2014 has been affected by highway alterations as part of the phasing of the Boulevard scheme and is not indicative of any trend.

Similarly, site 8 was removed during late 2013 to permit phase 1 of the Morfa Distribution Road to be undertaken whilst site 15 was affected by resurfacing works during 2013.

Site 24 has seen an increased flow during 2013 but again, no significance can be placed on the growth rate due to gas main replacement works along Carmarthen Road during 2012 distorting the AADT. The AADT for 2013 returned to normal.

Sites 50-53 are presented for information only and no significance should be placed on the growth figures for 2013 as these are based on an incomplete picture for the base year of 2012. Similarly, sites 54 and 55 only commenced monitoring during 2013 so the comparison to previous years is incomplete.

The details relating to the Swansea Metro project have been reported previously as significant highway alterations were undertaken to permit operation of the Metro service. The likelihood is that the metro route will be significantly altered within the city centre within coming years as part of the ongoing review. A limited revision of the adopted layout for the metro service has already commenced along Westway outside the Quadrant Bus Station in the city centre during 2016. Whilst the vehicles used to operate the Metro service have ceased to operate, the service itself remains but is now operated with conventional single decker buses.

Swansea Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

Swansea Council confirms that all the following have been considered:

- **Road traffic sources**
- **Other transport sources**
- **Industrial sources**
- **Commercial and domestic sources**
- **New developments with fugitive or uncontrolled sources.**

4 Local / Regional Air Quality Strategy

Air quality was highlighted in the *Swansea Environment Strategy: Time to Change*, which was published by Swansea Environmental Forum (SEF) in 2006. One of the Strategy's five themes is Sustainable Transport and Air Quality – the combination of these two issues reflecting the fact that transport is the main cause of air pollution problems in Swansea. Two of the twenty two strategic priorities in the document relate to air quality – ST3: *Improve air quality and reduce air pollution* and ST4: *Improve air quality monitoring and reporting mechanisms*. A number of air quality measures are also used as indicators for the Strategy and these have changed and increased in number over the last decade as air quality monitoring has developed.

The Strategy and accompanying biennial action plans are reviewed every two years and in most of these reviews the strategic priorities for air quality have received a red or amber RAG status. In the most recent review, the two priorities received amber status and the summary report commented that *"Air quality in Swansea is still a concern and as inner city dwellings and café type environments increase then the number of people exposed to poor air quality may also increase unless traffic can be reduced or diverted."* The Swansea Environment Strategy and associated action plans and reviews can be accessed from the Swansea Environmental Forum website: www.swanseaenvironmentalforum.net

In 2008, air quality was also selected as one of five local environmental issues identified by SEF as requiring greater prioritisation and wider collaboration in order to effect progress. In 2009, SEF convened a task group of officers from various council departments and services to share information on air quality issues and draft an air quality improvement action plan. The task group meetings were chaired by the Director of Environment (who was also, at the time, chairperson of SEF).

The draft air quality improvement action plan lists eight aims, in order of priority:

1. Develop traffic management systems to reduce air quality impacts
2. Improve monitoring and reporting of air quality

3. Ensure air quality issues are considered in planning processes and major development schemes
4. Reduce the direct impact of the council and partner organisations on air quality
5. Reduce the impact on air quality from journeys to schools
6. Encourage improvements to public transport
7. Arrange research projects to support air quality improvement schemes
8. Reduce air pollution from other sources

The task group met on several occasions throughout 2010 and 2011, sometimes inviting presentations from outside bodies and organising, in partnership with SEF, a seminar on Low Emission Zones, which attracted a wide audience. Though the task group did not meet during 2012, the group did reconvene in September 2013 to review the action plan. The phrase ‘promote cycling’ was added to action no.6. The group has not met since.

SEF has sought to maintain air quality as a key strategic priority in overarching strategic documents such as *Ambition is Critical* (the community strategy for Swansea) and its successor, the One Swansea Plan (the Integrated Plan for public service delivery in Swansea). Air quality indicators have been used in connection to these and their related needs assessment documents. In 2015, air quality was included as a ‘Challenge’ (one of 22 key priorities) in the One Swansea Plan and was retained as such in the 2016 update. The latest version of the One Swansea Plan is structured around a series of driver diagrams with a secondary driver labelled ‘Improve and maintain air quality’. This will be further explored and developed over the next twelve months as the public sector works towards the Wellbeing Plan (which will supersede the Integrated Plan).

Air quality improvements also feature in the goals of Swansea Healthy City initiative. A new Healthy Urban Environment (HUE) group, which oversees progress in Swansea with Theme 4 of Phase VI of the international Healthy City programme. HUE has prioritised the proposed city centre developments as its priority focus for the next year and air quality is included in its action plan.

Also, to 'Improve and Maintain Air Quality' has been included with Outcome F: People Have Good Places to Live, Work and Visit as part of Swansea's Assessment of Local Well-Being 2017. The Assessment of Well-being 2017 can be found via 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

The Well-being Plan will be produced by May 2018.

5 Planning Applications

Details of all major projects known of are summarised below as some developments have the potential to impact upon air quality. In the main, these impacts will largely have been/ will be resolved through the planning process. Some development sites have been completed while others remain either in the early stages of construction or of the planning processes. These details have previously been reported fully within the Updating and Screening Assessments and Progress Reports and the details can be found within the various reports at http://www.swansea.gov.uk/article/2850/Local-air-quality-management-reports.

5.1 The Tawe Riverside Development Corridor

Proposals for the Tawe Riverside Development span a large area of former derelict industrial land and currently occupied commercial sites from Quay Parade Bridges up to, and beyond the new Liberty Stadium and Morfa Retail Park area of the lower Swansea Valley. The proposals include some housing development sites as well as mixed use sites. All details relating to this development corridor are identified and discussed here as to split the developments may detract from the overall scale of the proposals and significance that the authority is placing on the regeneration of the lower Swansea Valley/Tawe Riverside area. The development area can be seen within figure 5.1 below[41]. The Morfa Road and Hafod Copperworks proposals fall within the existing Swansea Air Quality Management Area 2010.

The River Tawe Corridor provides a series of distinct locations linked by the river and its rich industrial past. The Tawe forms part of the Swansea Waterfront concept, which is of national importance. The concept seeks to integrate the City Centre, Maritime Quarter, SA1 and the River Tawe corridor to allow the creation of a high density, mixed use, modern core for the City. The riverside corridor area provides the next significant opportunity to create a new place in the City for living, working and visiting, capitalising on the heritage importance of the area, which is a key theme linking the development of the area, and the potential of the river for visual interest, leisure and recreation. The Tawe Corridor provides a new sector of the city between

[41] Tawe Riverside Corridor Study Development and Transport Assessment Final Report June 2006 Hyder Consulting

the Waterfront and City Centre and links the modern developments at Morfa to the City Centre.

These proposals have the potential to impact significantly on air quality both within the existing Swansea Air Quality Management Area 2010 and outside. An internal working group has been established in order that discussions can take place on how the air quality issues raised can be addressed as air quality objections have already been tabled in respect to certain parts of the master plan.

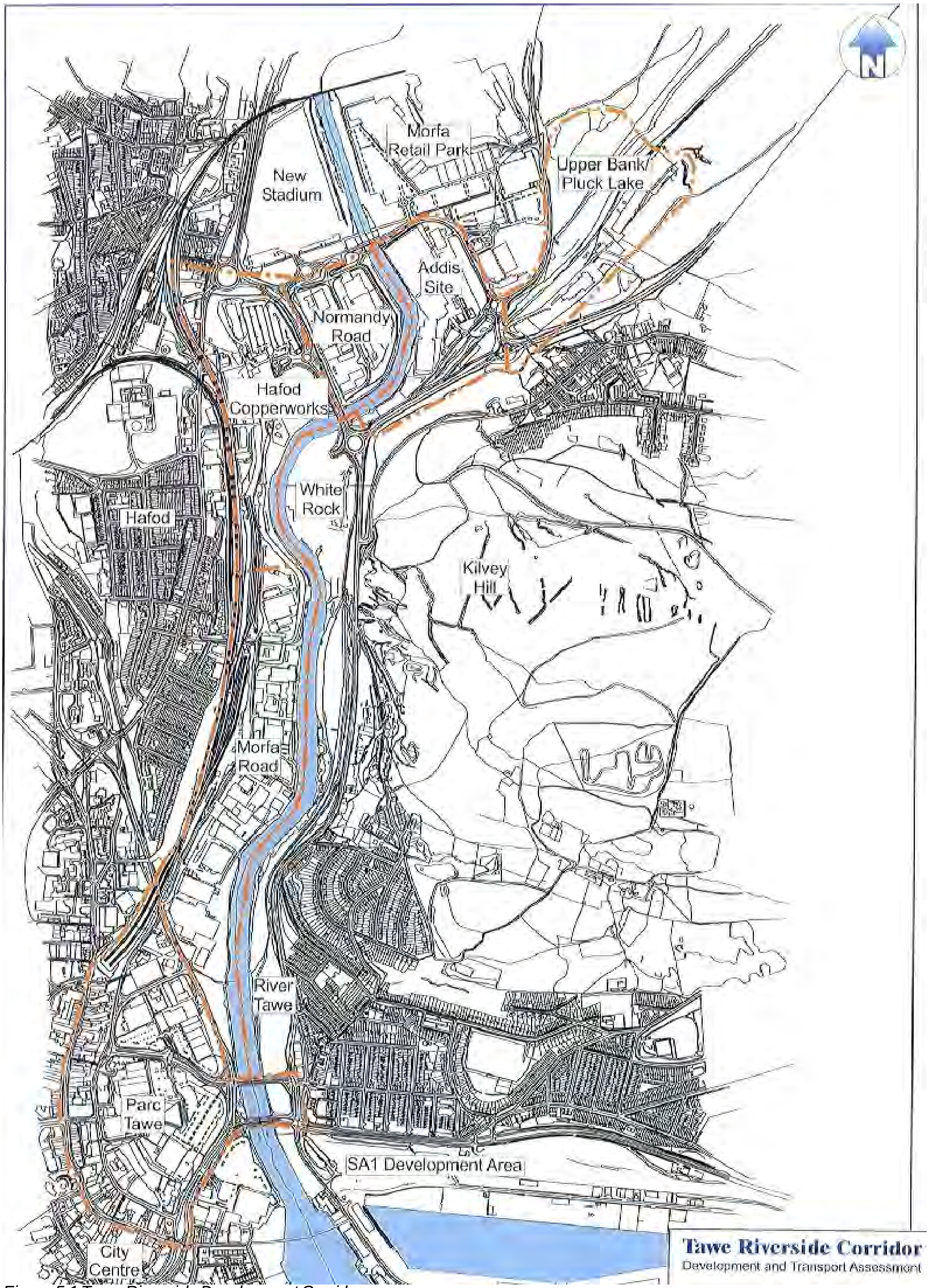

Figure 5.1 Tawe Riverside Development Corridor.

The Corridor is of immense importance in terms of its industrial past. The development area comprises the western edge of the former Hafod and Morfa Copperworks, which merged in 1924 and were acquired by Yorkshire Imperial Metals in 1957, and are therefore widely known as the YIM site. It lies on the west bank of the River Tawe, bounded to the west by the Swansea Canal, which was established in 1794-8 to open up the coal trade from the head of the Swansea Valley. Its presence encouraged the establishment of other industries, such as Hafod and Morfa Copperworks. No longer profitable by 1902, it became disused and finally closed in 1931. It was infilled, both naturally and deliberately, and was complete by the 1970s. Sections higher up the valley, at Clydach and Pontardawe, were still "wet" in 1988. In 2002, a study was undertaken by Atkins Consultants on the restoration of the Swansea and Neath-Tennant Canals. This developed a range of proposals for restoration, although it was not proposed to restore the canal within the development area to a working waterway given that significant sections are no longer in place.

Hafod Copperworks was established in 1810, the adjoining Morfa Works dating from 1828. A video detailing the history of the area has been compiled and can be viewed at https://www.youtube.com/watch?feature=player_embedded&v=ZpNgDYLQW7A

At its peak in the mid-19th century, Hafod was the largest Copperworks in the world, with the greatest output. Morfa's output followed closely behind and between them, the 13 Copperworks in the Lower Swansea Valley accounted for 90% of the world's copper production.

The two works merged in 1924 and were acquired as Yorkshire Imperial Metals in 1957. Copper working ceased in 1980 and the site was acquired by (then) Swansea City Council. Much of it was cleared. The A4067/A4217 Cross Valley Link Road was carried through the centre of the site in the early 1990s, and light industrial units established in the eastern half. In the 2000s, part of the site was occupied by the Landore Park-and-ride scheme.

To the south of these Copperworks, between Morfa Road and the River Tawe, were a number of other industries. These were largely established in the 19th century although the Cambria Pottery, at the south end of the development area, dates from 1720. It was disused by 1868 and has now gone. This area lay between the Swansea Canal and the River Tawe and was a natural site for a series of coal wharves, and wet- and dry-docks. Other industries developed in this area during the 19th century including a foundry, a nickel-cobalt works and a phosphate works. Many of them had closed by the earlier 20th century. The canal, wharves and docks were progressively disused and infilled during the 20th century, and much redevelopment took place, mainly comprising light industrial units. An area to the south, between Morfa Road and the River Tawe, during the 19th century, was the site of a number of subsidiary industries including two large and important potteries, in addition to the coal wharves and dry docks that served the port of Swansea.

The area is of crucial importance to the later history and development of Swansea. The Hafod and Morfa Works, two 19th century Copperworks were, during the mid-19th century, the largest in the world, with the greatest output. Hundreds were employed in these industries, and housed in purpose-built densely packed back-to-back terraced housing - notably, the Hafod area.

The area is also an important feature of the urban landscape. It is one of the very few assemblages of 18th-19th century industrial buildings that survive in Swansea. There are 11 listed buildings within the development area, and two Scheduled Ancient Monuments, alongside the incomplete remains of a large number of other structures and features.

The structural remains within the development area are not limited to listed buildings and Scheduled Ancient Monuments. There are the remains of further former structures, and former surfaces, which together increase the Group Value of the site. The extensive use of local building stone (Pennant sandstone), and indigenous copper slag blocks, are an important contribution to the ‘sense of place’. The geometry of the area and its relationship with the Swansea Canal and the river, is also important, and is still well preserved.

The protection of the surviving remains is seen as “the last chance” to preserve and interpret the industrial copper heritage of Swansea.

5.1.2 Summary of Area Strategies

The strategies for the development and regeneration of the parts of the development area are in summary:

Morfa Distributor Road

- The introduction of a new road between the A4067 (Hafod Site) to the Strand and New Cut Road (Morfa Road site) to have a “distributor route” function to serve development in the area, enabling maximum development opportunities with minimum environmental impact, particularly on industrial heritage;

Morfa Road Area

- Altering the balance of uses in the Morfa Road area from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses. The development would thus capitalise on the superb riverside setting, the proximity of the area to the City Centre and waterfront and also celebrate and interpret the heritage of the area.

Hafod Copperworks Area

- An integrated, mixed use development of Hafod Copperworks, which:
- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings, to ensure the heritage importance of the area is fully celebrated;
- capitalises on the waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;

- provides for park and ride links to the City Centre; and
- provides a high quality living environment with strengthened links to the existing Hafod community.

Normandy Road Industrial Estate

- The retention of Normandy Road Industrial Estate as a location for employment and industry, whilst visually enhancing the site, reducing the visual impact on adjacent land uses and investing in improvements to properties to raise the quality of the estate.

Addis Site

- The redevelopment of the Addis site for residential uses as the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site. Development of this site commenced during 2006 with the former factory units being demolished and the site remediated. Construction works commenced late 2006/early 2007 but ceased during 2009 due to the economic downturn. In 2010 works recommenced at the site with several new blocks being erected. Development has continued throughout 2015.

Upper Bank/ Pluck Lake

- Encouraging a compatible mix of land uses to regenerate the Upper Bank site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- Accommodating the objectives and future plans of the Swansea Vale Railway Company and recognising the heritage value of the site; and

Recognising the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site

5.2 Morfa Distributor Road

The City and County of Swansea is proposing to introduce a new road from the vicinity of the existing junction between the B4603 and A4067 to the Strand and New Cut Road.

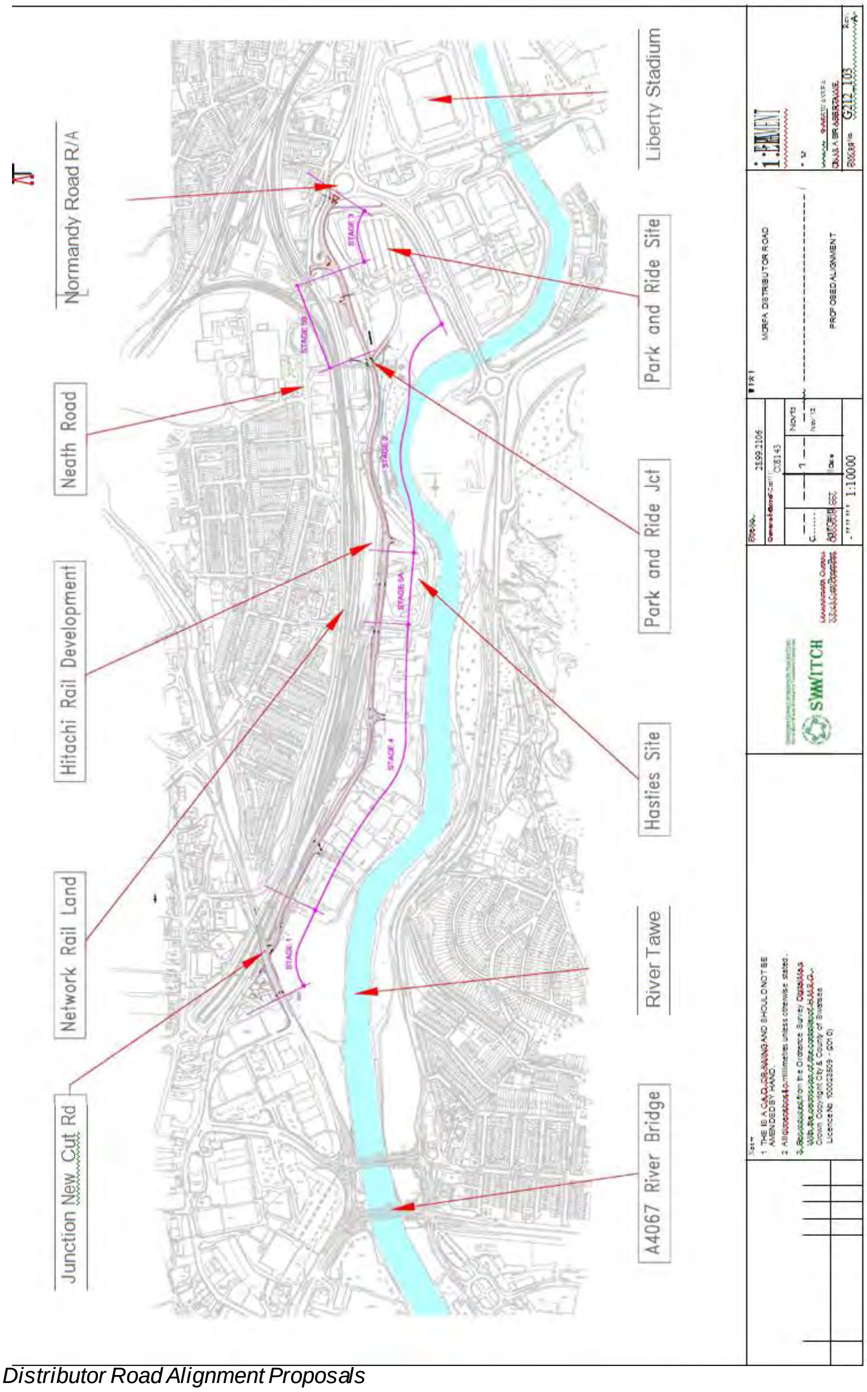

Figure 5.2 Morfa Distributor Road Alignment Proposals

It is intended that the road would have a “distributor route” function aiming to serve development in the area. Figure 5.2 above shows the Distributor Road proposals. Alternatives to this route have been investigated by the Highway Authority as part of the development proposals. This is to ensure that the route chosen enables maximum development opportunities in the Hafod/ Morfa Road area with minimum environmental impact, particularly on industrial heritage, as well as providing the distributor road.

The majority of the route runs along the line of the former Swansea Canal.
As a result, significant works have been undertaken to assess the existing ground conditions and mitigate any impact on nearby listed structures

Stage 1- The Authority’s Highway Construction Unit has completed during early 2014 the first stage of the Morfa Distributor Road scheme. This involved the reconfiguration of the junction between New Cut Road and Morfa Road to accommodate predicted future traffic flows and to provide improved pedestrian crossing facilities. The works extend up to the frontage of Pipehouse Wharf and will be progressed along Morfa Road in conjunction with future redevelopment of adjacent sites.

Stage 2 - Recent work has focused on reconciling the planning applications and proposals submitted by PMG Development at the Hastie’s Site and by Hitachi Europe Ltd at Network Rail’s Maliphant St Depot, which will enable the release of land required for the Distributor Road.

Enabling works are now progressing in parallel with the detailed design of Stage 2. This utilises additional site investigation information and Stage 2 will provide a route from the existing Park and Ride bus route to the entrance of PMG’s site. This is integral to the development of the PMG site which is identified for residential use. The design is also being adapted to accommodate potential development works at the adjoining Copper works Site. Proposals will enable key linkages for potential visitors to this important historic area. The main construction of this stage will not commence until dedication of land has taken place and until sufficient funding is available from the developer’s financial contribution and / or

Regional Transport Plan Grant funding.

Stage 3 - Traffic modelling work is currently underway to help develop a design that will maximise flows through the junction, whilst maintaining bus priority arrangements. The design is being developed so as to ensure that the majority of the works can be developed outside of the existing highway boundary, thereby limiting the impact on the highway network during the construction process

Stage 4 - The majority of works involve enhancements along the existing length of Morfa Road. These are to be delivered in conjunction with the proposed development of the adjoining sites. Key access points have been identified to permit development adjacent to the route whilst maintaining traffic flows along what will be a key distributor road.

Stage 5 - Stages 5A and 5B will provide the final linkages, connecting the Distributor Road as a through route. These elements will not be undertaken until all other stages are complete, so as to ensure that the road and junctions linking to the existing network are safe and sufficient to cater for the proposed highway demand. This work was completed in August 2017.

It is envisaged that the link under the railway from Maliphant Street would become for pedestrian and cyclists only, and be enhanced. This could include painting or cladding of the underside of the bridge in a light colour, a shared surface for cyclists and pedestrians which also allows emergency access, new signing and lighting.

• 5.3 Morfa Road Area

Morfa Road presents a significant opportunity for redevelopment, capitalising on the riverside setting, the proximity of the area to the City Centre and waterfront and also to celebrate and interpret the heritage of the area. The strategy for the regeneration of the area is to alter the balance of uses from light and heavy industry and dereliction, which ignores the river frontage, to a high quality mixed area of residential, commercial and light industrial uses.

While the land uses provide the framework for development, it is envisaged that the City and County of Swansea will take a flexible view of the use of each site, taking into account any changes in the market situation and the aspirations of land owners. Thus in the longer term, should market conditions change, the majority of the sites in the area may be redeveloped for housing and this is also considered to be acceptable.

The strategy is to be achieved through the provision of a master plan that sets the framework for investment by the private and public sector in the area and is shown within figure 5.3 below.

Figure 5.3 - Morfa Road Area Master Plan

The overall design concept is for:

- a mixed use development of individual sites according to land ownerships;
- the prime focus of each development site being orientated towards the river;
- a network of routes for pedestrians focussed on the riverside walkway/ cycleway with links through the sites at key locations to Morfa Road;
- a secondary focus to development sites to the centre of each site, giving a more intimate scale to the living environment. The central parts of site would be the location for any community facilities and local open space;
- traffic access from Morfa Distributor Road into each site. Within the sites, residential development in accordance with the 'Home Zone' principle of shared pedestrian and vehicular surface, designed for a speed of 10 mph.

The master plan incorporates the following elements:

- An upgraded Morfa Road to a distributor road standard, linking from the north between the Hastie Site and the railway. The road link is proposed to have a limited number of junctions, the locations for which have been chosen to enable phased development in accordance with the various land ownerships.
- A riverside walkway and cycle route of minimum width of 6 metres. This would provide continuous access from Parc Tawe through to the Hafod Site. A footpath is in place for the majority of the route at present, with the exception of the Swansea Industrial Components site. Moreover it is currently impassable in places due to overgrowth and there is no barrier to protect users along the river edge.
- The provision of a new pedestrian and cycle bridge across the Tawe between the areas of open space south of the former Unit Superheaters site, across to the former St Thomas Station site. This,

together with a similar facility shown for the Hafod Site, would enable use of both sides of the river bank, connecting to the National Cycle Route on the east bank and link the Morfa Road area to the St Thomas community;

- Mixed-use development of the sites including approximately 360 homes, enhancement and some new development of light industrial uses and trade counter uses; retention of the Dragon Arts Centre facility and approximately 23,000 m^2 of office space. Specifically:
  - Residential development of the former Unit Superheaters, Swansea City Highways Depot and Hastie site (7.3 ha, approximately 360 dwellings at a density of 50/ha);
  - Light industrial uses or trading counter uses on the Bevan and Gladeborough sites, involving a mix of enhancement of existing buildings and new development (2.7 ha, approximately 13,500 m^2 of industrial/ trading space);
  - Residential development of the former dairy site.
  - Retention of the Dragon Arts Centre facility;
  - Light industrial uses on the Swansea Industrial Components site, possibly comprising a single large factory unit of 5,500 m^2/ 60,000 sq ft; and
  - Retention of light industrial units on the GLT Exports site.

The master plan also illustrates the potential for an element of local needs convenience shopping, open space, and a public house/ café making up part of the overall development as illustrated.

Works commenced during late 2010 /early 2011 to the area formally occupied by Unit Superheaters and continues to see the development progress during 2015 with the construction of a multi storey block of student flats. This site fronts New Cut Road and Morfa Road and is adjacent to the existing Council transport unit at Pipehouse Wharf.

5.4 Hafod Copperworks Site

The Hafod Copperworks Site or Yorkshire Imperial Metals (Y.I.M.) Site is a site of international importance in industrial history and has the potential to help tell the story of Swansea's development over the past three hundred years, provide a place for public enjoyment of the riverside, and a new place for living and working.

The site has lain largely vacant for several decades however, the industrial monuments are deteriorating and certain buildings are at serious risk of loss. The site is the last opportunity to preserve and interpret the City's industrial history.

The strategy for Hafod Copperworks is for an integrated, mixed use development which:

- preserves heritage structures, interprets industrial history and finds new uses for heritage buildings;
- capitalises on the waterfront location and strategic proximity to the stadium by the introduction of a hotel and restaurant/ bar/ café uses, bringing economic vitality back to the river frontage by day and evening;
- provides for water transport links and recreation, in particular a ferry stop to enable the site to be linked to the Swansea Waterfront and the National Museum;
- provides for park and ride links to the City Centre; and
- provide a high quality living environment with strengthened links to the existing Hafod community.

The strategy is to be achieved through the master plan that sets the framework for development of the site. The overall design concept for the Hafod Copperworks site aims to:

- create a stimulating contrast between the dispersed historic buildings and structures and contemporary architecture and activities, all set in a consistent landscape theme;
- exploit the riverfront and differences in level to create memorable views and a sense of drama;
- establish a pattern of mixed uses which will help create vitality, day and evening, particularly on the waterfront;
- organise linkages into and through the site which will be convenient, safe and secure;
- maximise the development potential of the key riverside site; and
- minimise the potential impact of the railway.

A master plan has been developed for the Hafod site, based on the proposed route of the distributor road with the crossing from White Rock and can be seen below in figure 5.4.

Figure 5.4 Hafod Copperworks Development Site

The main elements are:

- a new river crossing for traffic with an alongside pedestrian and cycle route, from White Rock to a roundabout junction south of the Musgrove Engine House;
- an extension to the existing park and ride scheme (300 additional spaces);
- Mixed use waterfront development – a mixed development of apartments, hotel and public house/ restaurant;

- High density housing on two sites either side of the former canal route (approximately 100 units);
- Restoration of the canal as a landscape and heritage feature with a walk along the route;
- Creation of a public space on the river front, giving setting to the Engine Houses and a location for a river ferry stop;
- Continuous walking and cycling route from the footbridge south along the riverfront;
- The consolidation and re-use of the listed buildings and Scheduled Monument within the site:
  - Further development of the Museum Stores for public access, with car parking and pedestrian routes from Neath Road;
  - Consolidation and refurbishment of the Laboratory and Canteen Buildings for commercial use, such as eating and drinking;
  - Consolidation and interpretation of the Musgrove Engine House for public access; and
  - Commercial uses in the Vivian Engine House.

The master plan sets out the potential form of development, but within the framework there is some flexibility to respond to demands for other uses. In particular, there may be potential demand for alternative uses, such as:

- Student and potential key worker accommodation;
- A residential care home;
- Social low cost and specialist housing, including older person accommodation, family accommodation and special needs bungalows.

A new doctor's surgery/medical centre to replace one surgery potentially requiring relocation in the Hafod.

5.5 Addis Development Site

The Addis site occupies a strategic location adjacent to the Morfa Retail Park. The site was formally occupied by the Addis factory, which produced plastic household goods. It was acquired by PMG Developments Ltd who sought planning permission for the redevelopment of the site for residential uses. The redevelopment of the site for residential will be the next stage in forming a truly mixed use and high quality part of the riverside – with leisure, retail, industrial and residential uses, whilst respecting the heritage importance of the site (notably the listed industrial building and Bascule bridge)

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A planning application was submitted in January 2006 by Holder Matthias Architects for the redevelopment of the site with construction of 564 residential units including:

- 8 no five storey blocks of 296 residential apartments along the riverside;
- 146 apartments in 2 and 3 storey blocks;
- 122 terraced 2 and 3 storey dwellings; and
- retention of the listed building in the centre of the waterfront area, with future uses to be determined.

The application includes for access, car parking (including under croft), landscaping, open space and infrastructure works including a new riverside cycle path/ walkway.

The overall design concept is to develop a strong river frontage with blocks of apartments and a new riverside walkway and cycleway, graduating eastwards to lower rise two and three storey town houses and terraces. The development uses the principles of a home zone, with access within the site as shared surface between pedestrians and vehicles. The housing design has the majority of properties fronting directly onto the street with gardens to the rear in courtyards/ enclosed spaces. Images of what the development may look like are included as Figures 5.5 and 5.6.[42] The Master plan for the site produced for the application is included as figure 5.7.

[42] Images courtesy of Hyder Consulting Final Report Taw e Riverside Corridor June 2006

Figure 5.5

Figure 5.6

- Works commenced during late 2006/early 2007 with the five story blocks closest to the A4217 (blocks E, F, G and H). During late 2007 the first of these blocks were occupied. Development has recommenced after a short period of inactivity during 2011 due to uncertainty within the housing sector as a result of the financial crisis. Further areas of the site have now been cleared during 2015 and construction of other dwellings within the overall scheme is well advanced.

Figure 5.7 – Former Addis Development Site

5.7 Upper Bank/Pluck Lake

Upper Bank represents one of the few predominantly underused sites in the area occupying a key location overlooking the redeveloped area of Liberty Stadium and Morfa Retail Park. The opportunity now exists to regenerate the site, connecting to the key development land and transport links in the area, whilst promoting a mix of different land uses.

The last remaining section of the Swansea Vale Railway runs through the centre of the site and is occupied by the Swansea Vale Railway Society. The Society has a vision to create a Railway Heritage Centre. The majority of the Upper Bank site is however in a state of considerable dereliction. The adjacent Pluck Lake area is an important amenity area and ecological resource.

The strategy for the future development of the site is to:

- encourage a compatible mix of land uses to regenerate the site, removing the current areas of dereliction and contributing to the regeneration of the wider area;
- accommodate the objectives and future plans of the Swansea Vale Railway Company and recognise the heritage value of the site;
- recognise the amenity importance of Pluck Lake and Kilvey Woodland, whilst bringing selective development into the area to improve the attractiveness of the site;

The overall design concept for the Upper Bank/ Pluck Lake site aims to:

- maximise the commercial development potential of the site;
- exploit the differences in level to provide attractive views out from the site to the west;

- establish a pattern of viable mixed uses which will create an attractive living environment and complement the regeneration of the wider area;
- enhance the role of the site in telling the story of Swansea's industrial heritage;
- improve linkages to the Pentrechwyth community and the Kilvey Community Woodland.

The master plan for the site is illustrated in figure 5.8 below and includes:

- A new access westwards from a proposed roundabout junction on Nantong Way;
- A mix of affordable and general housing, totalling approximately 125 units;
- A roundabout junction providing access into the housing areas and railway heritage area;
- Relocation of the Railway Society operations with provision to enable future phases of development of a heritage centre; and
- Potential development site for a hotel south of Pluck Lake

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The master plan as proposed would release a significant parcel of brownfield land for housing development. The area of housing land identified on the plan would amount to 3.19 hectares.

- The site would be sensitively integrated with the adjacent rail land and the amenity of the future occupiers will be safeguarded from any of the potential impacts of the rail activity by close attention to a green buffer between the two.

Figure 5.8 Upper Bank/Pluck Lake Development Site

The master plan includes the provision of an area to safeguard the future operations and expansion of the Railway Society site. The proposal includes the recommendation that the site redevelopment includes for implementation of Phase 1 works (by negotiation between the Railway Society and City and County of Swansea) to enable the Railway Society to continue their current operations of upgrading the remaining section of the Swansea Vale Railway and restoring the locomotives and rolling stock within a covered modern industrial unit. The proposals would also enable the Society to fully explore the feasibility of establishing a shuttle service between the two terminals at Upper Bank. This will require basic facilities at either terminal, but will help to establish a revenue stream for the Society and the impetus to progress subsequent phases.

Site clearance commenced during early 2013 in preparation for implementation of the scheme. Construction works commenced during early 2014 and have continued during 2015 and the early months of 2016.

5.8 Former Walkers Crisp Factory, Pontarddulais Road

The proposals for this former industrial complex include partial demolition of the rear portion of the existing factory building, to provide 107 residential dwellings (comprising 12 detached dwellings, 14 semi-detached dwellings, 3 blocks of 14 no. terraced dwellings, 4 blocks of 67 no. flats) parking and associated works.

The site fronts onto the busy A483 and north of the boundary of the Fforestfach Air Quality Management Area that itself forms part of the Swansea Air Quality Management Area 2010. The site is adjacent to the Pontarddulais Road Retail Park and opposite the Parc Fforestfach Retail Park with the Swansea West Industrial Park located off the A483 approximately 550m to the south. Figure 5.9 below outlines the proposed development site. As of early 2016, the development has not commenced.

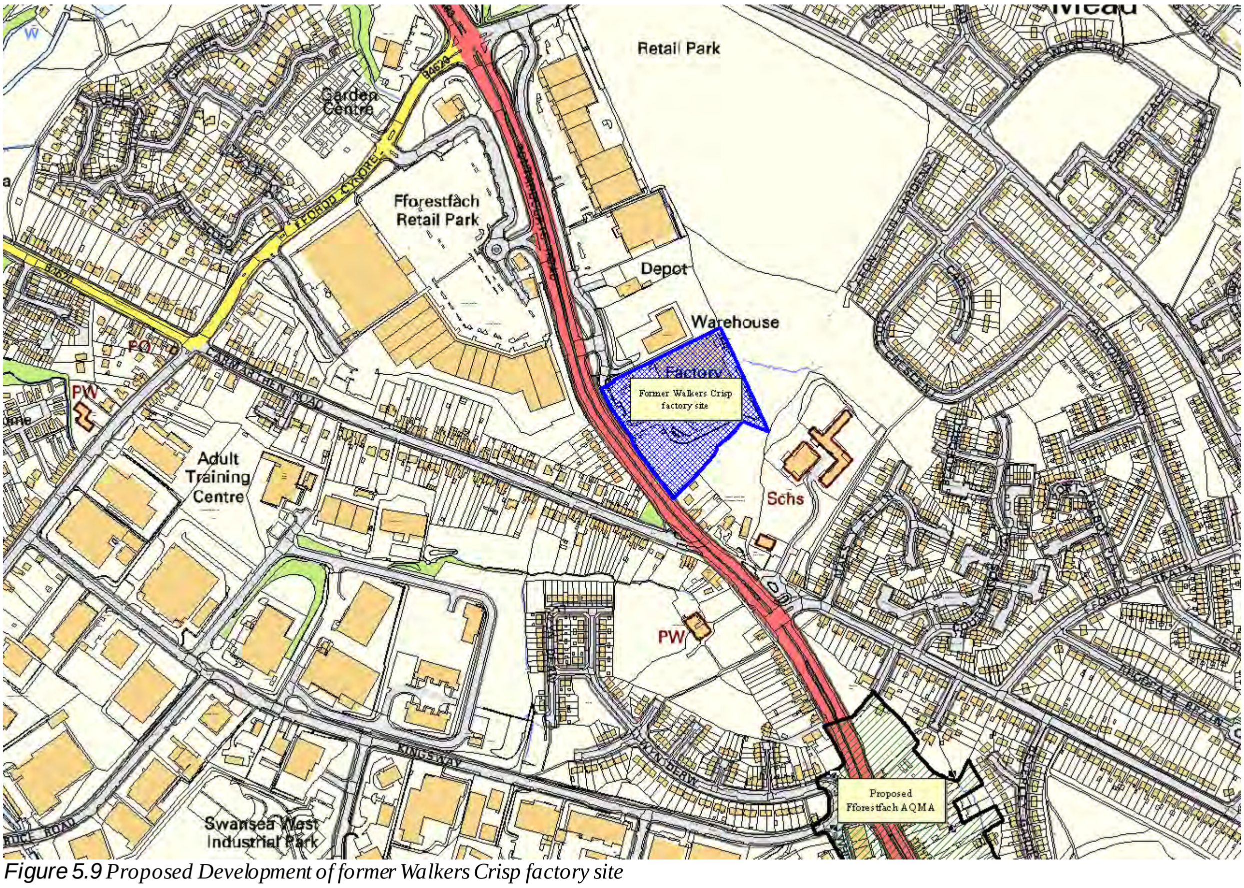


Figure 5.9 Proposed Development of former Walkers Crisp factory site

5.9 Liberty Stadium Expansion

A Planning Application was submitted by Swansea City AFC (ref 2013/0554) to expand the Liberty Stadium, Landore, Swansea from 21,600 seats to 34,000 seats.

The proposed development was planned to be split over three phases:-

- Phase 1 provides an additional 3,844 seats and was proposed be completed in time for the start of the 2014/2015 season.
- Phase 2 will provide a further 4,718 seats and was proposed to be available for the start of the 2015/16 season
- Phase 3 will provide an additional 3,383 seats and was proposed to be constructed after the 2015/16 season.

The application site lies within the Swansea Air Quality Management Area 2010 and has the potential to generate additional traffic movements on match days. Air quality considerations are being dealt with by way of the Travel Plan submitted as part of the application. The primary aim is to intercept travelling spectators some distance away from the stadium area and direct them to Park and Ride sites – both home and away supporters. Numerous items are under consideration including discounting the park and ride as part of season tickets etc. The application was approved during early 2014 but as of early 2016 the works are yet to commence. Further updates will be provided in due course.

A map of the proposed development location is given below as figure 5.10. The Swansea 2010 Air Quality Management Area is highlighted as the shaded area.

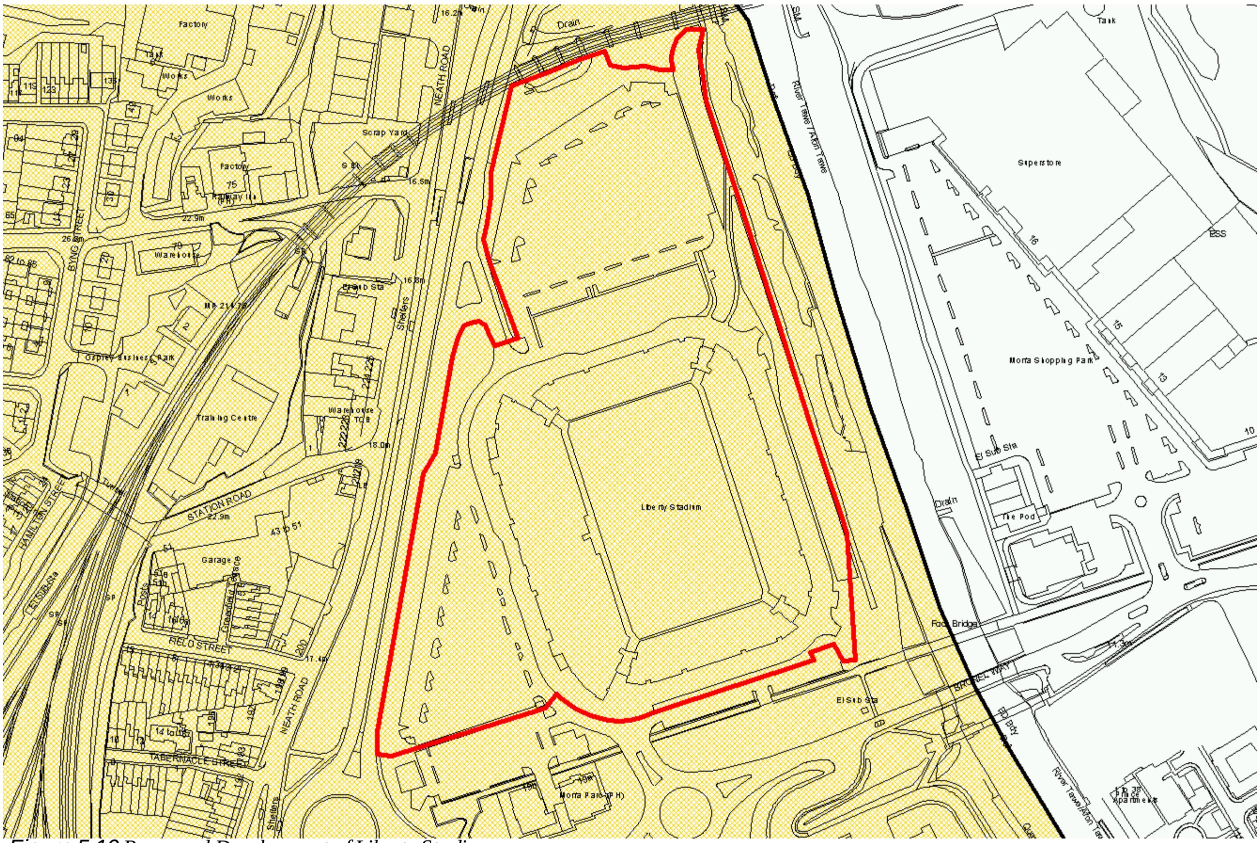


Figure 5.10 Proposed Development of Liberty Stadium

5.10 Additional Planning Applications Received

Lists of additional planning applications received where the scheme could possibly impact upon local air quality are listed below within table 5.1.

App Ref. No.	Location	Description
2016/0083	62 The Kingsway, Swansea SA1 5HN	Change of use of part of first floor and second floor from offices (Class B1) to 7 self-contained flats and formation of new ground floor entrance door
2016/0408	15-20 Castle Street Swansea SA1 1JF	Change of use, conversion of existing first and second floors and erection of two new floors to create 44 live/work units (Class C3/B1) and associated works
2016/0526	Hendrefoilan Student Village Hendrefoilan Drive Killay Swansea SA2 7PG	Residential redevelopment - Discharge of conditions 4 (phasing), 10 (Construction Traffic Management), 12 (Construction Environment Management), 13 (Construction Waste Management), and 19 (Aboricultural Method Statement) of planning permission 2014/1192 granted 6 January, 2016
2016/0392	Plots E2 And E3A Langdon Road Swansea Docks Swansea SA1 8QY	Residential Development - Discharge of conditions 2 (Finishes),3 (Building details), 4 (Enclosure), 5 (landscaping), 8 Contamination), 10 (Monitoring), 12 (CPMP), 13 (Site Waste), 14 (CTMP), 17 (Satellite system), 18 Archaeology), 19 (Drainage), 21 (Road Construction), 22 (Travel Plan)and 23 (Pedestrian crossing) of planning permission 2015/1107 dated 19th February, 2016
2016/0521	22A Princess Way Swansea SA1 3LW	Change of use of public conveniences to residential (Class C3 & C4) at first floor and commercial at ground floor (Class A1, A2, B1 & D1) and associated external fenestration alterations
2016/0556	Mariner Street Car Park, 2-3 Mariner Street, 59-60 And 63-64 High Street, Swansea	Demolition of existing buildings on site and the construction of a purpose built student accommodation building between 6, 8 & 22 storeys (725 bedrooms comprising 145 studios & 105 cluster units) with ancillary communal facilities/services, 4 no. ground floor commercial units (Classes A1 (retail), A2 (Financial/Professional), A3 (Food and Drink), B1 (Business), D1 (non-residential Institution), and D2 (Assembly/Leisure), car parking/servicing area, associated engineering, drainage, infrastructure and landscaping works
2016/0692	Plot D7, Langdon Road, Swansea	Construction of 23 no. four & three storey townhouses with associated access, car parking and landscaping works
2016/0987	First Floor Public Conveniences, Welcome Lane, Swansea, SA1 1HY	Change of use of former female public conveniences to four bedsit units (Class C3)
2016/1100	Land At New Cut/Morfa Road Swansea SA1 2EN	Phase 2 Student Accommodation - Discharge of conditions 1,3,9,10,11,17,21,22,23,27,28,29,31, 32 of outline planning permission 2007/2829 granted 19th December, 2008 and conditions 1,2,3,4,6 of revised planning permission 2015/1293 granted 17/08/2015

2016/1089	Land At Upper Bank Pentrechwyth Nantong Way Pentrechwyth Swansea Swansea	Construction of 19 dwellings (details of access, appearance, landscaping, layout and scale pursuant to planning permission 2006/1902 granted 6th July 2012)
2016/1046	Land At Ta Centre Park Road Gorseinon Swansea SA4 4 Up	Demolition of existing buildings and construction of a residential development for 37 dwellings comprising of 30 x one bedroomed flats, 6 x two bedroomed flats and one detached bungalow with associated access and landscaping works
2016/1320	36 Oldway Centre Orchard Street City Centre Swansea SA1 5AQ	Change of use of existing Oldway Centre 13-storey office building (Class B1) and upper floors of High Street block to student accommodation with construction of additional 2 storeys of new student accommodation to High Street block (556 bed spaces in total) with ancillary ground floor communal facilities/services, car/cycle parking & refuse store with external alterations to existing building envelope, and change of use of Unit No's 40, 41/42, 43/44, 45/46, 47 & 48 High Street to form a single unit - Classes A1 (Shops), A2 (Financial & Professional), A3 (Food & Drink), B1 (Business) and D2 (Assembly & Leisure)
2016/1427	Cwmbwrla School Stepney Street Cwmbwrla Swansea SA5 8BD	Demolition of former school building and construction of 49 flats, with associated access and landscaping works
2016/1472	Former British Legion Site, Newton Road, Mumbles Swansea	Mixed Use redevelopment with a ground floor 1295m2 retail food store, with 61 basement car park and 9 apartments at first and second floor with 15 associated car parking spaces
2016/1478	Land North Of Garden Village Swansea	Hybrid planning application (with all matters reserved apart from strategic access) for residential-led mixed use development, to be developed in phases, including: preparatory works as necessary including earthworks/regrading of site levels; approximately 750 residential units (use Class C3, including affordable homes); provision of 1 no. Primary school; circa 280m2 - 370m2 flexible A1-A3 / D1 floorspace; open space including parks; natural and semi natural green space; amenity green spaces; facilities for children and young people; outdoor sports provision including playing pitches; associated services, infrastructure and engineering works including new vehicular accesses, improvement works to the existing highway network, new roads, footpaths/cycleways; landscaping works (including sustainable drainage systems), ecological mitigation works and ancillary works
2016/1511	Plot A1, Swansea Waterfront, Swansea	Construction of purpose built student accommodation between 7 and 9 storeys (500 bedspaces) with ancillary community facilities/services, 1 no. Class A3 ground floor unit, car and cycle parking, servicing area, refuse store, associated engineering, drainage, infrastructure and landscaped public realm

2016/1573	Land At The Former Unigate Dairy Site, Morfa Road, Swansea	Demolition of existing on site building /structures and construction of purpose built student accommodation (up to 706 bedrooms) (Sui Generis) within an indicative access / layout of 5 blocks & scale parameters of 4 to 6 storeys with 4 No. ground floor commercial units of Block 1(A1/A2/A3 &B1) and 1 No. ground floor convenience retail store (A1) / 1 No. commercial unit (A1/A2/A3 & B1) of Block 2 together with ancillary communal uses including management / laundry / common room (D1 & D2 uses), car & bicycle parking/servicing area, associated engineering, drainage, related infrastructure and landscaping works (Outline Application - all matters reserved)
2016/1673	Sainsbury's, Quay Parade, Swansea, SA1 8JA	Installation of a combined heat and power plant including a 20m chimney flue and associated equipment
2016/3121	Land At Upper Bank Pentrechwyth Nantong Way Pentrechwyth Swansea	Reserved Matters application (Details of access, appearance, landscaping, layout and scale pursuant to outline permission 2006/1902 granted 6th July 2012)
2016/3473	Felindre Urban Village Land North West Of M4 J46 Porth Felindre Gateway Northern Section Llangyfelach Swansea	PRE APP for mixed development
2016/3498	Dr Organic Ltd Head Office Alberto Road Swansea Enterprise Park Swansea SA6 8RG	PRE APP for biomass energy centre
2015/1221	Tivoli Amusements 145 Mumbles Road And 512 Mumbles Road Mumbles Swansea SA3 4DN	Conversion and adaptation of the Tivoli Building to a mix of uses comprising 3 no. Class A1 general retail units and 1 no. Class A1 food retail unit on the ground floor, storage for Class A1 food retail unit together with 1 no. Class A3 restaurant unit on the first floor, 1 no health spa unit on the first floor intermediate mezzanine and 1 no. Class A3 bar unit on the second floor. The construction of 2 no. Class A3 units on adjacent land and reconfiguration of existing associated parking area and the subdivision of 512 Mumbles Road from 1 no. Class A1 food retail unit to 2 no. Class A1 general retail units. (Variation of condition 19 (imposed via non-material amendment application 2015/0846) attached to planning permission 2014/0681 in order to modify the position/design of Units 1 & 2)

Table 5.1 – List of Planning Applications Received

5.11 Swansea Local Development Plan 2010-2025

The City and County of Swansea Deposit LDP was presented to Council on 16 June 2016 and endorsed for a public consultation. The public consultation is now underway and will be ongoing throughout July and August 2016.

The full text can be viewed at http://www.swansea.gov.uk/ldpdeposit

The Deposit LDP presents a positive approach to managing the inevitable future growth and change that will occur within the City and County of Swansea. The policies and proposals set out in the plan address the county's need for new homes, jobs, infrastructure and community facilities to support economic growth and raise standards of living. Policies that promote development are set out alongside those that will ensure future proposals respect and promote the county's cultural heritage, important landscapes and sensitive environments.

The plan promotes a clear 'placemaking' agenda and strategy, and emphasises that future development must accord with the overarching aims of enhancing quality of life and well-being. Planning for growth that is commensurate with the aspirations of a City Region inevitably involves difficult decisions about releasing greenfield land for development. However, the Deposit LDP provides the opportunity to ensure that such development is of a quality and nature that will ensure the place that is ultimately delivered provides a proud legacy for future generations.

The Deposit written statement comprises:

- Overview and Strategy
- Policies and Proposals
- Monitoring Framework
- Proposals Map
- Glossary
- Appendices

The LDP Proposals Map comprises a series of maps covering all areas of the county, and features a variety of designations overlain on an Ordnance Survey base. These include sites and development areas described in the preceding policies and proposals. It also defines the settlement boundaries of the main urban area and key villages, beyond which are the areas considered open countryside, where most forms of development are not favoured. The Proposal Map designations include:

- Housing Sites (allocations and commitments)
- Strategic Development Areas
- District Centres and Retail Parks
- Mineral Safeguarding Areas
- Green Belt/Green Wedges
- Special Landscape Areas

Within the LDP 2010-2025 Strategic Development Areas (SDAs) are allocated at 12 locations to provide new homes and opportunities for job creation and commercial investment at a strategic scale.

Residential led SDA's are capable of accommodating a minimum of 500 homes, in accordance with the schedule of estimated units set out in this policy, and other complementary and supporting uses depending on the nature and scale of the site. Mixed use SDA's will provide new homes as part of wider mixed-use proposals to also deliver significant investment and economic benefit arising from commercial, community and/or cultural regeneration projects.

SDA's boundaries are defined on the Proposals Map and include areas that will not be suitable for development due to technical constraints, environmental sensitivities and/or site specific requirements, including public open space and infrastructure.

Six SDA's are capable of delivering a greater number of homes beyond the Plan period, as highlighted in the following schedule, the details of which are set out in the relevant site specific SDA policy:

Residential led Strategic Development Areas

Proposals Map Site Reference	Strategic Housing Policy Zone	Site Name	Estimated Units during Plan Period
A	Greater N west	South of Glanffrwyd Road, Pontarddulais	720
B	Greater N west	North of Garden Village	750
C	Greater N west	South of A4240, Penllergaer	750*
D	North	West of Llangyfelach Road, Penderry	1160*
E	North	North of Clasemont Road, Morriston	675
F	West	Cefn Coed Hospital, Cockett	500
		Total number of homes for residential led SDAs	4555

Table 5.2

Mixed use SDAs

Proposals Map Site Reference	Strategic Housing Policy Zone	Site Name	Estimated Units during Plan Period
G	Greater N west	Northwest of M4 Junc.46, Llangyfelach	850*
H	North	North of Waunarlwydd / Fforestfach	800*
I	East	Swansea Vale	750*
J	Central	Central Area and Waterfront	1000*
K	East	Fabian Way Corridor	525
L	Central	Tawe Riverside Corridor and Hafod Morfa Copper Works	370
		Total number of homes for Mixed Use led SDAs	4295

Table 5.3

*** Sites capable of delivering a greater number of homes beyond the Plan period**

The nature and scale of development for each SDA is set out in individual site specific policies (Policies SD. A-L), which define the Placemaking Principles and Development Requirements at each location. These include details of the necessary range of uses, infrastructure, open spaces and any distinctive attributes at each site

It is anticipated that SDAs will contribute around 75% of the allocations for residential development across the County over the Plan period. The anticipated number of dwellings capable of being delivered during this period are summarised in the schedule, however the precise number will have regard to the site specific masterplanning to be undertaken in support of any future planning application. The number of homes specified for each residential led SDA are considered ceiling figures for the period up to 2025 that should only be exceeded if appropriate evidence is submitted to demonstrate a rise in numbers is justified and appropriate having regard to comprehensive masterplans.

It is anticipated that SDAs will contribute around 75% of the allocations for residential development across the County over the Plan period. The anticipated number of dwellings capable of being delivered during this period are summarised in the schedule, however the precise number will have regard to the site specific masterplanning to be undertaken in support of any future planning application. The number of homes specified for each residential led SDA are considered ceiling figures for the period up to 2025 that should only be exceeded if appropriate evidence is submitted to demonstrate a rise in numbers is justified and appropriate having regard to comprehensive masterplans.

The Proposals Map defines the full extent of the SDA masterplan areas. In some cases sites are capable of delivering more homes than the numbers shown in the schedule, as highlighted in the Policy. However, it is expected that in such instances these sites will not be fully built out until beyond the end of the Plan period (i.e. after 2025). For the avoidance of doubt, the capacity for additional homes at these identified SDAs do not contribute to the housing growth figures for the Plan period, since evidence suggests that build rates are unlikely to exceed the numbers specified in the policy.

Proposals Map Site Reference: A

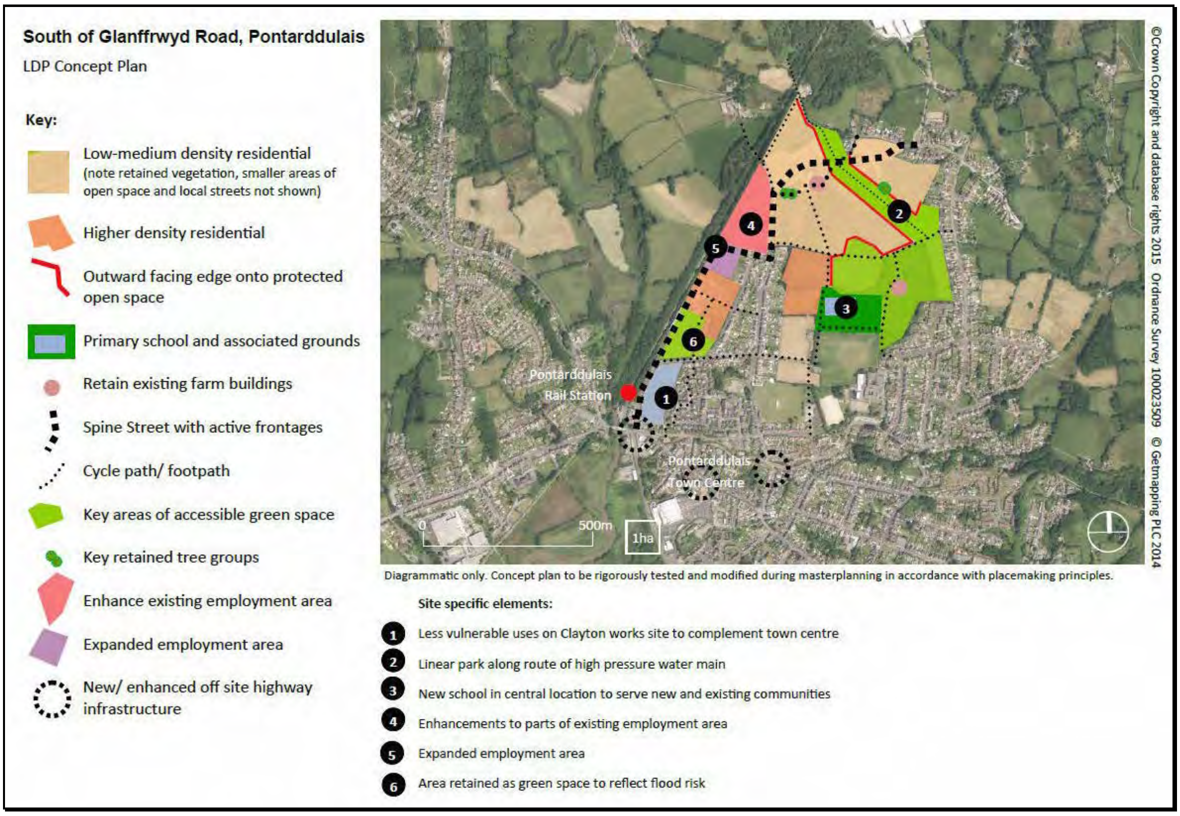


Figure 5.11

Proposals Map Site Reference: B

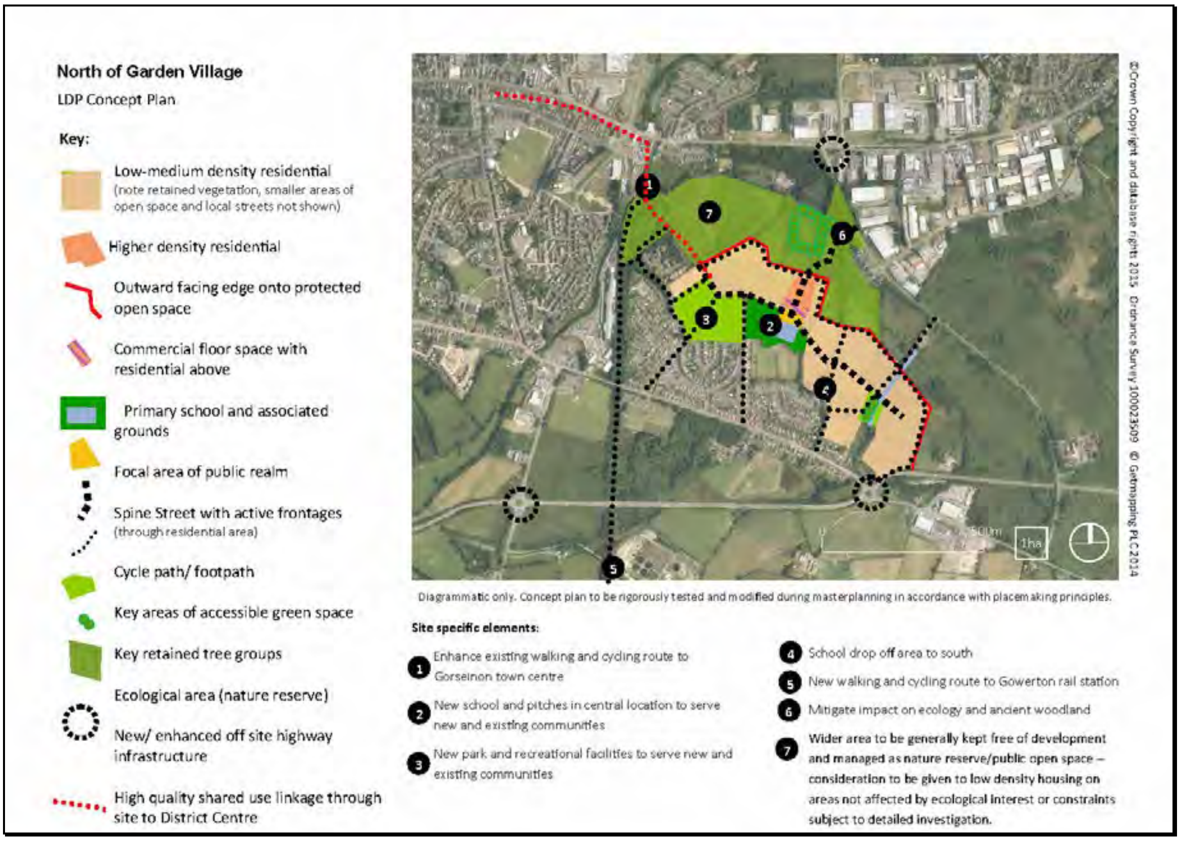


Figure 5.12

Proposals Map Site Reference: C

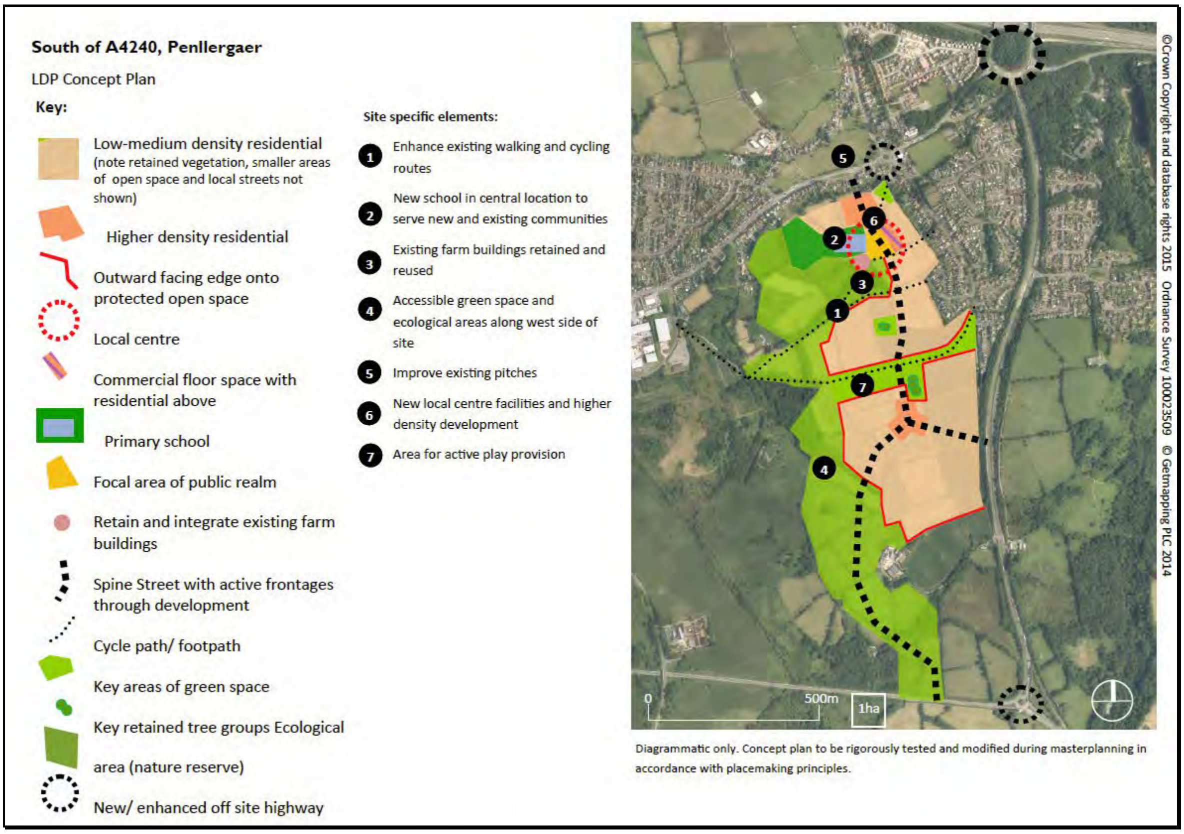


Figure 5.13

Proposals Map Site Reference: D

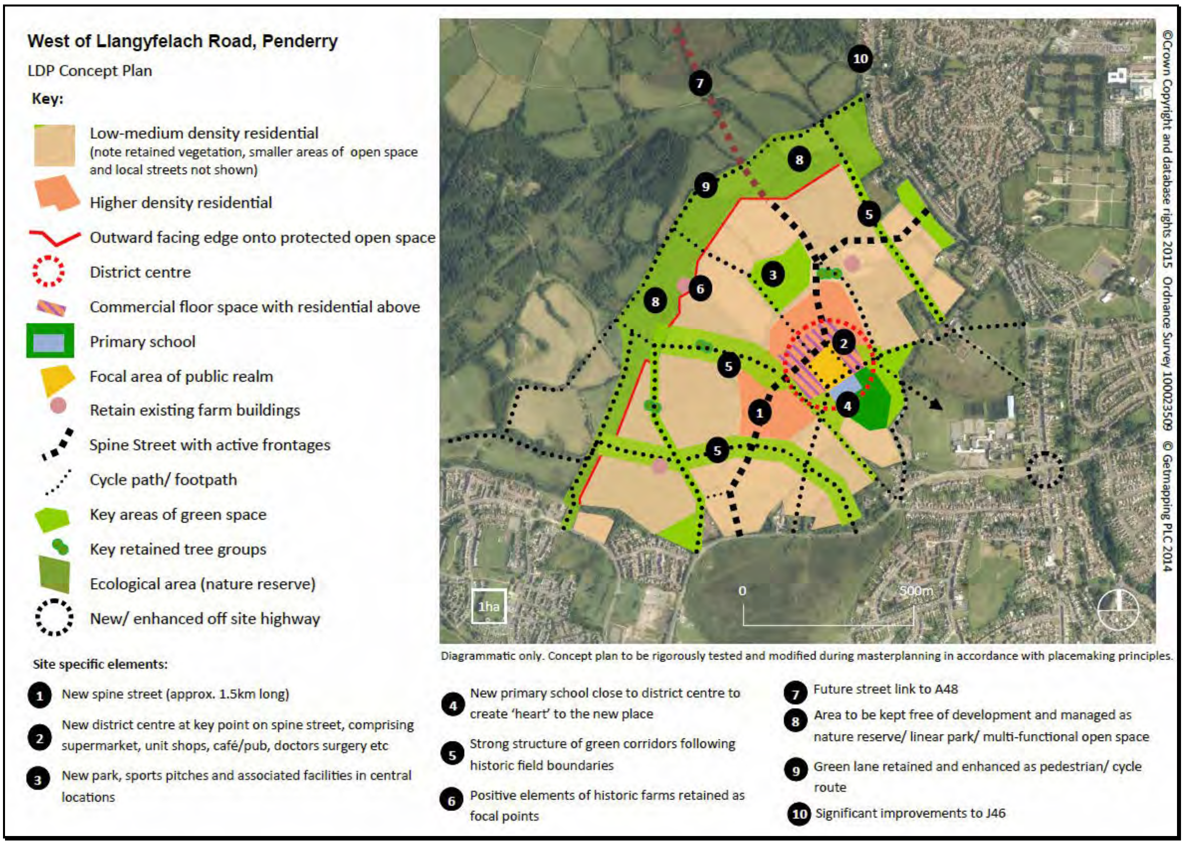


Figure 5.14

Proposals Map Site Reference: E

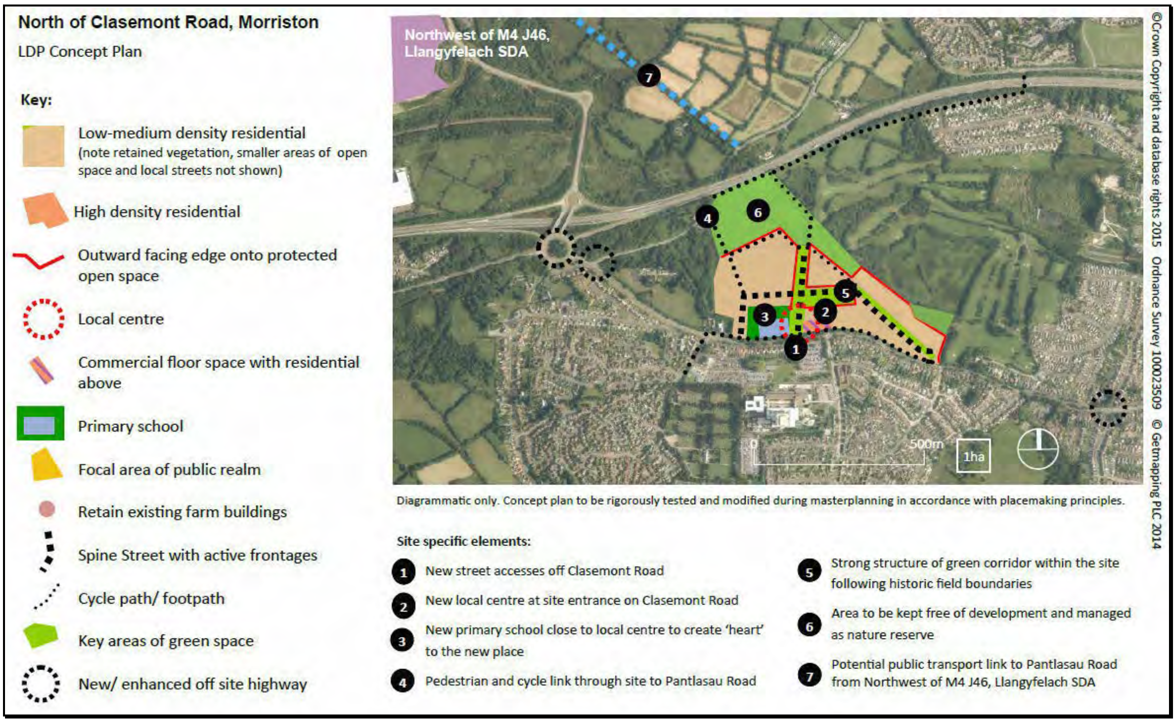


Figure 5.14

Proposals Map Site Reference: F

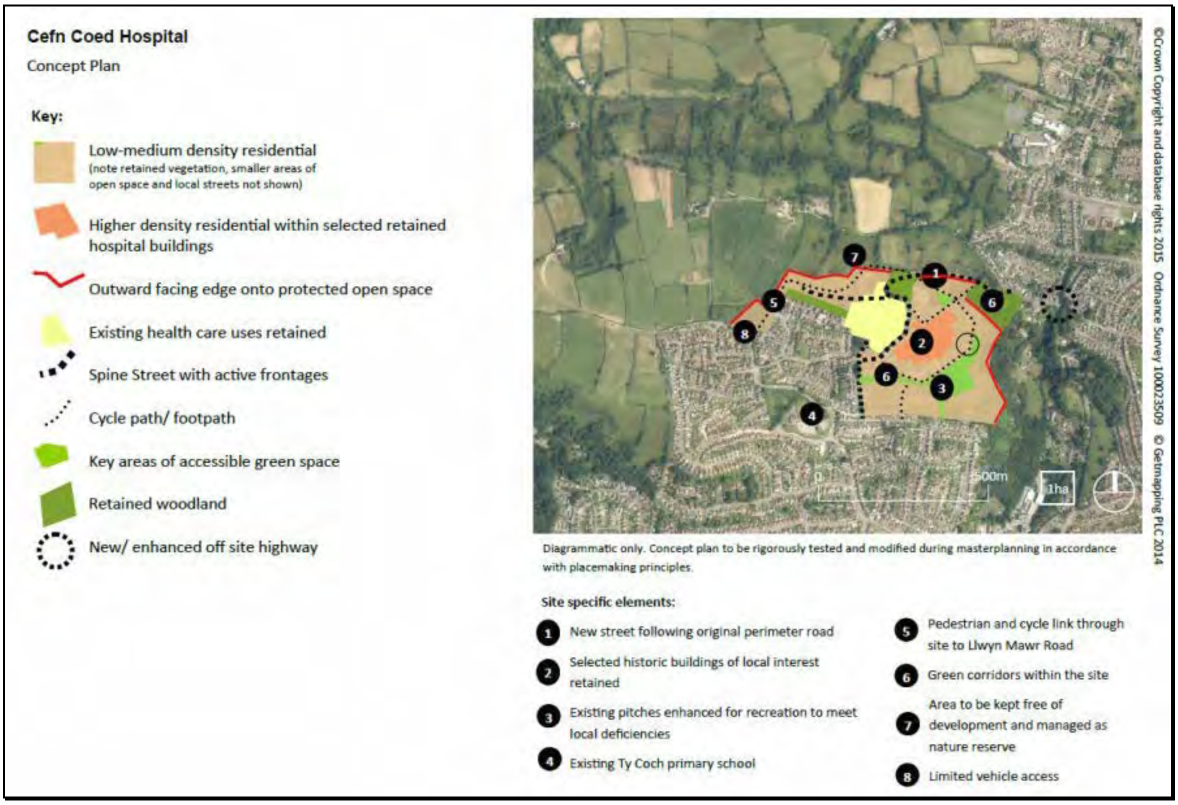


Figure 5.15

Proposals Map Site Reference: G

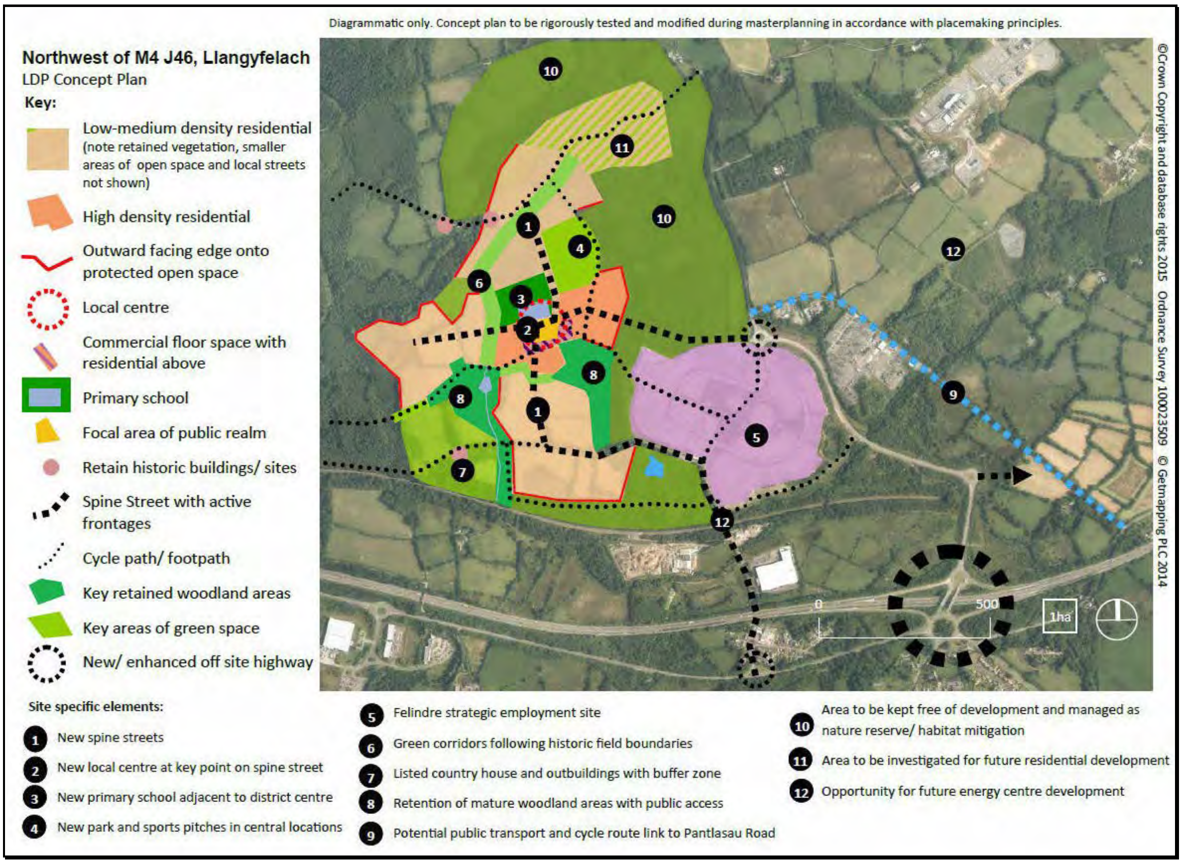


Figure 5.16

Proposals Map Site Reference: H

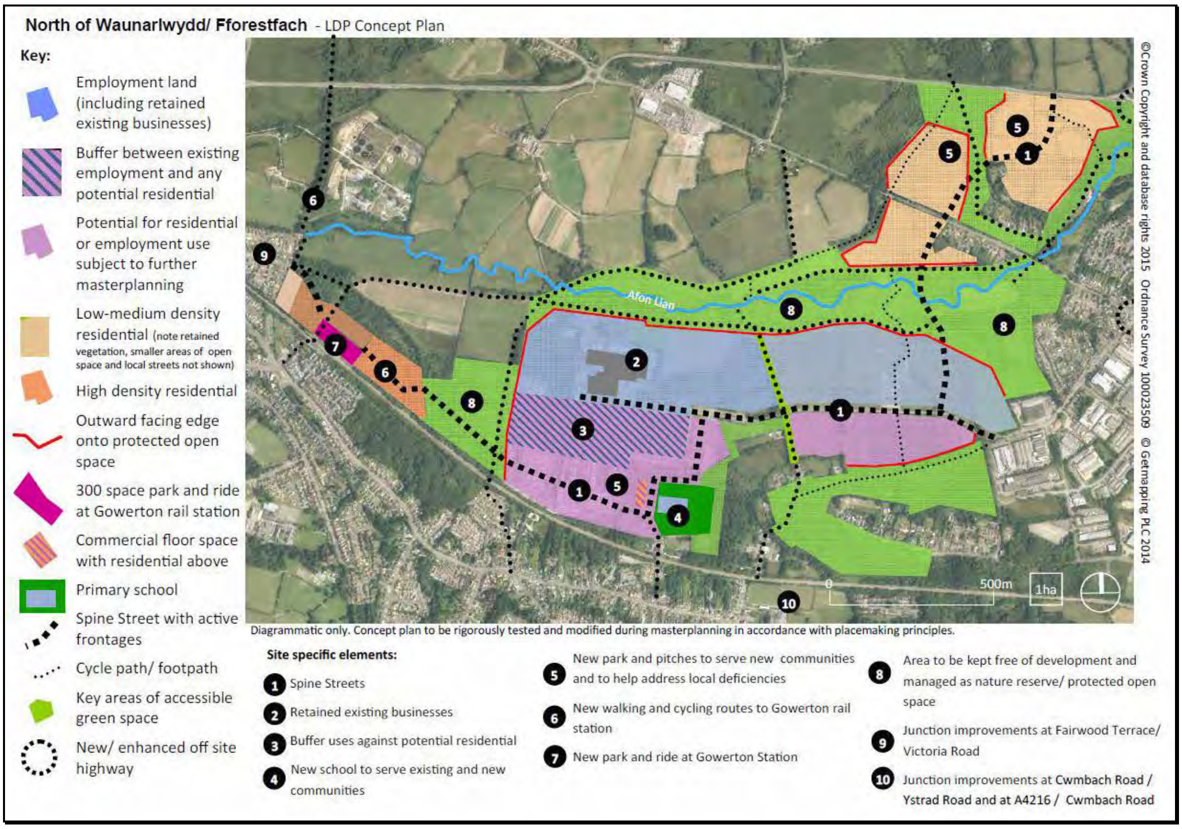


Figure 5.17

Proposals Map Site Reference: I

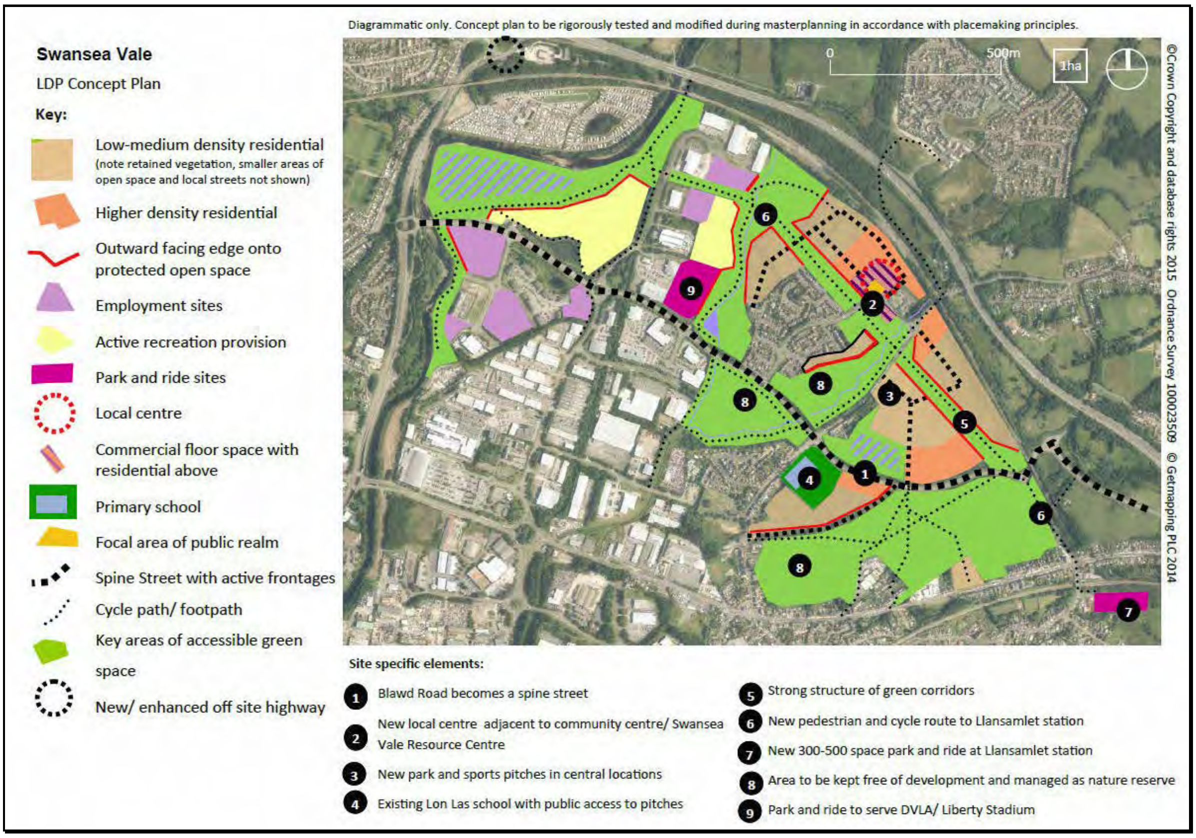


Figure 5.18

Proposals Map Site Reference: J

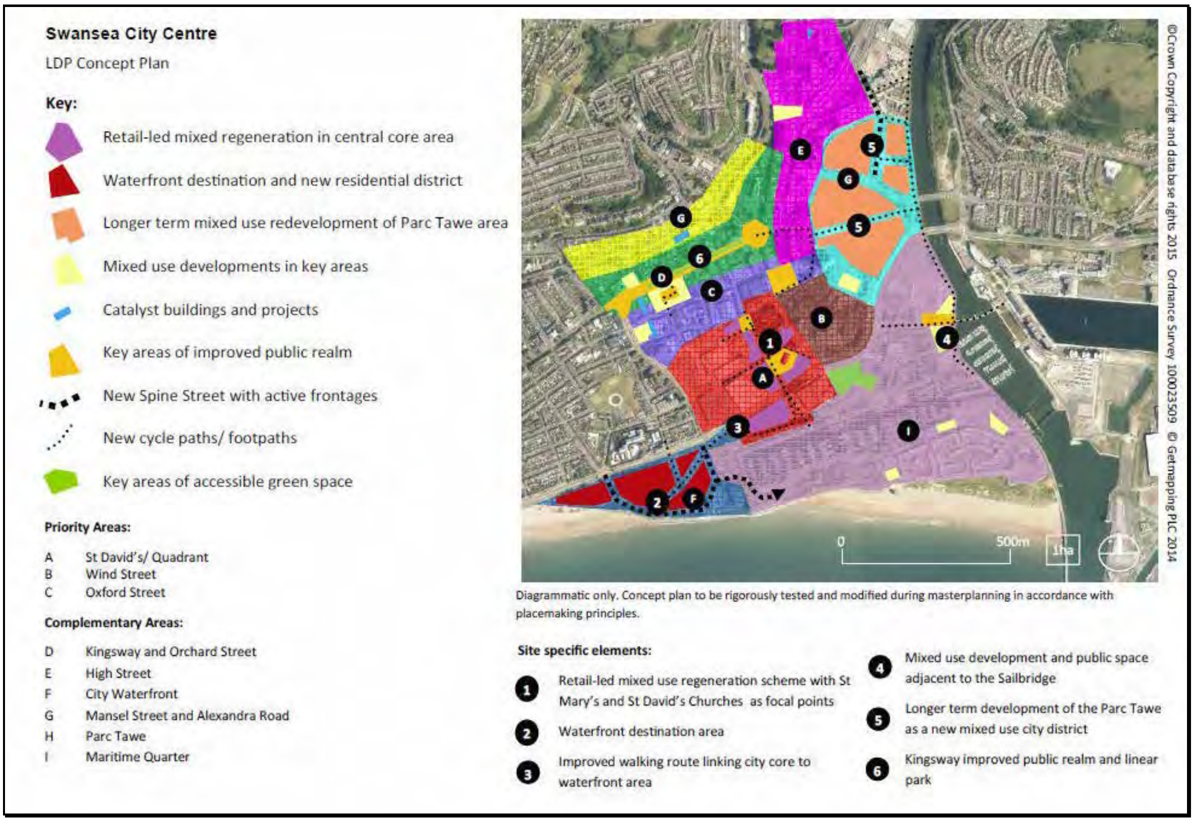


Figure 5.19

Proposals Map Site Reference: K

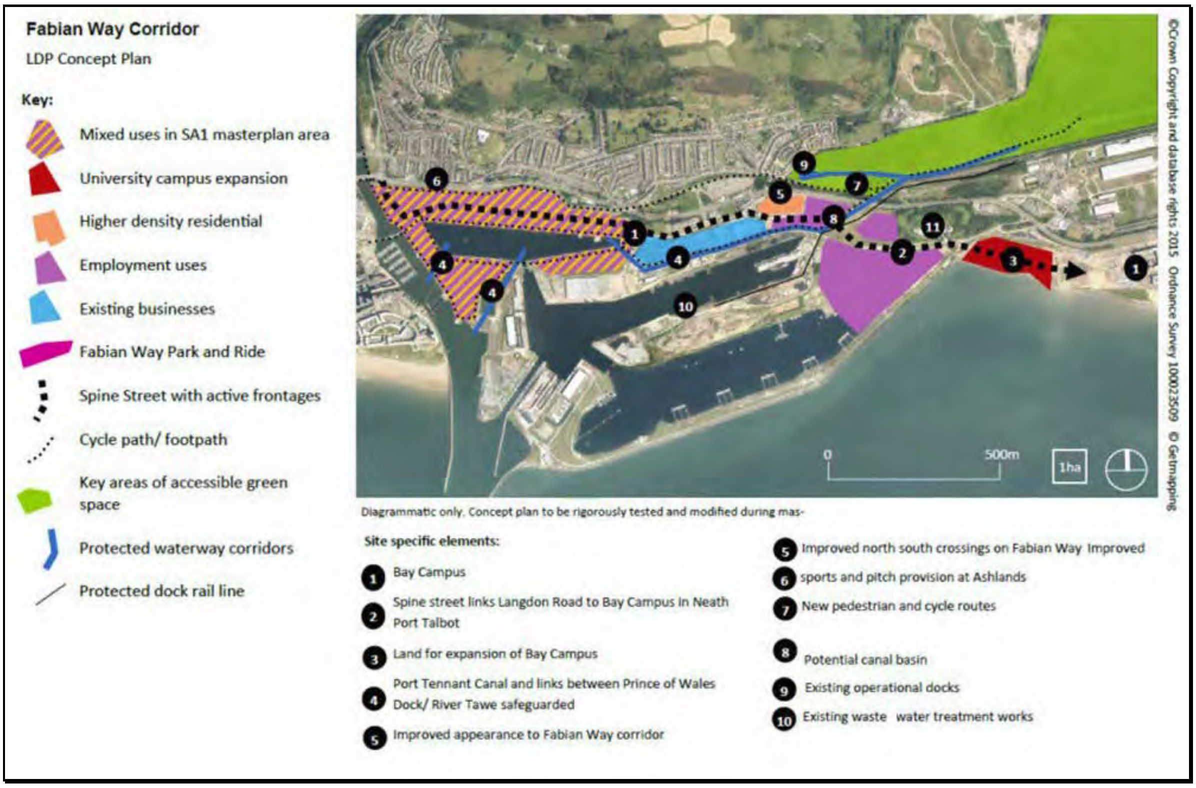


Figure 5.20

Proposals Map Site Reference: L

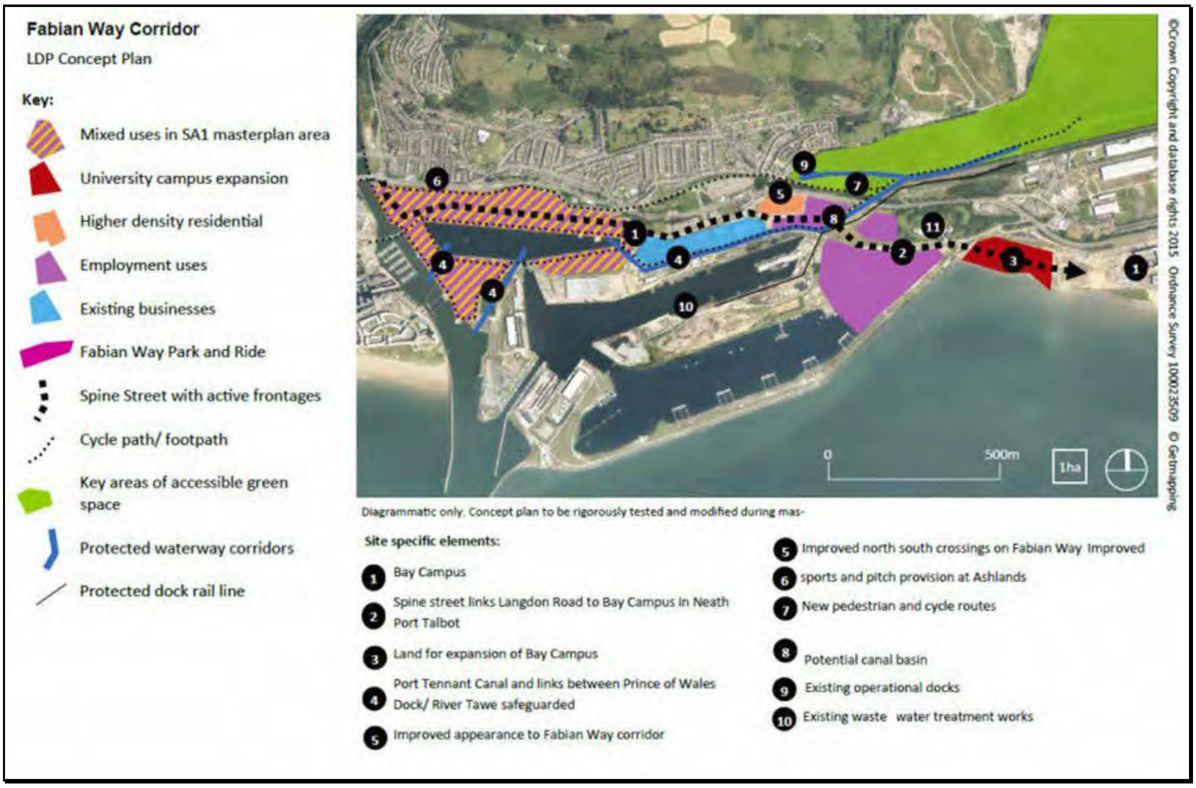


Figure 5.21

Proposals Map Site Reference: M

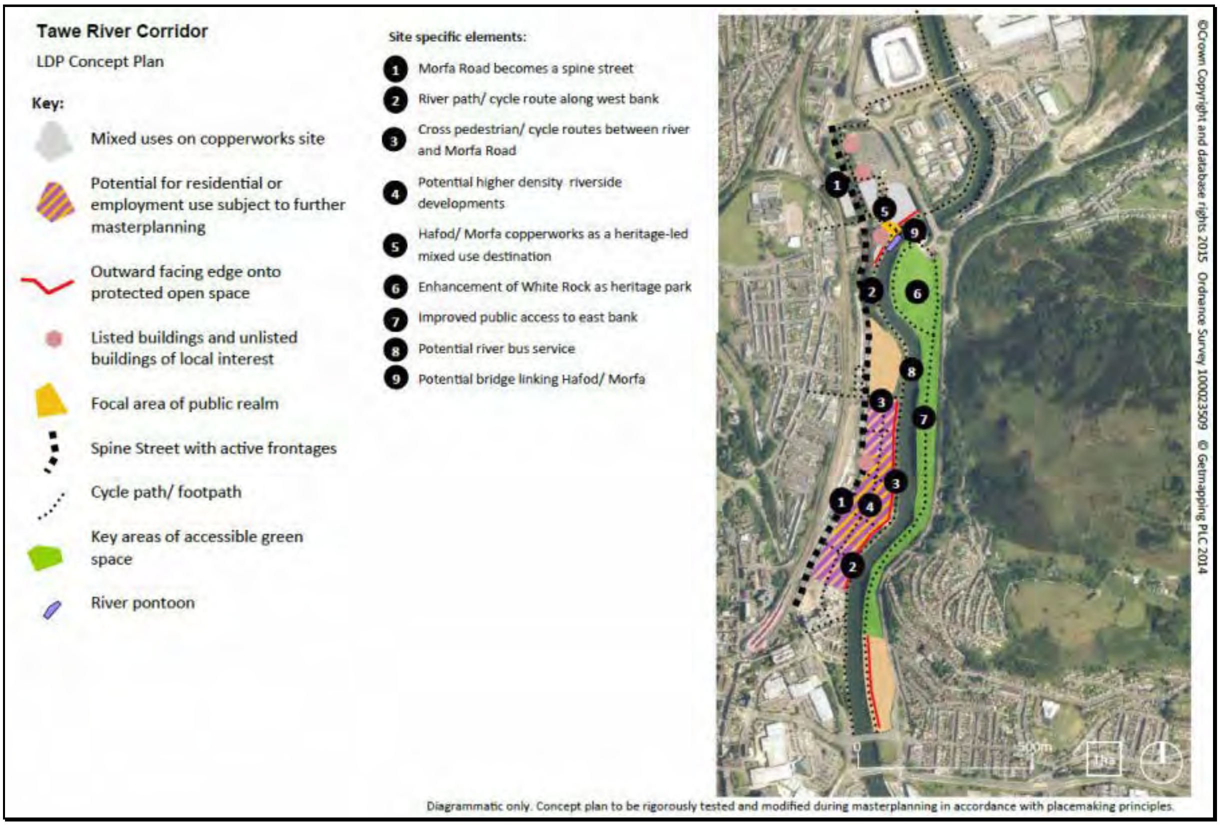


Figure 5.22

Section 2.5 of the deposited LDP on page 121 (http://www.swansea.gov.uk/media/17120/Deposit-LDP---consultation-document/pdf/Deposit_LDP_Consultation_-__FINAL_JULY_2016.pdf) lists Non-Strategic Housing Sites where additional land is allocated for the delivery of new homes. This table is not reproduced here as the capacity for new homes at these sites is generally (but not at all sites) below100 homes. The number of dwellings allocated under these Non-Strategic Housing Sites amount to an additional 2950 homes.

The scale of developments within the proposals maps A-M above are significant and certain development sites will have the capacity to influence local air quality over the coming years.

6 Air Quality Planning Policies

Policy EV40 has been inserted within the authorities Unitary Development Plan. In particular, sub policies within policy EV40 seek to clarify the authority's position with regard to air quality considerations.

1.8.8 Pollution may cause significant damage to human health, quality of life, residential amenity, and the natural and historic environment. This policy seeks to ensure that developments that would result in unacceptable high levels of noise, light or air pollution are appropriately located away from residential areas, other sensitive developments and areas of landscape, natural environment and heritage importance. The policy also seeks to ensure that incompatible development and land uses are not located close to existing sources of potential pollution.

1.8.9 The adverse effects of pollution are an important consideration when determining planning applications. When assessing new development proposals the Council will seek to minimise the impact of pollution of all kinds, and where possible planning conditions will be used to minimise environmental harm. The Council will look to the statutory environmental agencies to use there anti-pollution legislative powers to monitor and enforce against discharges, noise, etc.

Planning permission will not be granted for development that would be harmful 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 (proposed or in Regulations). This may be a declared Air Quality Management Area (AQMA), or an area that might become an AQMA if the application were to be granted.

7 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.

8 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 resilent 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
http://www.swansea.gov.uk/media/17120/Deposit-LDP---June-2016/pdf/Deposit LDP Consultation - FINAL JULY 2016.pdf

9 Implementation of Action Plans

Action Plan Progress Report is to be submitted separately.

10 Conclusions and Proposed Actions

Proposals to develop the Tawe Riverside Development Corridor are on-going with phase 2 of the St David's Student accommodation being completed and planning applications received for developments along the proposed Corridor.

There still hasn't been a formal decision regarding the Swansea Bay Tidal Lagoon development and so this will be addressed should the go ahead be given.

The planning application for the expansion of the Liberty Stadium has been approved however there still is no timeline for any proposed works.

10.1 Conclusions from New Monitoring Data

Real Time Continuous Automatic Monitoring Data NO_2.

Four of the six fixed monitoring locations within the City and County of Swansea continue to show compliance with Annual Mean Objective concentration (AURN, Morriston Groundhog, Cwm Level Park, St. Thomas DOAS). However, previous years have shown a downward trend in annual mean at these four sites; 2016 data has seen an increase in concentrations at these locations which may be due to a larger proportion of North Easterly winds, the interactions within the lower Swansea Valley and possible recirculation of wind flow.

The Hafod Doas and Station Court sites continue to show an exceedence of the annual mean objective. The Station Court site has reduced in concentration which could be related to the close proximity of the bus stop and changes to the bus fleet i.e. the stoppage of the vehicles original used to operate the Metro Service reported in the 2016 Progress Report.

The Hafod Doas site still exceeds the annual mean objective and the concentration has increased from the 2015 annual mean, which was treated with caution in the 2016 Progress Report. The Morfa Distirbutor Road is scheduled to open in 2017 and so with the implementation of the Nowcaster System, as part of the Action Plan, future reductions in concentrations of NO_2 are expected.

All six of the fixed monitoring locations continue to show compliance with the one hour objective concentration and there is no intention to cease monitoring at any of these locations.

NO_2 Diffusion Tube Data.

Exceedences of the annual mean objective continue to be seen within the existing Swansea Air Quality Management Area 2010 along the Neath Road, Llangyfelach Road, Courtney Street, Cwm Level Road, Carmarthen Road (Dyfatty), High Street, Carmarthen Road (Fforestfach) and Gower Road.
Newton Road, Fabian Way, Vale of Neath Terrace and locations within the City Centre, all outside the Swansea AQMA 2010, have been identified as exceeding the annual mean objective The City Centre locations are currently being assessed as identified in the 2016 Progress Report and will be commented on in subsequent reports. The Newton Road, Fabian Way and Vale of Neath Terrace locations will be subject to further investigation and so detailed assessments.

Sulphur Dioxide Real Time Continuous Automatic Monitoring Data

No exceedances of any of the objectives have been observed within Swansea for several years. Measurements are now only made from the St.Thomas DOAS due to budgetary restraints.

Carbon Monoxide Real Time Continuous Automatic Monitoring Data

No exceedance of the objective has been observed within Swansea since monitoring commenced. Monitoring ceased during 2009/2010 due to budgetary restraints

Particulate Matter PM_{10}

No exceedances of the annual mean objective were seen at any of the monitoring stations during 2016. Similarly, no breach of the 35 permitted exceedances of the 24 hour objective was seen to exceed 50ug/m^3.

Benzene

No exceedance of the objective has been observed within Swansea since monitoring commenced.

Ozone

Compliance with the 8-hour mean UK objective (not set in regulation) has been seen during 2016 at all sites. Whilst ozone is considered a national rather than local problem it will continue to be measured for the foreseeable future.

Heavy Metals Monitoring

Monitoring results during 2016 have shown **nickel** concentrations to be below the 4th Daughter Directive annual mean target value following improved abatement at the primary release point. Identified release points within the Pontardawe area of Neath Port Talbot Borough Council have the potential to influence measured nickel concentrations within the Swansea area given certain meteorological conditions.

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

Additionally, from the data available, it is clear that annual mean concentrations for **lead** at all monitoring locations fall well below the 0.25ug/m^3 required under the Air Quality (Amendment) (Wales) Regulations 2002 to be achieved by the 31st December 2008.

10.2 Conclusions relating to New Local Developments

The two main planning applications of interest both within the Swansea AQMA 2010 are the Mariner Street Car Park, application number 2016/0556 and the Former Unigate Dairy Site, Morfa Road, application number 2016/1573. The Marnier Street application has been listed within section 5.10 of this report. Air Quality Assessments were submitted for both and can be found in Appendix C, both reports concluded that the developments would not lead to exceedences of the Air Quality Objectives.

10.3 Other Conclusions

It should be highlighted that within the Deposit Local Development Plan 2010-2025, Strategic Development Areas (SDAs) are allocated at 12 locations to provide new homes and opportunities for job creation and commercial investment at a strategic scale. Whilst the SDAs are outlined within the deposit plan (http://www.swansea.gov.uk/media/17120/Deposit-LDP---consultation-document/pdf/Deposit_LDP_Consultation_-__FINAL_JULY_2016.pdf it is too early within the process to form a definitive view of the implications of development as outlined within the SDAs. However, the scale of development indicated within several SDAs are likely to have implications as the scale of development proposals are confirmed and brought forward through the planning process.

10.4 Proposed Actions

Passive diffusion tube data returned for 2016 has indicated the exceedences of the annual mean objective concentration for NO2 on Newton Road, Fabian Way, Vale of Neath Terrace, High Street and the City Centre. The City Centre was identified as requiring further investigation in the 2016 Progress Report and that work is ongoing. Due to the reduction in annual mean concentration observed across most sites in Swansea over recent years the intention is to carry out further investigation in these areas; we shall proceed to a detailed assessment in these areas.

Given the knowledge base that has been built up over the many years of monitoring within the City and County of Swansea there will be a relocation of diffusion tube sites to ensure that assessment of relevant areas can be carried out with the reduction in resources that are available.

As part of the ongoing assessment for the City Centre area, against the annual mean and one hour objective, the number and location of monitoring sites will be assessed. Information will also be utilised from colleagues with the Highways Department due to the ongoing proposals for redevelopment within the City Centre and the associated alterations to the highway infrastructure.

Due to the addition of a section 106 agreement on the planning application for new Student Residential accommodation on Morfa Road, a new real-time NOx box will be installed in the summer of 2017.

The will be no changes made to the existing Swansea AQMA 2010.

11 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: Quality Assurance / Quality Control (QA/QC) Data

Appendix B: Local Transport Plan 2015-2020. Progress Report/Update 2016/17

Appendix C: Planning Air Quality Assessments

Appendix A: QA/QC Data

Diffusion Tube Bias Adjustment Factors

All NO2 diffusion tubes used in Swansea are currently provided by Environmental Scientifics Group. They have advised the following:

- The manufacture and analysis of NO2 diffusion tubes is covered by our UKAS accreditation
- The method meets the requirements laid out in DEFRA's "Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance."
- The laboratory has taken part in the WASP (now AIR PT) proficiency scheme since its inception, and carries the highest ranking of 'Satisfactory' for all rounds on the DEFRA LAQM summaries since the adoption of the harmonised method in 2009.
- In 2016, 7500+ internal quality control samples were analysed in conjunction with the diffusion tubes, achieving an analytical repeatability of 2.0% (at 95% confidence).

The AIR PT results are in Table A1

Table A1: Laboratory summary performance for AIR NO_2 PT rounds AR007, 9, 10, 12, 13, 15, 16 and 18

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 ≤ ± 2 as defined above.

AIR PT Round	**AIR PT AR007**	**AIR PT AR009**	**AIR PT AR010**	**AIR PT AR012**	**AIR PT AR013**	**AIR PT AR015**	**AIR PT AR016**	**AIR PT AR018**
Round conducted in the period	April – May 2015	July – August 2015	October – November 2015	January – February 2016	April – May 2016	July – August 2016	September – October 2016	January – February 2017
Aberdeen Scientific Services	100 %	75 %	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 [1]	**100 %**	**100 %**	**100 %**	**100 %**	**75 %**	**75 %**	**100 %**	**100 %**
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	100 %	75 %	100 %	0 %	100 %	100 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	100 %	100 %	100 %	NR [2]	NR [2]
Lambeth Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Milton Keynes Council	100 %	100 %	100 %	50 %	100 %	100 %	75 %	100 %
Northampton Borough Council	100 %	100 %	100 %	50 %	100 %	NR [2]	75 %	0 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	75 %	100 %	100 %	75 %	100 %	100 %
Staffordshire County Council	100 %	75 %	75 %	75 %	75 %	100 %	NR [2]	100 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	NR [2]	NR [2]	100 %	NR [2]	100 %	NR [2]	100 %
West Yorkshire Analytical Services	75 %	75 %	75 %	75 %	100 %	NR [2]	50 %	100 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO_2 diffusion tube monitoring and therefore did not submit results.

Factor from Local Co-location Studies

Checking Precision and Accuracy of 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 Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	06/01/2016	03/02/2016	37.8	29.8	36.8	35	4.4	13	10.8	33.94	93.6	Good	Good
2	03/02/2016	02/03/2016	38.5	33.8	36.2	36	2.4	6	5.8	33.81	99.85	Good	Good
3	02/03/2016	30/03/2016	37	33.3	33.9	35	2.0	6	4.9	31.83	99.55	Good	Good
4	30/03/2016	27/04/2016								29.67	99.85		Good
5	27/04/2016	25/05/2016								29.89	99.85		Good
6	25/05/2016	30/06/2016								23.23	99.77		Good
7	30/06/2016	27/07/2016	22	21.4	14.7	19	4.1	21	10.1	14.89	99.23	Poor Precision	Good
8	27/07/2016	24/08/2016	24.4	22.4	22.5	23	1.1	5	2.8	18.83	95.68	Good	Good
9	24/08/2016	28/09/2016	29.4	27.1	29.3	29	1.3	5	3.2	22.25	99.64	Good	Good
10	28/09/2016	27/10/2016	39.7	38.1	40.3	39	1.1	3	2.8	35.29	99.71	Good	Good
11	27/10/2016	30/11/2016	47.9	46.5	35.5	43	6.8	16	16.9	39.60	99.88	Good	Good
12	30/11/2016	04/01/2017	56.5	52	58.9	56	3.5	6	8.7	49.24	89.64	Good	Good
13													

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

Overall survey --> Good precision | Good Overall

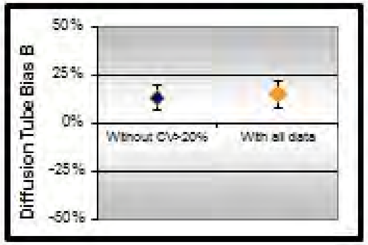
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Swansea AURN 2016

Precision 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 8 periods of data
Bias factor A 0.89 (0.84 - 0.95)
Bias B 12% (5% - 18%)
Diffusion Tubes Mean: 37 μgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 33 μgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 33 (31 - 35) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 9 periods of data
Bias factor A 0.89 (0.83 - 0.95)
Bias B 13% (6% - 20%)
Diffusion Tubes Mean: 35 μgm^{-3}
Mean CV (Precision): 9
Automatic Mean: 31 μgm^{-3}
Data Capture for periods used: 97%
Adjusted Tubes Mean: 31 (29 - 33) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Discussion of Choice of Factor to Use

Swansea Roadside AURN tri-location

Tri located tubes were exposed on the sample intake, synchronised for exposure for the monthly period to match the exposure on/off timings as suggested by the Welsh Air Quality Forum exposure calendar (mirrors the old UK monitoring network). All results were entered into the spreadsheet provided by AEA Energy and Environment to determine tube bias as well as checking the accuracy and precision of the diffusion tube measurements.

Appendix B: Local Transport Plan 2015-2020. Progress Report/Update 2016/17

Table 1 – Local Transport Fund Contact information

Local authority	City & County of Swansea
Lead contact	Ben George
Contact telephone	01792 636343
Contact email	Ben.george@swansea.gov.uk

Table 2 – Local Transport Fund Scheme Spend 2016/17

Scheme name	Description	Scheme Category *	Welsh Government Funding Allocation (2016/17)	Welsh Government Funding Claimed (2016/17)	Match Funding (2016/17)
Fabian Way Business Case	The development of a business case to support the long-term infrastructure planning for this important cross-border corridor.	Integrated Transport / Highways / Active Travel	£453,000	£449,000	
Morfa Distributor Road	A 1.8 km road to link New Cut Road with Normandy Road Roundabout to provide a new arterial route into the city centre from the north. The route will provide a number of benefits, including: • Reduced peak hour congestion in the Hafod. • Alleviation of poor air quality in the Hafod and the Hafod Air Quality Management Area. • The provision of access to land on the west bank of the River Tawe to enable development. Access to jobs and services generated along the corridor and to the destinations that it serves.	Highways	£1,146,100	£1,146,100	£613,000
Kingsbridge Link	A shared use path, measuring approximately 1.6km, linking Gowerton to Kingsbridge, Gorseinon and Grovesend.	Active Travel	£55,000	£55,000	
Active Travel Mapping	A grant allocation to support the requirements of the Active Travel (Wales) Act.	Active Travel	£18,000	£17,000	

* Integrated Transport / Highways / Rail / Active Travel

Table 3 – Local Transport Fund Scheme Purpose 2016/17

Scheme name	Original Scheme Purpose	Summary of Scheme Progress	Reasons for any Changes during Scheme Delivery
Fabian Way Business Case	Development of a Strategic Outline Business Case for the Fabian Way Corridor. Assessment of forecasted traffic growth and its impact to the Corridor. Including some ground investigation to support specific infrastructure proposals.	All works completed on schedule. Most of the grant was claimed, but £4k was accrued into 2017/18.	£4k was carried over into 2017/18 in order to meet compensation claims as a consequence of survey works adjacent to Baldwins Bridge.
Morfa Distributor Road	To deliver the final phases of the Morfa Distributor Road.	All works completed on schedule and all grant claimed.	N/A
Kingsbridge Link	To deliver the outline design. Ongoing negotiations for the purchase of the required land and legal work to deregister the common land also progressed.	All works completed on schedule and all grant claimed.	N/A
Active Travel Mapping	The funding was used to employ consultancy resource to undertake the development and consultation work for the Integrated Network Map.	All works completed on schedule and all grant claimed.	The final claim for this allocation was approximately £1k less than the maximum as the final contract value was less than originally expected.

Table 4 – Local Transport Fund Key Benefits for all schemes completed over the last three years

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
Fabian Way Business Case	The project was largely a desktop study to deliver a business case for the infrastructure needs for the corridor.	£453,000 [LTF 2016/17]	Strategic Outline Business Case; Options Appraisal & Outline Design for the Baldwins Bridge junction.	These will be quantified and qualified as and when the project has been delivered.	These will be quantified and qualified as and when the project has been delivered.	These will be quantified and qualified as and when the project has been delivered.	These will be quantified and qualified as and when the project has been delivered.
Morfa Distributor Road	This project delivered a new arterial route for traffic entering Swansea City Centre from Swansea Valley.	£5.2million [Total Project Cost 2014-17]	1.8km shared use path; 1.8km road; access to a number of riverside development plots.	Improved local connectivity. Displacement of traffic from the Hafod Air Quality Management Area. New off-road infrastructure for cycling; linking the city centre cycle network to the strategic National Cycle	The scheme opened in June 2017, so it is not yet possible to measure the impact of the project in terms of its traffic impact. Two riverside plots have been redeveloped for residential developments & another is at the early planning	Morfa Highway Works Packages: Number of jobs created. **Morfa Stage 1** Directly employed 26 Sub contracted 10 Supply chain 4 **Morfa Stage 2, 5A and 5B** Directly employed 34 Sub contracted 30 Supply chain 8 **Morfa Stage 3 and 4** Directly employed 32	The road and shared use path has improved connectivity between Swansea City Centre and the Enterprise Park to greatly improve access to key services at these locations.

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
				Network (43).	stage.	Sub contracted 25 Supply chain 8 ***Summary total 177*** However, the scheme has facilitated the following: Persimmon – Glan yr Afon 60 Hitachi Rail Depot 130 Hafod Copperworks Redevelopment (currently 25 / potential 100) *Likely future projects / development sites* Pipehouse 60 Former Unigate Site 60 Gladeborough Site 60 Riverside cycle route 30 ***Summary total 500*** **Overall total 677**	
Kingsbridge Link*	The delivery of this project is ongoing. The scheme will	£155k [2014/15 – 2016/17]	General arrangement and outline design of	The project is still in the process of	These will be quantified and qualified as and	These will be quantified and qualified as and when the project has	These will be quantified and qualified as and

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
*(Also referenced as a part of the Urban Cycle Network in 2015/15)	deliver a new shared use path between Gowerton and Kingsbridge, Gorseinon and Grovesend.		the route. Purchased approximately 80 metres of boardwalk ready for future installation on the route.	delivery.	when the project has been delivered.	been delivered.	when the project has been delivered.
Active Travel Mapping	Swansea Council is required to fulfil a number of legislative duties as set out in the Active Travel (Wales) Act. The Existing Route Map was submitted to the Welsh Government in 2015 and the Integrated Network Map will be submitted in 2017.	£88k [2014/15 – 2016/17]	Swansea Council delivered an existing route map to meet the requirements of the Act, and supported this with a walking and cycling map to improve promotion of the shared use routes.	Improved understanding and awareness of local walking and cycling routes.	The direct impacts of the scheme will be known once funding has been secured to deliver the aims of the Active Travel (Wales) Act.	The direct impacts of the scheme will be known once funding has been secured to deliver the aims of the Active Travel (Wales) Act.	The direct impacts of the scheme will be known once funding has been secured to deliver the aims of the Active Travel (Wales) Act.
Fabian Way Shared Use Path & Bus Corridor	The development of Fabian Way Corridor is rapidly expanding which presents a number of	£332,000 [2015/16 - LTF] £250,000	1.2km of shared use path. Seven bus shelters were	The cycle counter on Fabian Way has shown the	The number of cyclists using the route has increased	The public transport and walking and cycling improvements have served to improve	The Fabian Way Corridor is bounded by a number of SSSIs

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
Enhancements	challenges as it is used to access large new developments, whilst also supporting its very important role as a strategic arterial route for Swansea City Centre. The Swansea University Bay Campus opened in September 2015. The Campus has limited provision for parking and the facilities for bus public transport and walking and cycling are therefore of strategic importance to the success of the site.	[2015/16 – S106]	upgraded to glass and stainless steel construction, including integral lighting to improve the experience of the thousands of students travelling to the Bay Campus each day. MOVA was installed at the Port Tennant Road junction to improve its capacity and efficiency. The options appraisal for Baldwins Bridge was completed and its conclusions taken forward into the development of the Fabian Way	24 hour AADT has increased from 130 daily users (2014/15) to 344 daily users (2015/16). The number of bus passengers using the route is commercially sensitive information. The vast majority of the students travelling to the Bay Campus each day do so by public transport; the increase in use is therefore	substantially and, in conjunction with the planning conditions to restrict private motor vehicles, has served to reduce the volume of potential traffic on this important route. Public transport services have increased significantly. Buses operate on a 4 minute frequency during the peak hours.	accessibility for not only the student population, but to the general public also. The Fabian Way Corridor is an important site for regeneration and development in the coming years, so will offer many economic opportunities for those travelling to and through this important corridor.	and Ramsar sites. The improvement of general connectivity and accessibility will enable a great population to access and enjoy these important environmental sites. The development of Fabian Way has also improved access to the beaches south of Fabian Way. These were previously poorly used but are increasingly popular with students and dog walkers.

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
			Business Case in 2016/17.	substantial.			
Wheels 2 Work	The Wheels 2 Work project is a not-for-profit scooter loan scheme for those who have no other means of getting to, or keeping, a job/training due to a lack of public or private transport options.	£25,000 [LTF 2015/16]	The additional funds were used to purchase an additional ten motorised scooters which ultimately expanded the scope of the project.	All users have passed their CBT training prior to using the vehicles, which has increased their confidence. To date seven people have utilised W2W scooters since March 2016, two of which have since passed their car driving test and purchased their own vehicle to continue accessing employment. One client received a conditional employment offer if he had his own transport. As a	The scheme serves to provide motorised scooters to those who would otherwise be without a means of transport to access local services and employment opportunities.	The scheme has been established with the sole aim of improving access to employment and therefore each of its users will be directly impacting the local economy.	The inability to access local jobs and services is one of the major contributors to social isolation which has many social and health disbenefits. This scheme, in part, seeks to combat these problems.

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
				result of W2W, he received CBT training and a vehicle within a week and is now in employment for the first time in six years. W2W clients have been given more than just transport and employment opportunities, but confidence, independence and social/health benefits.			
Links to NCN	The scheme created an environment in the City Centre which supported and encouraged Active	£300,000 [LTF 2014/15] and £75,000 [Match Funding	The construction of 1.7km of shared use path in the City Centre.	A baseline survey is not available for this scheme. Cycling	Improved sustainable access for those living in the City Centre. Improved	The scheme supported skilled construction workers and labourers posts during the development stage and is now providing low cost	The improvement to this route provides direct access to a wide range of key services and

Scheme name	Context	Inputs	Outputs	Outcomes	Transport Impact	Economic	Environmental, Social and Cultural Benefits
	Travel. This is to facilitate access by low cost and healthy means as well as improving the air quality, permeability and ambience of the City Centre.	2014/15]		numbers using the route remain low as the onward connections to the route remain unfinished, but are due to complete in 2018/19. Recent surveys have shown that 882 pedestrians use the route each day (24hour AADT).	sustainable access for those wishing to walk or cycle to, from or around the City Centre.	access to employment and training in and around the City Centre.	facilities throughout the city centre, including to many cultural destinations such as the Glynn Vivian Art Gallery and Swansea Museum.

Appendix C: Planning Air Quality Assessments

PATRICKPARSONS



AIR QUALITY ASSESSMENT

MARINER STREET STUDENT ACCOMMODATION, SWANSEA

For Varsity Projects

March 2016

patrickparsons.co.uk

Air Quality Assessment

Mariner Street Student Accommodation,

Swansea

for

Varsity Projects

N16053	Air Quality Assessment, Mariner Street Student Accommodation, Swansea

Revision	Date of issue	Comments	Prepared by	Checked by
Draft	03.03.16	DRAFT ISSUE	MF	DH
1	07.03.16	FIRST ISSUE	MF	DH

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APPENDICES

1.0 INTRODUCTION

1.1 Background

SLR Consulting Ltd has been commissioned by Patrick Parsons Limited, to undertake an Air Quality Assessment for a proposed mixed-use development at Mariner Street, Swansea. The proposed development comprises of a 725 bed student accommodation with commercial units on the ground floor.

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then considers the future baseline in terms of the air quality conditions at the application site and any potentially significant environmental affects the proposed plans may have on the baseline environment. The assessment describes the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual impacts after these measures have been employed.

1.2 Summary of Proposed Scheme

The application site (the site) is situated on land between Mariner Street and Alexandra Road (the B4290). The site setting is addressed in Section 4.1 and presented in Figure 4-1.

The proposed development comprises of a 725 bed student accommodation over 21 levels with commercial units on the ground floor. The proposal includes 16 car parking spaces; 10 spaces serving commercial uses and 6 spaces serving student accommodation (for disabled users and building management). The tenancy agreement will prevent students bringing a car to the site, or parking on site.

The site is currently predominantly occupied by a 107 space surface level car park, with land in the east of the site occupied by a café and vacant gym. On a weekday this car park generates approximately 500 arrivals and 500 departures each day. Therefore, there will be a significant reduction in trips to and from the site associated with the development proposals in comparison to the existing use (circa 200 fewer arrivals and 200 fewer departures)[1].

1.3 Scope

The scope of the assessment has been agreed in pre-application discussions with City and County of Swansea (CCS) Environmental Pollution Department[2]. The scope of the assessment incorporates:

- an assessment of construction dust impacts assessed using Institute of Air Quality Management (IAQM) '*Guidance on the assessment of dust from demolition and construction*' and identification of any mitigation requirements; and
- a qualitative exposure assessment of future air quality at the site, based on a review of baseline air quality conditions in the surrounding area using CCS monitoring data, Local Air Quality Management (LAQM) Reports and other Department for the Environment, Food and Rural Affairs (Defra) published guidance and tools.

---

[1] Based on communication from developers transport consultant Vectos Ltd.

[2] Email correspondence between Tom Price, Senior Environmental Health Officer within CCS, and SLR Consulting, dated 25/02/2016.

The results of the assessment are detailed in the following sections of this report.

1.4 Structure of Report

The remainder of this report is structured as follows:

- Section 2 describes the relevant legislation and guidance referred to in the assessment;
- Section 3 describes the assessment methodology;
- Section 4 characterises the baseline environment in the vicinity of the proposed development site from an air quality perspective, with regard to site location and nearby receptors;
- Section 5 assesses the potential impacts during the construction phase and required mitigation;
- Section 6 presents the operational phase impacts and exposure assessment; and
- Section 7 concludes the assessment.

2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

2.1 Air Quality Standards Regulations

The Air Quality Standards (Wales) Regulations 2010 (the regulations) provide a transposition of the Air Quality Framework Directive, and transpose the Fourth Daughter Directive within Wales. The regulations include Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed Air Quality Assessment Levels (AQAL) throughout this report). The Limit Values cover seven pollutants, sulphur dioxide (SO_2), nitrogen dioxide (NO_2), benzene (C_6H_6), lead (Pb), carbon monoxide (CO) and particles of an aerodynamic diameter of less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$).

This assessment has focused on NO_2, PM_{10} and $PM_{2.5}$, as these are the pollutants of greatest health concern associated with road traffic. The Limit Values for these pollutants are presented within Table 2-1 and Table 2-2. Emissions of other exhaust gases, such as carbon monoxide (CO), small quantities of SO_2 and non-methane volatile organic compounds (NMVOC) including 1,3-butadiene and benzene, will also occur from vehicles. National level measurement and modelling assessments carried out by Defra have shown that policy measures already in place have reduced levels of CO, 1,3-butadiene and benzene within compliance with the respective AQALs, even at busy roadside locations.

Table 2-1
Air Quality Limit Value for Protection of Human Health

Pollutant	Limit Value	Measured as:	
Nitrogen dioxide (NO_2)	40µg/m^3	Annual mean	-
	200µg/m^3	1 hour mean	Not to be exceeded more than 18 times a calendar year
Particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) (gravimetric)	40µg/m^3	Annual mean	-
	50µg/m^3	24 hour mean	Not to be exceeded more than 35 times a calendar year
Particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$)	25µg/m^3	Annual mean	-

Table 2-2
Relevant Critical Level for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (µg/m^3)	Measured as
Oxides of Nitrogen (NOx)	30	Annual mean

2.2 Air Quality Strategy

The United Kingdom Air Quality Strategy (UK AQS) for England, Scotland, Wales and Northern Ireland[3], last updated in 2007, sets out the Government's policies aimed at delivering cleaner air in the United Kingdom (UK). It sets out a comprehensive strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that Government, industry, the Environment Agency (EA), local government, business, individuals and transport have in protecting and improving air quality.

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007.

2.3 Local Air Quality Management (LAQM)

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any AQALs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed AQALs are not likely to be achieved the authority concerned must designate an Air Quality Management Area (AQMA). For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the AQAL.

As such, Local Authorities (LAs), including CCS, have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

Defra on behalf of the Welsh Assembly Government has published technical guidance for use by local authorities in their review and assessment work[4]. The document provides guidance on assessing air quality against the regulations stating that the AQALs should be assessed at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the standard. A summary of relevant exposure for the AQAL presented in Table 2-1 are shown below in Table 2-3.

Table 2-3
Relevant Public Exposure

Averaging Period	Relevant Locations	AQALs should apply at:	AQALs should not apply at:
Annual mean	Where individuals are exposed for a cumulative period of 6 months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	Where individuals may be exposed for eight hours or more in a day	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure if expected to be short term
1-hour mean	Where individuals might reasonably expected to spend one hour or longer	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

2.4 General Nuisance Legislation

Part III of the Environmental Protection Act (EPA) 1990 (as amended) contains the main legislation on Statutory Nuisance and allows local authorities and individuals to take action to prevent a statutory nuisance. Section 79 of the EPA defines, amongst other things, smoke, fumes, dust and smells emitted from industrial, trade or business premises so as to be prejudicial to health or a nuisance, as a potential Statutory Nuisance.

In legislation there are currently no numerical limits in terms of what level of dust constitutes a nuisance.

[4] Department for Environment, Food and Rural Affairs (Defra), the Scottish Government, the Welsh Assembly Government and the Department of the Environment in Northern Ireland: Local Air Quality Management Technical Guidance LAQM.TG(09), June 2014.

Fractions of dust greater than 10µm (i.e. greater than PM_{10}) in diameter are not covered within the UK AQS and typically relate to nuisance effects as opposed to potential health effects. When the rate of accumulation of this coarser fraction of dust (referred to as deposited dust) is sufficiently rapid to cause fouling or discoloration then it is generally considered to introduce a nuisance. The point at which an individual perceives dust deposition as a nuisance and causes a complaint is highly subjective

2.5 Planning Policy

2.5.1 Planning Policy Wales

Planning Policy Wales describes the policy context in relation to pollutants including air pollutants in Chapter 13 '*Minimising and Managing Environmental Risks and Pollution'* which states:

> *"13.12.1 The potential for pollution affecting the use of land will be a material consideration in deciding whether to grant planning permission. Material considerations in determining applications for potentially polluting development are likely to include:*
>
> *[…]*
>
> *• impact on health and amenity;*
>
> *• the risk and impact of potential pollution from the development, insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the development would impact on an Air Quality Management Area or a SAC);*
>
> *• prevention of nuisance*; […]"

2.5.2 City and County of Swansea Unitary Development Plan

The CCS Unitary Development Plan (UDP) was adopted on 10th November 2008. It is the most up to date Development Plan covering the authorities' administrative area and is used in the determination of planning applications. The UDP sets out a range of policies and proposals relating to future development. Policy EV2 and EV40 are specifically relevant to air quality:

> *"POLICY EV2*
>
> *[…]*
>
> *New development must have regard to the physical character and topography of the site and its surroundings by:*
>
> *(xiii) Having full regard to existing adjacent developments and the possible impact of environmental pollution from those developments, as well as the creation of any environmental pollution to the detriment of neighbouring occupiers (including light, air and noise*)"
>
> *"Policy EV40*

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, […] pollution.”

2.6 Assessment Guidance

2.6.1 Local Air Quality Management Technical Guidance LAQM.TG(09)

Defra has published technical guidance for use of local authorities in their LAQM work (referred to as LAQM.TG(09)). The guidance includes approaches and methods for handling background air quality data and undertaking assessments. The guidance and associated tools have been applied as appropriate in this assessment.

2.6.2 Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) Guidance

Environmental Protection UK (EPUK) and the IAQM have together published guidance[5] to help ensure that air quality is properly accounted for in the development control process. It clarifies when an air quality assessment should be undertaken, what it should contain, and how impacts should be described and assessed. Importantly, it sets out a recommended approach to assess the significance of impacts.

2.6.3 Construction and Dust Demolition Guidance

Guidance on the assessment of dust from demolition and construction has been released by the IAQM[6]. The guidance provides a series of matrices to determine the risk magnitude of each potential dust source in order to identify appropriate mitigation measures that are defined within further IAQM guidance.

.

[5] Environmental Protection UK and Institute of Air Quality Management, ‘Land-Use Planning and Development Control: Planning for Air Quality', 2015.

[6] Institute of Air Quality Management (IAQM), Guidance on the assessment dust from demolition and construction (2014).

3.0 ASSESSMENT METHODOLOGY

This section provides information relating to methods used in this assessment.

3.1 Construction Dust Assessment

The assessment has been undertaken with reference to IAQM '*Guidance on the assessment of dust from construction and demolition*'.

Descriptors for magnitude of impact and impact significance used in this assessment of construction phase dust are from the IAQM Guidance and reproduced in Appendix AQ1 of this report.

3.2 Operational Phase and Exposure Assessment

A qualitative assessment has been undertaken with reference to the following documents:

- LAQM.TG(09); and
- Land-Use Planning and Development Control – Planning for Air Quality – EPUK and IAQM[7].

The assessment is based on a review of available information largely drawn from CCS LAQM reports, in particular the 2015 Air Quality Updating and Screening Assessment[8] (referred to as the 2015 USA). Other LAQM reports have also been used as well as Department for Transport (DfT) automatic traffic counts.

The qualitative assessment also makes use of the following tools:

- Defra 'NO_x-NO_2 calculator' (v4.1) available on the Defra LAQM Support website; and
- Cambridge Environmental Research Consultants (CERC) ADMS Roads (Version 4) air dispersion model.

[7] Environmental Protection UK and Institute of Air Quality Management, 'Land-Use Planning and Development Control: Planning for Air Quality', 2015.

[8] 2015 Updating and Screening Assessment for the City & County of Swansea. In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management (June 2015).

4.0 BASELINE ENVIRONMENT

4.1 Location and Site Setting

The site, is located between Mariner Street and the B4290, in Swansea centre at Grid Reference (NGR) x265648, y193596 (see Figure 4-1).

The site is currently a car park. The surrounding land uses comprise commercial and retail properties to the north, residential apartments to the west on New Orchard Street, the railway station to the east and high rise offices to the south on Alexandra Road (B4290).

A review using the Magic web-based interactive mapping service[9] was undertaken to identify statutory designated sites of ecological or nature conservation importance within 50m of the scheme or within 200m of any road with a traffic flow affected by the proposed development site, to determine the potential impact resulting from construction dust and operational phase traffic emissions, respectively. The review indicates there are no such sites in proximity to the affected area.

Figure 4-1
Site Location

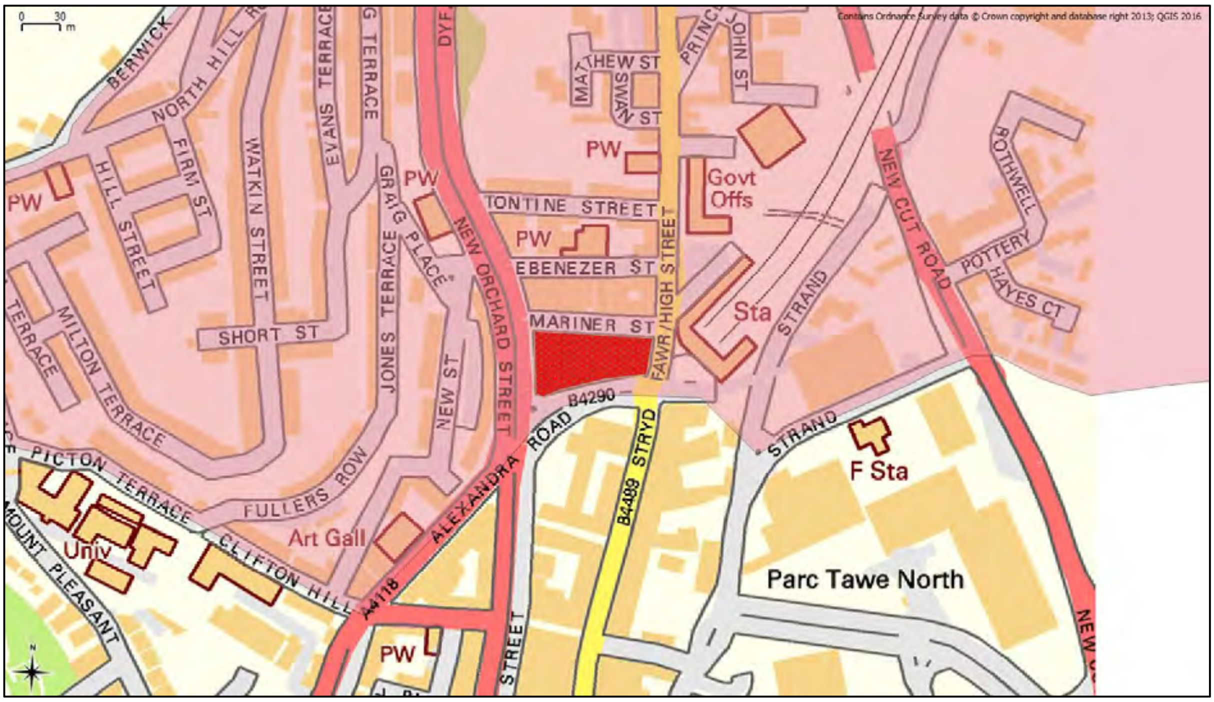


Figure Notes: AQMA as pink shaded area

4.2 Local Air Quality Management

As required under Section 82 of the Environment Act (1995) (Part IV), CCS has conducted an on-going exercise to review and assess air quality within their administrative area. This process has indicated that there are areas where the annual mean NO_2 concentrations are above, and likely to remain above the AQAL at locations of relevant public exposure. The Swansea Air Quality Management Area 2010 comprises the Hafod and the Sketty and Fforestfach areas. The site lies just inside the southern extremity of the Hafod area of the AQMA (as illustrated in Figure 4-1).

[9] Natural England, www.magic.gov.uk, accessed January 2015.

The most recent published LAQM report is the 2015 USA. This report contains the latest air quality monitoring results within the CCS. 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';*
- *'all sites remain compliant for Particulate matter PM_{10}. Similarly, for the other pollutants set in regulation'; and*
- *'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 exceedences of the nitrogen dioxide annual mean objective outside of the Swansea Air Quality Management Area 2010'.*

4.3 Baseline Air Quality

4.3.1 Roadside Air Quality Monitoring

CCS deploy both automated and passive diffusion tube monitoring techniques within their administrative area. The position of monitoring sites in relation to the application site is presented in Figure 4-2.

Figure 4-2
CCS Monitoring Locations

Table 4-1 and Table 4-2 below presents the monitoring data for the sites that are of most relevance to this assessment, i.e. the closest diffusion tube sites on the approaching roads, and the automatic real-time monitoring site on the High Street. Trends in annual mean monitored concentrations at each of the diffusion tube monitoring locations are presented in Figure 4-3.

Table 4-1
NO_2 Diffusion Tube Monitoring Results

ID	Distance to kerb of nearest road (m)	2008	2009	2010	2011	2012	2013	2014	2015
		Annual Mean Concentration (µg/m^3) [c]							
19	5	42.6	44.9	52.2	45.8	45.3	43.8	42.6	41.4
68	6	34.4	34.6	41.5	39.3	39.7	35.7	36.1	35.3
69	3	42.1	43.6	50.9	40.8	42.3	36.7	40.3	39.8
118	7	29.3	32.0	38.6	33.0	31.8	29.2	29.3	29.0
121	3	79.3	61.2	52.3	52.7	51.0	50.6	52.7	47.8
122	3	39.5	37.2	47.4	37.1	34.4	32.5	34.8	30.5
123	4 [b]	54.4	51.3	51.8	51.0	48.8	46.6	47.0	a
242	4 [b]	-	-	45.2	46.0	44.3	41.5	40.9	a
287	2	-	-	-	30.8	29.7	31.9	29.5	a
288	2	-	-	-	33.4	32.9	32.3	31.5	a
289	2	-	-	-	37.3	35.9	34.2	33.0	a

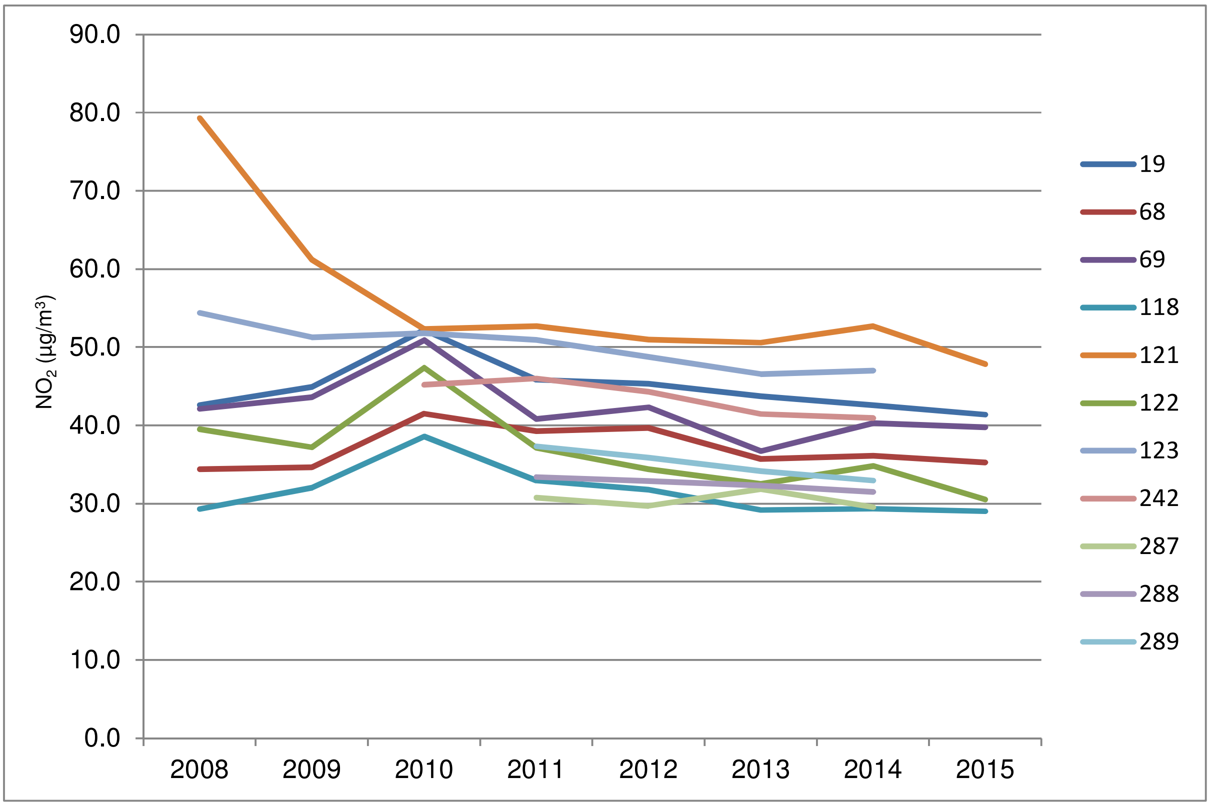
Table Note:
a) Data not obtained.
b) 242 is located at approximately 4m height in the same location as 123 (2m height approximately).
c) Bias corrected.

Table 4-2
High Street (ID 13): NO_2 Automated Monitoring Results

Year	Number of exceedences of 200µg/m^3 hourly mean (99.79%ile µg/m^3)	Annual Mean Concentration (µg/m^3)
2014[(a)]	5 (194.7µg/m^3)	56.9
2015[(b)]	2	54.7

Table Note:
Distance to kerb of nearest road 2 (m)
a) 2014 data is provisional based on 48.4% data capture as monitoring started in July 2014. Therefore the 99.8%ile is presented in brackets.
b) 2015 data is provisional and not yet ratified. Indications are 93% collection efficiency

Figure 4-3
NO_2 Diffusion Tube Monitoring Results



The diffusion tube data indicates that there has been a general downward trend at these roadside/kerbside monitoring sites since 2010, as presented in Figure 4-3. The most recent year of monitoring data (2015) indicates the annual mean AQAL of 40µg/m^3 has been exceeded at sites 19 and 121, with site 69 close to the limit. Site 121 and the High Street automated monitor are situated close to a bus stop and as such are likely to represent a 'hot spot' in relation to other locations along the same road. The 2014 data (2015 not obtained) for Sites 123 and 242 situated above it shows an exceedance at both sites with the higher tube showing a significant reduction toward compliance.

No monitoring for other pollutants is undertaken in close proximity to the site. In summary, monitoring results reported in the 2015 USA for other key pollutants (i.e. PM_{10} and $PM_{2.5}$) is as follows:

- PM_{10} is measured at 7 roadside sites. The concentrations ranged between a minimum annual mean at Morriston Groundhog of 13.2µg/m^3 to a maximum recorded at the Swansea AURN of 20.3µg/m^3. No more than 5 exceedences of 50µg/m^3 as a 24-hour mean were recorded at any location. As such PM_{10} concentrations across CCS appear well below the AQALs; and
- $PM_{2.5}$ is measured at the Swansea AURN. The annual mean concentration recorded in 2013 and 2014 was 11.9µg/m^3 and 12.8µg/m^3, respectively, and therefore below the AQAL.

4.3.2 Background Air Quality Data

'Background' air quality is intended to represent the air quality conditions away from or discounting the immediate effect of local sources.

CCS operate an 'urban background' monitoring station at Cwm Level Park, Landore, approximately 2.3km north of the application site. The monitoring location is 78m from the nearest road. The 2014 NO_2 background concentration was 17.1µg/m^3. There is no closer background monitoring location. There is no background monitoring undertaken for PM_{10} or $PM_{2.5}$.

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by Defra and is routinely used to support LAQM and Air Quality Assessments and has been sourced from the UK Air Information Resource (UK-AIR). Mapped background concentrations (based upon projections from the 2011 base year Defra update[10]) for NO_2, PM_{10} and $PM_{2.5}$ were obtained for the grid square containing the application site and surrounding study area. The annual mean 2014 Defra NO_2 background concentration for the grid square containing the Cwm Level Park automatic monitor is 16.5µg/m^3 which shows a reasonable level of agreement with the Defra modelled predictions.

The background pollutant concentrations in the study area for comparison with the last year of monitoring data (2015) and present year (2016) are presented in Table 4-3.

Table 4-3
Background Annual Mean Concentrations

	2015	2016
NO_2 (µg/m^3)	**16.7**	**16.3**
PM_{10} (µg/m^3)	**13.7**	**13.5**
$PM_{2.5}$ (µg/m^3)	**9.0**	**8.9**

[10] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home.

5.0 CONSTRUCTION PHASE ASSESSMENT

This section presents the potential air quality impacts associated with the construction phase of the development, including any required mitigation options.

Construction activities will include:

- demolition of existing buildings and structures on-site;
- material import and export;
- temporary stockpiling of materials;
- landscaping works;
- construction of new on-site buildings; and
- associated vehicle movements (including track-out of material by construction phase movements).

Potential air quality impacts associated with these activities have been identified as:

- generation of dust emissions on-site during construction works; and
- generation of exhaust emissions from construction phase road traffic, including Light Duty Vehicles (LDVs) carrying construction workers to and from the development site and HDV movements involved with the export and import of construction material.

5.1 Construction Dust

The following subsections provide a consideration of potential construction dust and conclude with a determined emission class and risk category, from each of the 4 categories identified by the IAQM Guidance. The contractors to build out the development have not been commissioned and at this stage there is no construction plan, so exact details on methods and plant to be used on site are not finalised, the assessment therefore is based on expert judgement.

5.1.1 Assessment Screening

There are ‘human receptors’ within 350m of the site but no habitat sites within 50m of the site boundary or within 50m of the site access roads. Therefore, an assessment of construction dust on ecological receptors can be screened out from this assessment but an assessment of construction dust at human receptors is required.

5.1.2 Potential Dust Emission Magnitude

The most significant potential source of dust emissions during construction would be earthworks activities. Dust is generated by the action of heavy vehicles (bulldozer, front-end loader, hydraulic excavator, and dump trucks) digging or moving earth, as well as by the movement of the vehicles on potentially dusty surfaces. Handling and storage of construction materials (aggregates), haulage across unsurfaced areas are also potential sources of dust generation. The potential dust emission magnitude for each activity is described in Table 5-1.

Table 5-1
Potential Dust Emission Magnitude

Activity	Comments	Dust Emission Magnitude
Demolition	Existing buildings on the development site require demolition. The building volumes are relatively small, with a building volume of less than 5,000m^3. The buildings are 2 storey with one 4 storey, and therefore demolition will be predominantly less than 10m above ground level. The buildings appear standard brick masonry and considered potentially dusty. Crushing and screening of material for re-use is unlikely to take place.	Small
Earthworks	Total area is of medium size at approximately 0.43 hectares and it has been assumed that the soil is potentially dusty. Excavation for foundations will be required however volumes of material removed would be small at less than 20,000m^3. Given the size of the site it is anticipated that less than 5 heavy earth moving vehicles would be in action on site at any one time.	Small
Construction	The building construction volume is estimated at approximately 100,000m^3. Construction material would be a combination of potentially dusty materials (e.g. concrete) and material with low potential for dust release (e.g. pre-fabricated panels). For the purposes of assessment it has been assumed that concrete batching could be taking place on site although this has not been confirmed.	Large
Trackout	It is anticipated that there could be between 10 and 50 HDV outward movements per day. The material is considered potentially dusty (i.e. clay content), considering the area of the site vehicles would be travelling on unpaved surfaces for less than 50m.	Medium

5.1.3 Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The surrounding receptors include residential (considered of high sensitivity to dust soiling and PM_{10}) to the west on the opposite side of New Orchard Street within approximately 25m, beyond which are further residential properties. To the north on Mariner Street (within 20m) and beyond, and to the south on Alexandra Road and High Street is predominantly commercial, retail and office receptors (considered of medium sensitivity to dust soiling and medium sensitivity to PM_{10}).

The sensitivity of the area and the factors considered are presented in Table 5-2.

Table 5-2
Sensitivity of the Area

Sensitivity to:	Sensitivity			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling Impacts	Medium sensitivity receptors within 20m. High sensitivity receptors 100m north. **Medium**	More than 10 less than 100 high sensitivity receptors within 50m. **Medium**	More than 10 less than 100 high sensitivity receptors within 50m. **Medium**	More than 10 high sensitivity receptors within 200m of the site access routes. **High**
Human Health	More than 10 medium sensitivity receptors	More than 10 medium sensitivity receptors	More than 10 medium sensitivity receptors	More than 10 high sensitivity

Sensitivity to:	Sensitivity			
Impacts*:	within 50m	within 50m	within 50m	receptors within 200m of access routes.
	Medium	**Medium**	**Medium**	**Medium**

Table Note: *Baseline PM_{10} is less than 24µg/m^3 according to Defra pollutant mapping and CCS monitoring

5.1.4 Risk of Impacts

The outcome of the assessment of the potential 'magnitude of dust emissions', and the 'sensitivity of the area' are combined in the table below to determine the risk of impact which is used to inform the selection of appropriate mitigation.

Table 5-3
Risk of Dust Impacts (without mitigation)

Potential Impact		Demolition	Earthworks	Construction	Trackout
	Magnitude :	Small	Small	Large	Medium
Dust Soiling Impacts	Sensitivity:	Medium	Medium	Medium	Medium
	Risk of Impact::	Low	Low	Medium	Low
Human Health Impacts	Sensitivity:	Medium	Medium	Medium	High
	Risk of Impact::	Low	Low	Medium	Medium

5.2 Vehicular Pollutants

The Highways Agency Design Manual for Roads and Bridges (DMRB) states that further assessment of potential air quality impacts should be undertaken if there is an increase in 24-hour annual average daily traffic (AADT) flow of more than 200 heavy duty vehicles (HDV).

Information on traffic movements anticipated during construction works was unavailable for the completion of the Air Quality Assessment. However, construction traffic is not anticipated to result in an increase in movements above the DMRB threshold criteria. Therefore, in accordance with the DMRB Guidance, '*the impact of the scheme* [from construction phase vehicle movements] *can be considered to be neutral in terms of local air quality'*.

5.3 Construction Phase Mitigation

In order to control potential impacts, the mitigation measures presented within Table 5-4 are proposed. With the effective application of the dust mitigation measures it is considered that the impacts at all receptors will be 'not significant'.

Table 5-4
Construction Dust Mitigation Measures

Site Application	Mitigation Measure
Communications	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary.
	Display the head or regional office contact information
General dust management	Develop and implement a dust management plan as part of the Construction Plan
	Record all dust and air quality complaints and take appropriate measures to reduce emissions
	Record any exceptional incidents that cause dust off site.
	Carry out regular site inspections, record inspection results, in accordance with DMP and make an inspection log available to the local authority when asked

Site Application	Mitigation Measure
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
	Minimise drop heights from loading shovels and other material handling equipment
	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible
	Impose a site speed limit of 15mph on paved routes and 10mph on unpaved haul roads
	Ensure all vehicles engines are switched off when stationary and not in use
	Ensure an adequate supply of water is available onsite for effective dust suppression
	Use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems
	Avoid site runoff of water or mud
	In close proximity to sensitive receptors erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles.
	Use enclosed chutes and covered skips.
	Keep site fencing and barriers clean using wet methods
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.
	In close proximity to sensitive receptors cover or fence stockpiles to prevent wind whipping
Demolition	Ensure water suppression is used during demolition operations as required
	Use of appropriate manual or mechanical techniques. No explosives.
	Use enclosed chutes, conveyors and covered skips, where practicable
	Use of screening techniques to minimize the fugitive release of dust (e.g. scaffolding and sheet wrapping techniques to prevent fugitive dust emissions)
Construction	Ensure aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	Avoid scabbling (roughening of concrete surfaces) if possible
Trackout	Use water assisted dust sweepers on access and local roads to remove tracked out material as necessary
	Avoid dry sweeping large areas
	Implement manual wheel washing system as required and site to provide an adequate area of hard surfaced road between the wheel wash facility and the site exit
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record inspection and outcome
	Access areas to be located at least 10m from receptors where possible

6.0 OPERATIONAL PHASE IMPACTS AND EXPOSURE ASSESSMENT

6.1 Potential Operational Phase Impacts

The site is currently predominantly occupied by a 107 space surface level car park. On a weekday this generates approximately 500 arrivals and 500 departures each day. The proposal includes 16 car parking spaces; 10 spaces serving commercial uses and 6 spaces serving student accommodation (for disabled users and building management). The tenancy agreement will prevent students (other than with disabled access requirements) bringing a car to the site, or parking on site. As a result, there will be a significant reduction in trips to and from the site (circa 200 fewer arrivals and 200 fewer departures).

As a result of the reduction in vehicle trips to the application site, the proposed development is predicted to contribute to a reduction in car emissions in the vicinity of the site. The reduction potentially represents a beneficial impact, although this has not been quantified to determine its significance. The surrounding road network is heavily trafficked with High Street experiencing approximately 10,000 AADT and New Orchard Street approximately 20,000 AADT[11]. The reduction in traffic flow would therefore be small (less than 5%) of existing total flows.

6.2 Exposure Assessment

Air quality at the proposed building will be influenced by traffic flow on the surrounding road network. According to the CCS 2015 USA the local authority is in the early stages of a wide ranging review of development proposals for the city centre. This review will also examine the existing road network and linkages within the city centre and surrounding area. As such it is possible that the current road network surrounding the application site will undergo significant change. This qualitative assessment of potential future exposure at the application site is based on the current road network and incorporates an appraisal of:

- present air quality;
- future air quality projections; and
- NO_2 concentration 'fall-off' with height.

6.2.1 Present Air Quality

The roads of greatest significance in terms of affecting air quality at the application site, given their proximity, are High Street to the east, Alexandra Road (B4290) to the south, and New Orchard Street to the west.

Section 4.3 describes the current monitoring data in the area. Those sites of most relevance to the roads immediately surrounding the application site are monitoring sites on High Street (north of the railway station Sites 121, 287, 288, 289) and on Dyfatty Street leading to New Orchard Street (Site 19). These monitoring sites are most likely to be influenced by traffic in similar volumes to that which will pass the application site given the road layout. The following observations on the monitoring data can be made (see Figure 4-2 for monitoring site locations):

- as stated previously, Site 121 and the High Street automated monitor are situated adjacent to a bus stop and close to a roundabout serving the railway station car park and as such are likely to represent a 'hot spot' when considered alongside Sites 287,

[11] According to Automatic Traffic Count site 22 (High Street) and site 7 (Dyfatty Street – north along from New Orchard Street) reported in the CCS 2015 USA for 2011 to 2014.

288 and 289 on the same road. Site 121 currently exceeds the AQAL, however 287, 288 and 289 are well below the AQAL at approximately 30µg/m^3;
- some of the other monitoring sites south on High Street (Sites 123 and 242) are likely to be influenced by canyon like effects due to the 4 and 5 storey buildings on either side of a relatively long, narrow and congested high street and therefore not as applicable to the application site that is in a more open location. The development comprises buildings of 6 to 21 storeys however with the orientation of the proposed building in relation to the existing buildings, and the wide junction layout, it is considered unlikely to result in pronounced canyon like effects;
- Site 19 on Dyfatty Street (approximately 20,000 AADT) is situated at the junction with Camarthen Road (A483) which has a reported traffic flow of approximately 26,000 AADT[12]. The annual mean concentration at this site is just above 40µg/m^3. The application site is also at a junction although the traffic flow on Alexandra Road (B4290) to the south is not known; and
- Sites 68, 69 and 122 are all on roads close to traffic lights that feed into the junction at which the Application Site is located. The annual mean concentration at these sites is between approximately 30 and 40µg/m^3. The complex junction layout around the Application Site and absence of traffic flow data for these feeder roads mean that it is only possible to provide a very broad indication of likely ambient concentrations adjacent to Alexandra Road (B4290) to the south of the application site.

On the basis of the current monitoring data review a precautionary assumption would be that the ground level concentration at the façade of the proposed building at the application site could be approximately 40µg/m^3 on the basis that the concentrations at the most applicable monitoring sites discussed above are generally between approximately 30 and 40µg/m^3.

A methodology is presented within LAQM.TG(09) to determine compliance with the hourly mean NO_2 objective. This Guidance states that:

> *'authorities may assume that exceedences of the 1-hour mean objective for NO_2 are only likely to occur where annual mean concentrations are 60 µg/m^3 or above'*

On the basis of the monitoring data, it can be assumed that annual mean concentrations are below 60µg/m^3, and therefore that the 1-hour mean NO_2 AQAL will be met at the ground level of the proposed development.

As such the air quality at ground level would be appropriate for the intended commercial uses (i.e. short-term exposure) but may be close to or marginally exceeding the annual mean AQAL and therefore not appropriate for residential use (which is only intended on Levels 1 and above).

No monitoring for other pollutants (e.g. PM_{10} and $PM_{2.5}$) is undertaken in close proximity to the application site, however on the basis of the monitoring undertaken in the wider area and the conclusions of the 2015 USA it can be assumed that AQALs for PM_{10} and $PM_{2.5}$ (and other measured pollutants) are met at the application site.

6.2.2 Future Year Projections

CCS have undertaken an assessment, reported in the 2015 USA, to project the collected diffusion tube data to future years based on guidance within LAQM.TG(09)[13]. The data for

[12] Department for Transport (Count Point 50596) http://www.dft.gov.uk/traffic-counts/cp.php?la=Swansea#50596.

[13] The adjustment based on latest update published during June 2014.

the applicable sites discussed above is presented in Table 6-1 alongside the most recent measured data (where available). Any exceedences of the AQAL are displayed in bold text.

Table 6-1
Projected Future NO_2 Concentrations at Diffusion Tube Locations

ID	2015 Measured data	2015	2016	2017	2018	2019	2020	2025
		Predicted Annual Mean Concentration (µg/m³)						
19	**41**	**42**	**40**	38	36	34	31	27
68	35	36	34	32	30	28	27	23
69	**40**	**40**	38	36	34	32	30	25
118	29	29	28	26	25	23	22	18
122	31	34	32	30	28	26	24	20
287	a	29	27	25	24	22	20	17
288	a	30	29	27	25	23	22	18
289	a	32	30	28	26	25	23	19

Table Note: projected NO_2 concentrations are based on ratified 2014 data sourced from the CCS 2015 USA.

It is evident that the 2015 measured data is similar to the projected data (and not higher) suggesting a fair correlation. These projected annual mean concentrations at all the applicable sites are predicted to have reduced to below the AQAL by 2017. On the basis of the assumptions above it is reasonable to assume that the concentration at the façade of the building would be less than the AQAL by the time the building is complete and occupied.

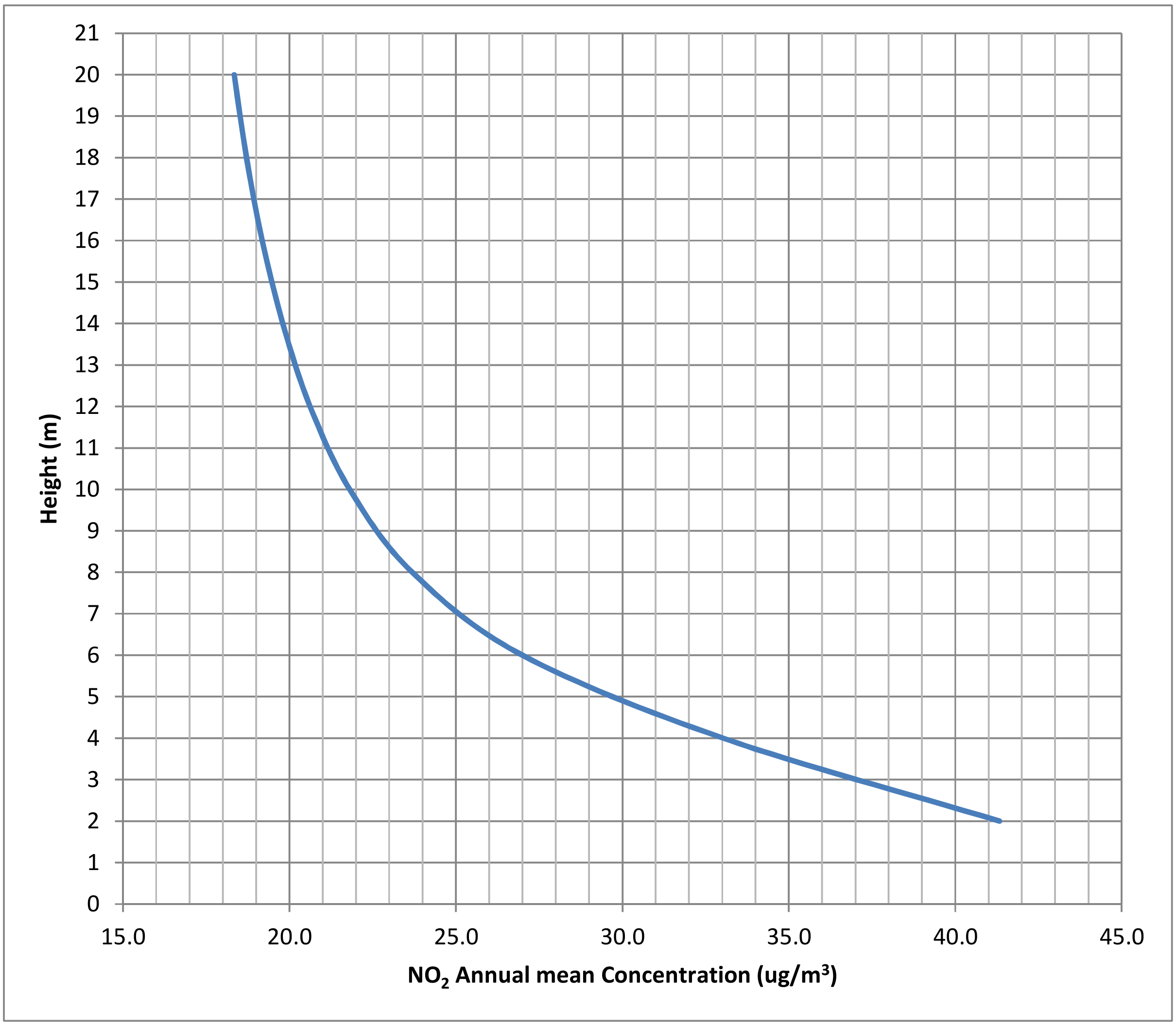
6.3 Potential NO_2 concentration 'fall-off' with height

The proposed development site will introduce relevant exposure locations for the annual mean AQAL at Level 1 (5.5m floor height) and above (the ground level will be for commercial use).

Ambient concentrations of traffic pollutants reduce with height away from road sources. This is demonstrated in CCS monitoring data at Sites 123 and 242. The graph below (Figure 6-1) presents the drop-off in NO_2 concentration with height based on the CERC ADMS Roads (v4) air dispersion model. Monitoring Site 19 data for 2015 has been used as a proxy combined with the Defra background to provide an illustration of potential ambient concentration drop-off with height (without the projected reduction in future years which therefore represents a precautionary approach).

The modelled predictions show that from an ambient concentration of 41.4µg/m^3 at the ground level façade of the building, the ambient concentration could reduce to 27µg/m^3 by Level 1 (5.5m floor level). On this basis, it is predicted that annual mean NO_2 ambient concentrations at Level 1 and above in the building will be below the AQALs.

Figure 6-1
NO_2 Concentration 'Drop-off' with Height



6.3.1 Summary

In summary:

- following an appraisal of CCS monitoring data in the area surrounding the development, it is estimated that current ground level concentrations at the proposed location of the façade of the building may be between approximately 30µg/m^3 and 40µg/m^3. As a precautionary estimate a concentration of approximately 40µg/m^3 has been assumed. Concentrations of PM_{10} (annual mean and 24-hour mean) and $PM_{2.5}$ (annual mean) are estimated to be well below their respective AQALs;
- on the basis of the published future projections reported in the 2015 USA it is reasonable to assume that the concentration at the façade of the building would reduce and be less than the current level by the time the building is complete and occupied, i.e. and therefore likely to be below the NO_2 annual mean AQAL; and
- dispersion model predictions show the drop-off in NO_2 concentration with height – applying the model predictions to the assumption of a concentration of 41.4µg/m^3 at the ground level façade, the ambient concentration is predicted to reduce to 27µg/m^3 by Level 1 (5.5m floor level) and therefore well below the AQAL

As such concentrations at the ground level façade of the proposed building are predicted to be below the relevant AQALs (i.e. 1-hour mean NO_2 AQAL) for the intended commercial use. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted be below the relevant AQALs for the intended student residential use (i.e. annual mean and 24-hour mean averaging periods).

7.0 CONCLUSIONS

The conclusions of the assessment are as follows:

- with respect to the construction phase, in the absence of mitigation, construction and track-out due to vehicles may present a medium risk of dust impacts in the immediate vicinity, the other main activities are predicted to result in a low risk of impact. However, with the effective implementation of the defined mitigation measures, the impacts are reduced and considered not to be significant at receptors;
- the operational phase of the scheme is not considered to lead to an adverse impact on air quality given that the development will result in an overall decrease in vehicle trips to and from the application site; and
- air quality at potential future locations of relevant exposure for short-term (commercial use) and long-term (student residential use) averaging periods at the proposed development is predicted to be below the relevant Air Quality Assessment Levels.

8.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Patrick Parsons Ltd; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Appendix AQ1 – Construction Dust Assessment Methodology

Predicting Risk

The assessment of risk is determined by considering the predicted change in conditions as a result of the proposed development. The risk category for potential dust effects arising from site works is defined into 4No. potential activities:

- demolition;
- earthworks;
- construction; and
- trackout.

The determination of risk categories presented above are based upon the descriptors presented within IAQM: *Guidance on the assessment of dust from demolition and construction*.

Sensitivity of Receptor

To determine the significance of dust effects associated with the construction phase of the proposed development, an evaluation of the sensitivity of the surrounding area is required. Receptors can demonstrate different sensitivities to changes in their environment, and are classified as detailed within Table AQ1-1.

Quoted distances to the nearest receptor are from the dust emission sources. Where this is not known, receptor distances are determined from the site boundary. The risk category is based upon the distance of site works to the nearest receptor.

Table AQ1-1
Methodology for Defining Sensitivity to Dust Effects

Sensitivity of Area	Examples		
	Human Receptors		Ecological Receptors (A)
	Dust Soiling Effects	Health Effects of PM_{10}	
High	• users can reasonably expect an enjoyment of a high level of amenity; or • the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations with an international or national designation and the designated features may be affected by dust soiling; or • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. • indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • indicative examples include parks and places of work.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health • and Safety at Work legislation.	• locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • locations with a national designation where the features may be affected by dust deposition. • indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.

Low	• the enjoyment of amenity would not reasonably be expected; or • property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal • pattern of use of the land. • indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• locations where human exposure is transient. • indicative examples include public footpaths, playing fields, parks and shopping streets.	• locations with a local designation where the features may be affected by dust deposition. • indicative example is a local Nature Reserve with dust sensitive features.

Notes:
(A) Only applicable if ecological habitats are present which may be sensitive to dust effects.

Assessment of Impact Significance – Dust Effects

Table AQ1-2 to Table AQ1-4 illustrate how the sensitivity of the area may be determined for dust soiling, human health and ecosystem impacts, respectively. The highest level of sensitivity from each table should be recorded.

Table AQ1-2
Sensitivity of Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	<1	Low	Low	Low	Low

Table AQ1-3
Sensitivity of Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m^3 (>18µg/m^3 in Scotland)	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	28 – 32µg/m^3 (16-18µg/m^3 in Scotland)	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	High	Medium	Low	Low	Low
	24 – 28µg/m^3 (14-16µg/m^3 in Scotland)	>100	High	Medium	Low	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 – 10	Medium	Low	Low	Low	Low
	<24µg/m^3 (<14µg/m^3 in Scotland)	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	2 – 10	Medium	Low	Low	Low	Low
Low	-	1	Low	Low	Low	Low	Low

Table AQ1-4
Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m) [(A)]	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

NOTE:
(A) For trackout, the stances should be measured from the side of the roads used by construction traffic.

Defining the Risk of Impact

Table AQ1-5 to Table AQ1-8 illustrates how the dust emission magnitude should be combined with the sensitivity of the area to determine the risk of impacts with no mitigation measures applied.

Table AQ1-5
Risk of Dust Impacts – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table AQ1-6
Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table AQ1-7
Risk of Dust Impacts – Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table AQ1-8
Risk of Dust Impacts -–Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	High Risk	Low Risk
Medium	Medium	Low Risk	Negligible
Low	Low	Low Risk	Negligible

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Air Quality Consultants

Air Quality Assessment:
Morfa Road, Swansea

August 2016

Experts in air quality
management & assessment

Document Control

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Job Number	J2604

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Executive Summary

The air quality impacts associated with the proposed student accommodation at Morfa Road in Swansea have been assessed.

Existing conditions within the study area show acceptable air quality, with concentrations of all pollutants below the relevant air quality objectives at the nearest monitoring locations. The site lies within an Air Quality Management Area.

The additional traffic generated by the proposed development will affect air quality at existing properties along the local road network. Increases in pollutant concentrations at sensitive locations resulting from emissions from these additional traffic movements will have *negligible* impacts for nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations. Concentrations will remain below the air quality objectives at all but one of the locations. The exceedence is already present at this location without the scheme and the change in concentration is *negligible*.

Air quality conditions for new residents within the proposed development have also been considered. Pollutant concentrations are predicted to be below the air quality objectives at the worst-case location assessed, and air quality conditions for new residents will be acceptable.

Overall, the air quality impacts 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 development of a 1,212 bed student accommodation building. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Short Brothers Homes Ltd.

1.2 The proposed development lies within an Air Quality Management Area (AQMA) declared by Swansea City Council for exceedences of the annual mean nitrogen dioxide objective. The development will lead to an increase in traffic on the local roads, which may impact on air quality at existing residential properties. The new residential properties will also be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.3 The site is located in close proximity to a number of railway lines, the closest of which runs north to south approximately 60 m west of the site. Defra guidance (Defra, 2016a) outlines an approach to assess the potential for exceedences of the annual mean nitrogen dioxide objective as a result of emissions from diesel locomotives. The guidance outlines that there is only the potential for an exceedence where there is long-term exposure within 30 m, and the annual mean background concentration of nitrogen dioxide is above 25 µg/m^3. The development site falls outside these criteria and thus the impact of emissions from railway locomotives on nitrogen dioxide concentrations are not considered further.

1.4 This report describes existing local air quality conditions (2015), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2018, which is the anticipated year of opening.

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

2 Policy Context and Assessment Criteria

Air Quality Strategy

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

Planning Policy

National Policies

2.2 Land-use planning policy in Wales is established within the policy document Planning Policy Wales (PPW) (Welsh Government, 2012) 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. 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

1.1 The City and County of Swansea Unitary Development Plan (UDP) was adopted in November 2008 (City and County of Swansea, 2008).

1.2 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'*

1.3 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.'*

2.6 The UDP is due to soon be replaced by the Swansea Local Development Plan. The LDP was presented to Council on 16th June 2016 and endorsed for a public consultation, which will run from 27th June to 12th August 2016.

Air Quality Action Plans

National Air Quality Plans

2.7 Defra has produced Air Quality Plans to reduce nitrogen dioxide concentrations in major cities throughout the UK (Defra, 2015). Along with a suite of national measures, the Air Quality Plans identify the need to establish Clean Air Zones within five Zones (Birmingham, Leeds, Southampton, Nottingham and Derby) where exceedences of the EU limit values for nitrogen dioxide have been forecast in 2020 and beyond. Within these Zones, lower-emission vehicles will be encouraged. The precise nature of these Clean Air Zones is still to be decided. In Greater London, Defra will continue to support and monitor the delivery of the Mayor's plans for improving air quality to meet the EU limit value for nitrogen dioxide by 2025. The study area is not in an affected area.

2.8 There is currently no practical way to take account of the effects of these Air Quality Plans on the modelling presented in this report, which is for assessment against the air quality objectives rather than the EU limit values.

Local Air Quality Action Plan

2.9 Swansea City Council has declared an AQMA for nitrogen dioxide that covers an area on the west bank of the River Tawe covering the Hafod District, Sketty and Fforestfach. The Council has since developed an Air Quality Action Plan (The City and County of Swansea, 2004).

Assessment Criteria

Health Criteria

2.10 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 (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.11 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 where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2016a). 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 where the annual mean concentration is above 32 $\mu g/m^3$ (Defra, 2016a). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedence of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 $\mu g/m^3$ it is unlikely that the 24-hour mean objective will be exceeded.

2.12 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, 2016a). 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 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.

2.13 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.

2.14 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/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 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, exceedences of the 24-hour mean PM_{10} objective are possible (Defra, 2016a).

[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

2.15 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] (EPUK & IAQM, 2015) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. 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 Swansea City Council via a telephone discussion and subsequent email correspondence between Phil Govier and Tom Price (Environmental Health Officers at Swansea City Council) and Paul Outen (Air Quality Consultants) held throughout June and July 2016.

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, 2016c) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2016a). Local sources have also been identified through discussion with Swansea City 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 (2016b). These cover the whole country on a 1x1 km grid.

3.4 Exceedences 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 2014 (Defra, 2016e) and for 2020 (Defra, 2016d), as well as from any nearby AURN monitoring sites (which operate to EU data quality standards). These are the maps used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedences of the limit value to the EU. The maps are currently available for the past years 2001 to 2014 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 2014, show no exceedences of the limit values anywhere in the UK in 2014.

Road Traffic Impacts

Sensitive Locations

3.5 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations both within, and close to, the proposed development. Receptors have been identified to represent worst-case exposure within these locations, being located on the façades of the properties closest to the sources. When selecting these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

3.6 Four existing residential properties have been identified as receptors for the assessment. An additional receptor has been identified within the new development, which represents exposure to existing sources. These locations are described in Table 2 and shown in Figure 1. In addition, concentrations have been modelled at the diffusion tube monitoring site located at New Cut Road (tube number 67), in order to verify the modelled results (see Appendix A3 for verification method).

Table 2: Description of Receptor Locations

Receptor	Description
Existing properties [a]	
Receptor 1	Residential property at St David's Student Accommodation Development
Receptor 2	Residential property at New Cut Road South
Receptor 3	Residential property at Former Bernard Hastie Site Committed Development
Receptor 4	Residential property at Llys Tawe Committed Development
New properties [b]	
Receptor A	Property within the proposed development

[a] Receptors modelled at a height of 1.5 m and 4.5 m to represent ground and first floor levels.

[b] Receptors modelled at heights of 1.5 m, 4.5 m, 7.5 m, 10.5 m, 13.5 m, 16.5 m, 19.5 m and 22.5 m to represent ground to seventh floor levels.

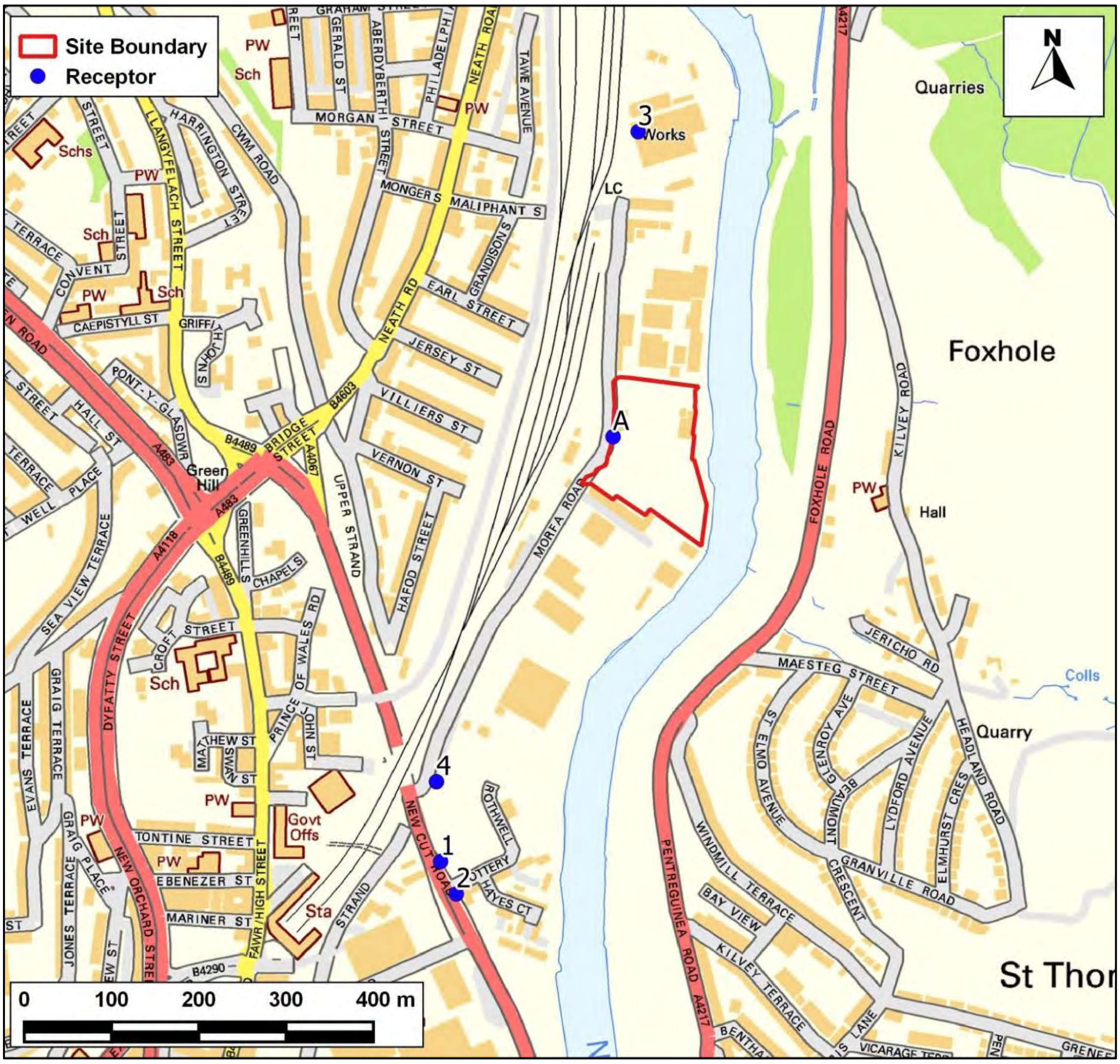

Figure 1: Receptor Locations

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Assessment Scenarios

3.7 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2015), and the proposed year of opening (2018). For 2018, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). 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 CURED tool (AQC, 2016a). This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016b).

Modelling Methodology

3.8 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 current and future year background nitrogen dioxide concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Traffic Data

3.9 Traffic data for the assessment have been provided by Asbri Transport, who has undertaken the Transport Assessment for the proposed development. Further details of the traffic data used in this assessment are provided in Appendix A3.

Uncertainty in Road Traffic Modelling Predictions

3.10 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.

3.11 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 current year (2015) concentrations.

3.12 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.

3.13 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. This pattern of no clear, or limited, downward trend is mirrored in some of the monitoring data assembled for this study, as set out later in Paragraph 4.8.

3.14 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).

3.15 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 v6.0.2) 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 A3.8 in Appendix A3, using AQC’s CURED 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.

3.16 It must also be borne in mind that the predictions in 2018 are based on the worst-case assumption that the proposed development is fully operational. This will have overestimated the traffic emissions and hence the 2018 with-scheme concentrations.

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 1.3 km northeast of Swansea City Centre. It is bound by Morfa Road to the west, the River Tawe to the east, and existing and under-development mixed-use premises to the north and south. The Swansea to Paddington railway line runs north to south, approximately 60 m to the west.

4.2 There are existing residential estates to the west, beyond the railway line, and to the east on the opposite side of the River Tawe. There are also a number of additional student accommodation buildings located to the south on Morfa Road.

Industrial sources

4.3 A search of the UK Pollutant Release and Transfer Register (Defra, 2016c) and Environment Agency's 'what's in your backyard' (Environment Agency, 2016a) 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 Review and Assessment

4.4 Swansea City Council 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 exceedences of the annual mean nitrogen dioxide objective. The proposed development lies within this AQMA. The declared AQMA is shown in Figure 2.

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

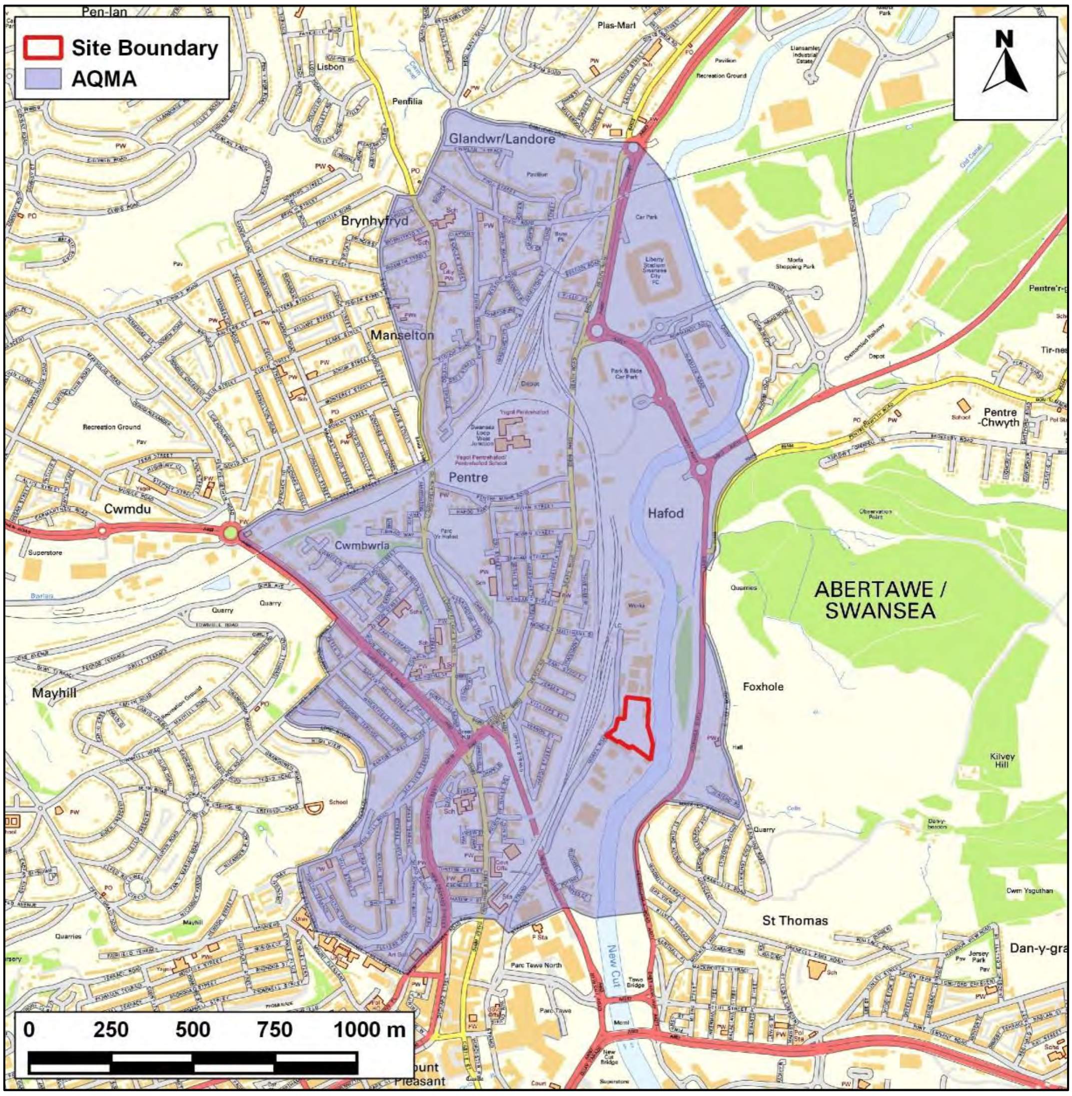

Figure 2: Declared AQMA

Local Air Quality Monitoring

4.6 Swansea City Council operates four automatic monitoring stations within its area, all of which are located within 1 km of the proposed development 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). These include 17 tubes located adjacent to the roads surrounding the proposed development site. Data for these sites have been provided by Swansea City Council. Results for the years 2010 to 2015, where available, are summarised in Table 3 and the monitoring locations are shown in Figure 3.

Table 3: Summary of Nitrogen Dioxide (NO2) Monitoring (2010-2015) [a]

Site No.	Site Type	Location	2010	2011	2012	2013	2014	2015
Automatic Monitors - Annual Mean (µg/m^3)								
-	Roadside	Swansea Roadside AURN	27.8	25.6	26.0	26.8	25.0	27.4
-	Roadside	Hafod DOAS [b]	**58.6**	**57.6**	**52.6**	**50.7**	**49.0**	**40.2**
-	Roadside	St Thomas DOAS [b]	**45.9**	**40.9**	38.6	39.5	35.8	33.7
-	Roadside	Station Court High Street	-	-	-	-	**56.9**	**54.6**
Objective			**40**					
Automatic Monitors - No. of Hours > 200 µg/m^3								
-	Roadside	Swansea Roadside AURN	0	1	0	0	0	0
-	Roadside	Hafod DOAS [b]	**20 (203.1)**	16	5	6	1	0
-	Roadside	St Thomas DOAS [b]	0	0	0	0	0	0
-	Roadside	Station Court High Street	-	-	-	-	5 (194.7)	2
Objective			**18 (200 – 99.79th Percentile if low data capture) [c]**					
Diffusion Tubes - Annual Mean (µg/m^3)								
19	Roadside	A4118	**52.2**	**45.8**	**45.3**	**43.8**	**42.6**	39.1
20	Roadside	A483	**45.5**	37.4	36.7	36.5	37.7	35.4
26	Roadside	B4603 Neath Road	**45.8**	**40.8**	**40.3**	39.1	38.6	35.4
27	Roadside	B4603 Neath Road	**45.4**	**40.0**	37.1	38.0	39.3	34.8
28	Roadside	B4603 Neath Road	33.5	30.3	30.1	28.3	28.2	25.7
29	Roadside	B4603 Neath Road	**53.4**	**53.5**	**47.6**	**43.9**	**47.4**	**48.9**
32	Roadside	A4217	38.8	33.2	31.5	35.2	33.4	30.2
33	Roadside	A4217	38.1	32.1	32.6	31.1	31.3	29.5

Site No.	Site Type	Location	2010	2011	2012	2013	2014	2015
35	Roadside	Delhi Street	**40.7**	**40.4**	33.5	31.3	32.2	31.4
36	Roadside	Delhi Street	34.4	33.6	31.7	30.1	27.5	26.5
38	Roadside	A483	39.1	37.2	35.4	33.6	31.1	32.7
59	Roadside	B4603 Neath Road	**60.3**	**54.0**	**53.9**	**58.0**	**50.3**	**47.8**
67	Roadside	New Cut Road	**46.3**	39.4	35.4	36.2	35.6	37.2
70	Roadside	Brunel Way	25.7	24.4	24.3	24.3	24.8	25.6
71	Roadside	Brunel Way	20.9	20.1	23.4	29.0	25.0	24.5
102	Roadside	Delhi Street	33.1	29.5	29.7	28.7	28.0	27.9
323	Roadside	Port Tennant Road	-	-	-	32.2	33.6	30.3
Objective			**40**					

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

[b] DOAS – Differential Optical Absorption Spectroscopy. Measurements are undertaken across an open path; a xenon lamp is shone from a transmitter, with the receiver being located a number of metres away. The receiver focuses and transmits the light via fibre optic cable into a spectra analyser. Concentrations are reported integrated over the path length and are therefore not directly comparable with fixed point measurements (Welsh Government and the Welsh Air Quality Forum, 2016).

[c] Values in brackets are 99.79th percentiles, which are presented where data capture is <90%.

4.7 Concentrations of nitrogen dioxide exceeded the annual mean objective at two of the four automatic monitoring sites in 2015; albeit only marginally at the Hafod DOAS monitoring site. Concentrations measured at the Station Court High Street monitor exceeded the objective by a substantial margin in 2014 and 2015. There have been no exceedences of the 1-hour mean objective at any automatic monitor since 2010. Annual mean concentrations measured at the diffusion tube sites vary considerably. In 2010, eight of the 17 tubes set out in Table 3 measured exceedences; however this falls to only two exceedences in 2015. The exceedences in 2015 were both measured along the B4603 Neath Road, at locations with canyon-like features where the dispersion of pollutants will be inhibited by rows of buildings and/or trees.

4.8 There is a slight downward trend in the monitoring results for the past six years at the majority of the monitoring sites. However, no clear trends are observed at a small number of sites (e.g. at diffusion tube site 71, where concentrations have shown a slight increase since 2010). These stable, or even increasing, concentrations over the past six years contrast with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards.

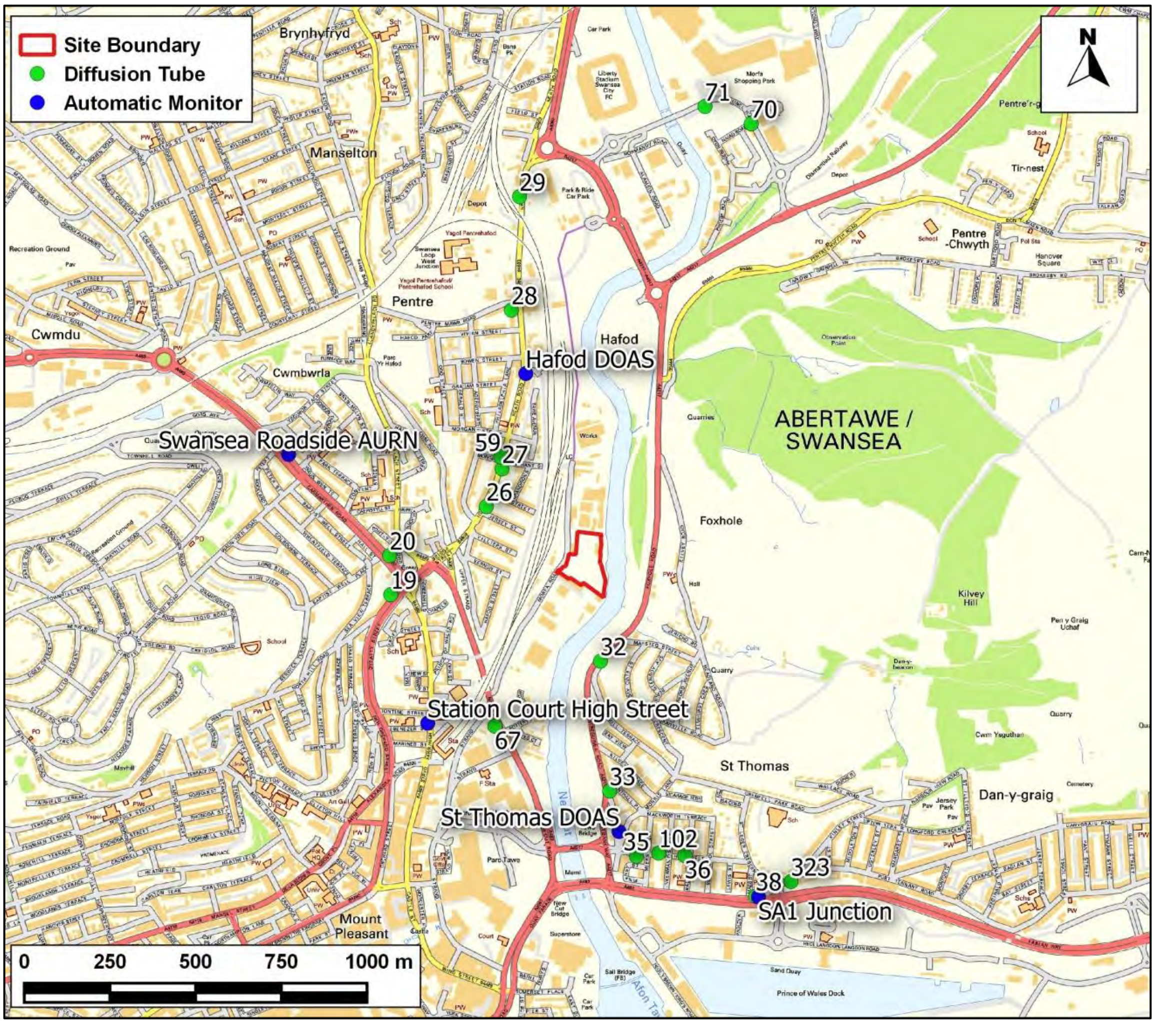

Figure 3: Monitoring Locations (DOAS monitor locations are shown as the location of the transmitter)

4.9 The Swansea AURN roadside automatic monitoring station, located approximately 860 m northwest of the proposed development site, is the closest station which measured PM_{10} concentrations in 2015. Results for the years 2010 to 2015 are summarised in Table 4. $PM_{2.5}$ concentrations are also measured at the Swansea AURN monitor, and the data for 2010-2015 are presented in Table 4. Concentrations have remained well below the objectives in every year of monitoring.

Table 4: Summary of PM10 and PM2.5 Automatic Monitoring (2010-2015)

Site No.	Site Type	Location	2010	2011	2012	2013	2014	2015
PM_{10} Annual Mean ($\mu g/m^3$)								
-	Roadside	Swansea Roadside AURN	15.8	14.7	17.8	19.0	20.3	20.2
Objective			**40**					
PM_{10} No. Days >50 $\mu g/m^3$								
-	Roadside	Swansea Roadside AURN	0	5 (29.8)	4	2	2	2
Objective			**35 (50 – 90th Percentile if low data capture) [a]**					
$PM_{2.5}$ Annual Mean ($\mu g/m^3$)								
-	Roadside	Swansea Roadside AURN	9.0	10.3	11.5	11.9	12.8	12.8
Objective			**25 [b]**					

a Reference equivalent. Where data capture was <90%, the 90th percentile of daily means is provided in parentheses.

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.

Exceedences of EU Limit Value

4.10 The Swansea Roadside AURN monitoring site lies within 1 km of the development site, and shows no exceedence of the annual mean nitrogen dioxide limit value in 2015 (Table 3). The national maps of roadside annual mean nitrogen dioxide concentrations (Defra, 2016e); used to report exceedences of the limit value to the EU, do not identify any exceedences within 1 km of the development site. Defra's mapping for 2020, which takes account of the measures contained in its 2015 Air Quality Plan (Defra, 2015), does not identify any exceedences within 1 km of the development site.

Background Concentrations

National Background Pollution Maps

4.11 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2015 and the opening year 2018 (Table 5) using Defra's background maps (Defra, 2016b). The background concentrations have been derived as described in Appendix A3. They include the emissions from the railway line that is not being considered explicitly. The background concentrations are all well below the objectives.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2015 and 2018 ($\mu g/m^3$)

Year	NO_2	PM_{10}	$PM_{2.5}$
2015	14.4 – 17.2	13.7 - 14.0	9.0 - 9.1
2018 [a]	13.0 – 16.0	13.3 – 13.7	8.7 - 8.8
2018 Worst-case Sensitivity Test [b]	*13.4 – 16.6*	*N/A*	*N/A*
Objectives	**40**	**40**	**25** [c]

n/a = not applicable. The range of values is for the different 1x1 km grid squares covering the study area.

[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.

Baseline Dispersion Model Results

4.12 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations (Figure 1 and Table 2). The results, which cover both the existing (2015) and future year (2018) baseline (Without Scheme), 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, PM_{10} and $PM_{2.5}$ have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A3). Only concentrations from the worst-case heights have been presented.

Table 6: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide ($\mu g/m^3$) at Existing Receptors [a]

Receptor (Height)	2015 [b]	2018 Without Scheme [c]	*Worst-case Sensitivity Test* [c,d]	
			2015	*2018 Without Scheme*
1 (1.5 m)	27.7	23.8	28.1	25.3
2 (1.5 m)	**45.2**	37.8	**45.1**	**40.5**
3 (1.5 m)	**42.7**	35.1	**42.6**	37.7
4 (1.5 m)	39.0	32.5	39.7	34.9
Objective	**40**			

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

[b] In line with Defra's forecasts.

[c] Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.8.

[d] The methodology for the sensitivity test uses different traffic emissions and required a separate verification (Appendix A3), which leads to slightly different 2015 values.

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

Receptor (Height)	PM_{10} [a]		$PM_{2.5}$	
	2015	2018 Without Scheme	2015	2018 Without Scheme
1 (1.5 m)	15.4	14.9	10.1	9.7
2 (1.5 m)	17.1	16.5	11.2	10.6
3 (1.5 m)	17.4	16.9	11.2	10.7
4 (1.5 m)	17.5	17.1	11.4	10.9
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 (EPUK & IAQM, 2015).

[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.

2015 Baseline

4.13 The predicted annual mean concentrations of nitrogen dioxide are above the objective at two of the four receptors. Concentrations of PM_{10} and $PM_{2.5}$ are below the objectives in 2015 at all receptors. The annual mean PM_{10} concentrations are below 32 µg/m^3 and it is therefore unlikely that the 24-hour mean PM_{10} objective will be exceeded.

4.14 These results are generally consistent with the conclusions of Swansea City Council in the outcome of its air quality review and assessment work. Predicted concentrations are higher at receptors 1 and 2 in 2015 than was measured at diffusion tube monitoring site DT67 in 2015, which is located close to the receptors. This is likely to be due to meteorological factors, whereby higher concentrations are being predicted on the eastern side of side of New Cut Road, which is downwind of the prevailing wind, whereas the monitor is on the western, upwind, side of the road.

2018 Baseline

4.15 The predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are all below the objectives. The annual mean PM_{10} concentrations are below 32 µg/m^3 and it is therefore unlikely that the 24-hour mean PM_{10} objective will be exceeded.

Worst-case Sensitivity Test for Nitrogen Dioxide

4.16 The results from the upper-bound sensitivity test show are not materially different from those derived using the 'official' predictions; however, an exceedence of the annual mean nitrogen dioxide objective is predicted at Receptor 2 in the 2018 Baseline scenario.

5 Impact Assessment

Road Traffic Impacts

5.1 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are set out in Table 8, Table 9 and Table 10 for both the "Without Scheme" and "With Scheme" scenarios. Only concentrations from the worst-case heights have been presented. These tables also describe the impacts at each receptor using the impact descriptors given in Appendix A1. For nitrogen dioxide, results are presented for two scenarios so as to include a worst-case sensitivity test.

Table 8: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2018 (µg/m^3) [a]

Receptor (Height)	Without Scheme [b]	With Scheme [b]	% Change [b,c]	Impact Descriptor [b]	*Worst-case Sensitivity Test [d]*			
					Without Scheme	*With Scheme*	*% Change [c]*	*Impact Descriptor*
1 (1.5 m)	23.8	23.9	0	Negligible	25.3	25.4	0	Negligible
2 (1.5 m)	37.8	38.0	0	Negligible	**40.5**	**40.6**	0	Negligible
3 (1.5 m)	35.1	35.3	0	Negligible	37.7	37.8	0	Negligible
4 (1.5 m)	32.5	32.7	0	Negligible	34.9	35.0	0	Negligible
Objective	**40**		**-**	**-**	***40***		**-**	**-**

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

[b] In line with Defra's forecasts.

[c] % changes are relative to the objective and have been rounded to the nearest whole number.

[d] Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.8.

Table 9: Predicted Impacts on Annual Mean PM_{10} Concentrations in 2018 (µg/m^3)

Receptor (Height)	Annual Mean PM_{10} (µg/m^3)			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
1 (1.5 m)	14.9	14.9	0	Negligible
2 (1.5 m)	16.5	16.5	0	Negligible
3 (1.5 m)	16.9	16.9	0	Negligible
4 (1.5 m)	17.1	17.1	0	Negligible
Criterion	**32 [b]**		**-**	**-**

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] 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 (EPUK & IAQM, 2015).

Table 10: Predicted Impacts on Annual Mean $PM_{2.5}$ Concentrations in 2018 (µg/m^3)

Receptor (Height)	Annual Mean $PM_{2.5}$ (µg/m^3)			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
1 (1.5 m)	9.7	9.7	0	Negligible
2 (1.5 m)	10.6	10.6	0	Negligible
3 (1.5 m)	10.7	10.7	0	Negligible
4 (1.5 m)	10.9	10.9	0	Negligible
Objective	25 [b]		-	-

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[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 annual mean nitrogen dioxide concentrations are below the objective at all receptors.

5.3 The percentage changes in concentrations, relative to the air quality objective (when rounded), are predicted to be zero at all of the receptors. Using the matrix in Table A1.1 (Appendix A1), these impacts are described as *negligible*.

5.4 The annual mean nitrogen dioxide concentrations are below 60 µg/m^3 at all of the receptor locations. It is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded.

Worst-case Sensitivity Test

5.5 The results from the upper-bound sensitivity test show are not materially different from those derived using the 'official' predictions. A marginal exceedence of the annual mean nitrogen dioxide objective is predicted at Receptor 2; however, the scheme is not causing this exceedence.

PM_{10} and $PM_{2.5}$

5.6 The annual mean PM_{10} and $PM_{2.5}$ concentrations are well below the annual mean objectives at all receptors, with or without the scheme. 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.

5.7 The percentage changes in both PM_{10} and $PM_{2.5}$ concentrations, relative to the air quality objective (when rounded), are predicted to be zero at all of the receptors. Using the matrix in Table A1.1 (Appendix A1), these impacts are described as *negligible.*

Impacts on the Development

5.8 Predicted air quality conditions for residents of the proposed development are set out in Table 11 for Receptor A (see Table 2 and Figure 1 for receptor locations). All of the values are well below the objectives. Air quality for future residents within the development will thus be acceptable.

Table 11: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2018 for New Receptors in the Development Site

Receptor	Annual Mean NO_2 (µg/m^3)		Annual Mean PM_{10} (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)
	'Official' Prediction [a]	Worst-case Sensitivity Test [b]		
A	28.8	30.8	15.9	10.1
Objective/Criterion	40		32 [c]	25 [d]

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.8.

[c] 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 (EPUK & IAQM, 2015).

[d] 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.

Significance of Operational Air Quality Impacts

5.9 The operational 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, but in order to provide a reasonable worst-case assessment, the judgement of significance focuses primarily on the results from the sensitivity test.

5.10 More specifically, 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 at all but one receptor, and all of the impacts are predicted to be *negligible*. Where an exceedence is predicted, the scheme is not causing the exceedence.

6 Mitigation

Road Traffic Impacts

6.1 Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation. The assessment has demonstrated that the scheme will not cause any exceedences of the air quality objectives in areas where they are not currently exceeded. It is not considered appropriate to propose further mitigation measures for this scheme.

Good Design and Best Practice Measures

6.2 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates good design and best practice measures, including provision of a detailed Travel Plan to be issued to all future occupiers of the development, and provision of 610 cycle parking spaces.

7 Conclusions

7.1 The operational impacts of increased traffic emissions arising from the additional traffic on local roads, due to the development, have been assessed. Concentrations have been modelled for four worst-case receptors, representing existing properties where impacts are expected to be greatest. In addition, the impacts of traffic emissions from local roads on the air quality for future residents have been assessed at a single worst-case location within the new development itself. In the case of nitrogen dioxide, a sensitivity test has also been carried out which considers the potential under-performance of emissions control technology on modern diesel vehicles.

7.2 It is concluded that concentrations of PM_{10} and $PM_{2.5}$ will remain below the objectives at all existing receptors in 2018, whether the scheme is developed or not. This conclusion is consistent with the outcomes of the reviews and assessments prepared by Swansea City Council, which show that exceedences of the PM_{10} objective are unlikely at any location.

7.3 In the case of nitrogen dioxide, the annual mean concentrations remain below the objective at all but one of the existing receptors in 2018, whether the scheme is developed or not, and taking account of the worst-case sensitivity test. This location is within the AQMA.

7.4 The additional traffic generated by the proposed development will affect air quality at existing properties along the local road network. However, the increases as a result of the development are all *negligible*.

7.5 The impacts of local traffic on the air quality for residents living in the proposed development have been shown to be acceptable at the worst-case locations assessed, with concentrations being well below the air quality objectives.

7.6 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 but one location, and impacts all being *negligible*. Where an exceedence is predicted, the scheme is not causing the exceedence.

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9 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
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	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)
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
$\mu g/m^3$	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
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
PPW	Planning Policy Wales

Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TAN	Technical Advice Note
TEA	Triethanolamine – used to absorb nitrogen dioxide

10 Appendices

A1 EPUK & IAQM Planning for Air Quality Guidance

A1.1 The guidance issued by EPUK and IAQM (EPUK & IAQM, 2015) 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 follow apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use;
- 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;

- 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, the criteria for which are set out below. 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 is likely to be more appropriate.

- 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;
- the development will have one or more substantial combustion processes where the combustion unit is:
  - any centralised plant using bio fuel;
  - any combustion plant with single or combined thermal input >300 kW; or
  - a standby emergency generator associated with a centralised energy centre (if likely to be tested/used >18 hours a year).
- the development will have a combustion unit of any size where emissions are at a height that may give rise to impacts through insufficient dispersion, e.g. through nearby buildings.

A1.10 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.

A1.11 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.

Impact Descriptors and Assessment of Significance

A1.12 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 developed by EPUK and IAQM (EPUK & IAQM, 2015) has therefore been used. 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.

Impact Descriptors

A1.13 Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A1.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A1.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[a] Values are rounded to the nearest whole number.

[b] This is the ‘without scheme’ concentration where there is a decrease in pollutant concentration and the ‘with scheme’ concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency ‘Environmental Assessment Level (EAL)’.

Assessment of Significance

A1.14 The IAQM guidance (EPUK & IAQM, 2015) 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 and, 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.

A1.15 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. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A1.16 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

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc FIAQM

Prof Laxen is the Managing Director of Air Quality Consultants, a company which he founded in 1993. He has over forty years' experience in environmental sciences and has been a member of Defra's Air Quality Expert Group and the Department of Health's Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including nitrogen dioxide, lead, dust, acid rain, PM_{10}, $PM_{2.5}$ and ozone and was responsible for setting up the UK's urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports and for providing guidance and support to local authorities carrying out their local air quality management duties. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries, published over 70 scientific papers and given numerous presentations at conferences. He is a Fellow of the Institute of Air Quality Management.

Suzanne Hodgson, BSc (Hons) MSc CSci MIEnvSc MIAQM

Miss Hodgson is a Principal Consultant with AQC, with over eight years' experience in the field of air quality management and assessment. She has been responsible for a wide range of air quality projects covering impact assessments for new residential, commercial and industrial developments, local air quality management, ambient air quality monitoring of various pollutants and the assessment of nuisance odours and construction dust. She has extensive modelling experience, including the modelling of road traffic, energy centre (including energy from waste) and odour sources, and is familiar with preparing stand-alone air quality reports as well as chapters for inclusion within an Environment Statement. Suzanne has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. She is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Paul Outen, BSc (Hons)

Mr Outen is a Consultant with AQC, having joined in 2014. He holds a degree in Environmental Geoscience, having specialised in the study of landfill-related particulate matter for his final year thesis. Prior to joining AQC he worked as an Air Quality Consultant at Odournet UK Ltd for 6 years, undertaking a range of air quality and odour assessments across a number of different industries, as well as managing the sampling/technical department for the company. He now undertakes air quality assessments at AQC, utilising the ADMS dispersion models to assess the impacts of a variety of sources on concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$.

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 (v4.0). 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 Emission Factor Toolkit (Version 6.0.2) published by Defra (2016b).

A3.2 Hourly sequential meteorological data from Cym Level Park for 2015 have been used in the model. The Cym Level Park meteorological monitoring station is located approximately 1.7 km to the northwest of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions at the proposed development site; both the development site and the meteorological monitoring station are located at urban, hilly inland locations in the southwest of Wales where they will be influenced by the effects of inland meteorology on urban, hilly topography. The Cym Level Park meteorological data were used at the specific request of Swansea City Council, who also provided the raw data for use in the modelling.

A3.3 AADT flows, diurnal flow profiles, speeds, and vehicle fleet composition data have been provided by Asbri Transport, who is undertaking the Transport Assessment work for the proposed development. These have been derived from peak hour counts, which may over-predict annual average flows. The 2016 AADT flows have been factored backwards to the baseline assessment and verification year of 2015 using growth factors derived from the National Transport Model and associated guidance (DfT, 2009), adjusted to local conditions using the TEMPRO System v6.2 (DfT, 2011). 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. The worst-case assumption has been made that all development-related traffic entering Morfa Road will travel both north and south (i.e. a single flow is used for all receptors along Morfa Road). This will over-predict the overall impact of the scheme.

A3.4 The 2018 traffic data used in the model have been informed by modelling scenarios undertaken by Swansea Highways. The data take full account of the Morfa Distribution Road (MDR), which is currently under construction and due for completion in 2017, and thus the future year scenarios in this assessment assume that the MDR is fully operational. The MDR has been designed to accommodate future development along its length, and thus the flow data used in this assessment effectively consider all of the committed developments in the area. It is therefore judged that the data used for the future year (2018) in this assessment are the most realistic traffic data currently available.

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

Road Link	2015		2018 (Without Scheme)		2018 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
Morfa Road	13,763	5.8	13,342	5.8	14,539	5.7
New Cut Road (South of Morfa Road)	11,469	5.8	12,017	5.8	12,190	5.7
New Cut Road (North of Morfa Road)	12,824	5.8	13,363	5.8	13,384	5.8

[a] Only roads where a predicted increase of >100 AADT have been modelled, in accordance with the indicative criteria required to proceed to an air quality assessment for sites within an AQMA, as set out in the relevant guidance (EPUK & IAQM, 2015).

A3.5 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2011).

A3.6 Figure A3.1 shows the road network included within the model and defines the study area.

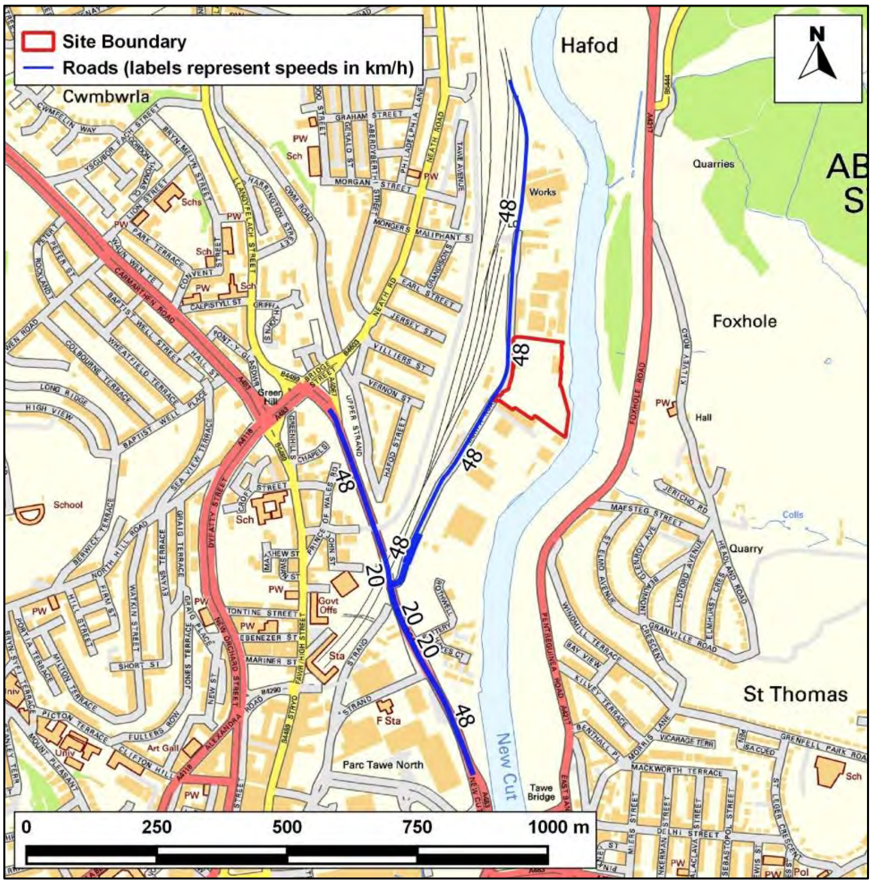

Figure A3.1: Modelled Road Network

A3.7 It should be noted that emissions from diesel locomotives at Swansea Railway Station have not been explicitly modelled in this assessment. Whilst it is recognised that emissions from diesel locomotives may impact upon concentrations of nitrogen dioxide at the receptors located close to the station and railway line, the use of a diffusion tube located close to the station for the model verification process will have accounted for this. In turn, the use of this monitoring site for the model verification may have resulted in over-predictions of concentrations at those receptors located further from the railway. It is also noted that the emissions from the railway line are incorporated in the background maps used in the modelling.

Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

A3.8 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, 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 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 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 Emission Factor Toolkit

Vehicle Type		Adjustment Applied to Emission Factors
All Petrol Vehicles		No adjustment
Light Duty Diesel Vehicles	Euro 5 and earlier	No adjustment
	Euro 6	Increased by 60%
Heavy Duty Diesel Vehicles	Euro III and earlier	No adjustment
	Euro IV and V	Set to equal Euro III values
	Euro VI	Set to equal 20% of Euro III emissions [a]

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

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

Background Concentrations

A3.9 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2016b). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The background maps for 2015 have been calibrated against concurrent measurements from national monitoring sites. 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 that derived from the Defra maps (AQC, 2016c).

Background NO_2 Concentrations for Sensitivity Test

A3.10 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

A3.11 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Nitrogen Dioxide

A3.12 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 2015 at the DT67 diffusion tube monitoring site. Concentrations have been modelled at 2.5 m, the estimated height of the monitor.

A3.13 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 4.1) available on the Defra LAQM Support website (Defra, 2016b).

A3.14 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, 2016b).

A3.15 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 37.2 $\mu g/m^3$

- Measured total-NOx: 68.0 µg/m^3
- 'Measured' road-NOx (total – background): 68.0 – 24.8 = 43.2 µg/m^3
- Modelled road-NOx = 10.7 µg/m^3
- Road-NOx adjustment factor: 43.2/10.7 = **4.0319**[4]
- Final Modelled Total NO_2 (using Defra NOx:NO_2 calculator) = 37.2 µg/m^3

A3.16 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.

PM_{10} and $PM_{2.5}$

A3.17 There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor calculated for road NOx.

Model Verification for NOx and NO_2 Sensitivity Test

A3.18 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 3.5509, which has been applied to all modelled road-NOx concentrations within the sensitivity test.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

A3.19 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2016b). 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.

[4] Based on un-rounded values.