2014 Air Quality Progress Report

for the

City & County of Swansea

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

July 2014

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Report Reference number	Swan/LAQM/ProgressReport 2014
Date	July 2014

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 exceedences of the nitrogen dioxide annual mean objective. This area was declared in September 2001 and a map outlining the area can be seen within Annexe 1.

During August 2010 and due to exceedences 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 can be seen within Annexe 2.

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 exceedences of the nitrogen dioxide annual mean objective outside of the Swansea Air Quality Management Area 2010 within the Mumbles, St.Thomas and city centre areas of the authority. 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.

Revised guidance issued by DEFRA during April 2012 to predict nitrogen dioxide concentrations in future years now indicates that the annual mean objective may not be achieved until after 2020 at some sites. Updates on the situation will be provided within future reports.

All sites remain compliant for Particulate matter PM_{10}. Similarly, for the other pollutants set in regulation. Ozone is monitored at four sites within Swansea and 23 and 22 exceedences of the permitted 10 instances where the 8-hour mean should not exceed $100\mu g/m^3$ have been seen during 2013 at the Cwm Level Park and St.Thomas DOAS monitoring sites respectively. Ozone is seen as a national rather than a local authority problem

The City and County of Swansea participates in the UK Heavy Metals Monitoring Network and had monitoring stations within the Glais, Clydach and Morriston areas monitoring the high level stack discharge from the nickel refinery within Clydach. During late 2007 the company installed improved abatement management on the high level stack discharge. Additional monitoring stations had been established during 2007/2008 both upwind and downwind of the release point taking the total monitoring locations to four. Two of these stations at Glais and YGG Gellionnen were adopted onto the UK Heavy Metals Monitoring network and wholly funded by this council. Monitoring results since 2009-2012 have indicated compliance with the 4th Daughter Directive critical threshold monitoring target value for nickel at all monitoring stations. Improvements continue to be made at the refinery and these improved abatement techniques are becoming increasingly evident within the monitoring results. However, the equipment at Glais has suffered from numerous, expensive breakdowns. These breakdowns coupled with the analytical costs have resulted in monitoring ceasing at this site during early 2013. Similarly, due to budget constraints, monitoring has ceased at YGG Gellionnen during January 2014. Only the two UK Heavy Metal Network funded sites at Gellionnen Cemetery and Morriston Groundhog remain to confirm continued and ongoing compliance with the 4th Daughter Directive critical threshold monitoring target value for nickel.

Due to budgetary constraints, progress with implementation of the measures contained within the authorities Air Quality Action Plan has been slow. Impending additional budgetary pressure may in effect mean that any further development of the plan will cease. Some Nowcaster delivery that has been undertaken, has only been possible having benefited from external funding i.e. 3 roadside message signs as part of the Swansea “Boulevard” project which aims to bridge the divide between the city centre and maritime quarter/foreshore and the funding of a further 3 additional roadside signs by the Welsh Government under its Tranquil, Greener and Cleaner Places grant scheme.

Additionally, due to the increasing financial pressures being faced by the authority, real-time automatic measurements at the Morfa Groundhog site ceased during early 2011. Consideration is being given to disposal of the equipment. Real time monitoring for the pollutants carbon monoxide and hydrogen sulphide have ceased at all remaining sites. Sulphur dioxide is now only measured at one location in Swansea at the St.Thomas DOAS.

The authority’s network of passive nitrogen dioxide tube monitoring has also been scaled back due to budgetary pressures and the staff resources required to operate such an extensive network. All sites that have consistently returned a bias corrected annual mean below 30ug/m^3 have been, or will be, discontinued with the exception of those sites within or near to the Swansea Air Quality Management Area 2010 where these sites may prove useful in assessing the benefit if any of measures taken within the AQMA.

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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 section 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.

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).

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

Table 1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Wales

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 rational 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 2009 to the Welsh Assembly Government during July 2009. The conclusions of this assessment were that exceedences 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 exceedence 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 exceedences 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 exceedences 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 exceedences before any additional AQMS were declared.

Updating and Screening Assessment 2012

The authorities USA 2012 continued to highlight and confirm exceedences 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 exceedences 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 exceedences 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.

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

Table 2 – Summary of Local Air Quality Management actions

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

2 New Monitoring Data

2.1 *Summary of Continuous Real Time Monitoring Undertaken*

The authority operates a network of monitoring stations, mainly located within the lower Swansea valley area. The network is a mixture of three, 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 3 with site by site operational details provided within section 2.1.1. Two of the fixed point stations (Morfa and Morriston) had datasets extending back to 2001. A summary of the commencement of measurement for each station is given below within section 2.1.8 as table 4.

Details of the Morfa Station are included for completeness but, as explained below this station was decommissioned during May 2011.

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 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 exceedences and not for exceedences of any PM_{10} objectives.

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	IN AQMA	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location
Swansea Roadside AURN	Roadside	X 265299 Y 194470	NO_2,PM_{10}, $PM_{2.5}$ CO, SO_2	Y	Y (12m)	4m	N
Morfa Groundhog	Roadside	X 266036 Y 195406	NO_2,PM_{10}, SO_2	Y	Y (34m)	5m	Y
Morriston Groundhog	Roadside	X 267210 Y 197674	NO_2,PM_{10}, CO, SO_2 and Ozone	N	Y (22m)	4m	N
Cwm Level Park	Urban Background	X 265912 Y 195890	NO_2 and Ozone	Y	N (100m)	78m	N
Hafod DOAS	Roadside	Transmitter X 265927 Y 194453 Receiver X 265991 Y 194706	NO_2 Ozone and Benzene	Y	Y (0.3m)	1.7m	N
St Thomas DOAS	Roadside	Transmitter X 266191 Y 193655 Receiver X 266263 Y 193370	NO_2 Ozone and Benzene	N	Y (2m) Varies along path length	1.7m	N
Fforestfach Cross	Roadside	X 263236 Y 195489	PM_{10}	Y	Y (19m)	3m	N
Uplands Crescent	Roadside	X 264078 Y 192888	PM_{10}	N	Y (12m)	1m	
Sketty Cross	Roadside	X 262681 Y 192871	PM_{10}	Y	Y (14m)	1m	
Westway Quadrant Bus Station	Roadside	X 265256 Y 192731	PM_{10}	N	Y (11m)	2m	
SA1 Junction Port Tennant	Roadside	X 266670 Y 193179	PM_{10}	N	Y (6m)	3m	

Table 3 Details of Automatic Monitoring Sites

2.1.1 Automatic Continuous Real Time Monitoring Sites

2.1.2 Swansea Roadside AURN, Carmarthen Road, Waun Wen

The Swansea AURN was located in the heart of the city centre on the pedestrian area of Princess Way. Due to the redevelopment of the David Evans complex, the monitoring station was scheduled for decommissioning on the 14th August 2006. The data logger failed on the 3rd August 2006 following a power surge at the site and in effect, data from the site ceased on this date as it was decided not to undertake any repairs to the data logger. Every effort had been made to re-establish the monitoring station within the city centre. However, DEFRA had amended the siting criterion which has resulted in a suitable site being unable to be identified. The station has now been relocated roadside on Carmarthen Road at Waun Wen. The Annual Average Daily Traffic flow (AADT) for 2013 was 21,048 vehicles. The relocated site is detailed and outlined below and is now sited 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 AUN station at Princess Way had been affiliated onto the UK National Network during late 1994 and had been operational ever since until 3rd August 2006. The new roadside site has also been affiliated onto the UK National Network with data capture commencing on the 20th September 2006 at 13:00hrs. The station has been given a site classification Roadside[1]. Map 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.

[1] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

Map 1 – Aerial view of Swansea Roadside AURN

All equipment is housed within an air-conditioned unit and operated continuously. The equipment comprises of an Advanced Pollution Instrument (API) real-time analyser measuring NO_x with Thermo FDMS units measuring PM_{10} and $PM_{2.5}$ until the 16th November 2011 when they were removed due to their unreliability and were replaced with Met One1020 BAM units on the 28th November 2011. The API gas analyser has been configured so that a daily automatic calibration is carried out (between 00:30 hours and 01:00 hours). This calibration data is automatically logged as invalid by the analyser. In addition officers from this authority performed routine monthly manual calibrations. The analyser is subjected to scrubbed internal 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 AEA (formerly AEA Energy and Environment) to perform data management procedures. The data is then further subjected to full network QA/QC procedure's undertaken by Ricardo AEA 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 48 hour 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 AEA together with the calibration gases stored on site

Hourly ratified data for 2013 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.

During 2007, the UK Automatic Network underwent a review by DEFRA. During this review, numerous stations were either decommissioned from the network, or, as in the case of the Swansea AURN, a limited number of analysers from the station were kept within the UK monitoring framework. This review was undertaken by DEFRA in response to their changing EU commitments. Whilst data from the CO and SO_2 analysers are no longer collected (post 1st October 2007) or ratified by DEFRA (by the then AEA Energy and Environment), this authority had decided to continue to fund their operation and data collection. However, due to budgetary constraints and the relatively low concentrations being recorded, this authority decided to cease measurements of CO and SO_2 during October 2010. The dataset from 1st October 2007 to 27th October 2010 for the above mentioned pollutants was therefore ratified by the authority. No presentation or analysis of CO and SO_2 since 2010 is made within this report as all objectives set in regulation had previously been met comfortably for several years at the AURN site. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, only NO_2 $PM_{2.5}$ and PM_{10} data are reported here for 2013.

The ozone analyser that was surplus to requirements at the site following the DEFRA review has been relocated at the Cwm Level Park urban background monitoring station during December 2008.

2.1.3 Morfa Groundhog

The Morfa station had been operational since August 2000 and was located in a fairly open area on a grass bank to the Morfa / Normandy roundabout which acts as a major intersection to the road network in the lower Swansea Valley. During May 2011 measurements ceased at this site due to the loss of the electricity supply to the station. The station was within the boundary of the Swansea Air Quality Management Area 2010 and had been given a site classification Roadside[2].

As with the majority of monitoring stations, the location finally chosen for monitoring has to be a compromise between the ideal desired location and the practicalities of siting a station of this size. It is recognised that this station having being sited adjacent to a roundabout is not ideally placed. However, in saying this, the station satisfied the majority of the monitoring criteria required by this authority with receptor locations (dwellings) being located within 35m. Due to its location in a fairly open aspect of the lower valley area, this station did not truly reflect the conditions experienced within the nearby narrow congested streets within the Neath Road corridor (see Hafod DOAS) that form part of the Swansea Air Quality Management Area 2010.

All equipment was housed within an air-conditioned unit and operated continuously. The equipment comprised of Advanced Pollution Instruments (API) real-time analysers measuring CO, SO_2 and $NO_{x,.}$ The R&P TEOM measuring PM_{10} was upgraded to a Thermo FDMS unit again measuring PM_{10} on the 28th November 2006 with data capture for the FDMS unit commencing at 13:00. 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 analyser's 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.

[2] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

The station was operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data has been re-scaled by the authority according to the calibration factors (monthly span and overnight/monthly zeros). The station was serviced and maintained twice yearly by Enviro Technology Services Ltd. In addition, the authority had a 48 hour 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 AEA Energy & Environment to run the Welsh Air Quality Forum in April 2004, all equipment on site was fully audited yearly by AEA Energy & Environment together with the calibration gases stored on site. The L10 span gas cylinders are replaced on a regular basis and are to a certified and traceable standard.

A map showing the location of the Morfa Groundhog station is given below as map 2. The boundary of part of the existing Swansea Air Quality Management Area 2010 is shown as the black/yellow dashed line.

Map 2 Location of Morfa Groundhog Station

As mentioned above, measurements ceased at this site during May 2011. Prior to this, the CO and SO_2 measurements ceased during August 2010 due to budgetary restrictions. No presentation or analysis of data for these pollutants is made within this report as all objectives set in regulation had previously been met comfortably for several years. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, no data are reported here for pre 2011 and its inclusion here is for information only.

2.1.4 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[3]. Map 3 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. 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 analyser's 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.

[3] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

The station is operated and calibrated in accordance with the UK National Network Local Site Operators manual. Data is re-scaled by the authority according to the calibration factors (monthly span and overnight/monthly zeros). 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. Since the awarding of the contract by the Welsh Assembly Government to Ricardo AEA (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 L10 span gas cylinders are replaced on a regular basis and are to a certified and traceable standard.

Map 3 - Aerial view - Morriston Groundhog
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However, due to budgetary constraints and the historically relatively low concentrations being recorded, this authority decided to cease measurements of CO during April 2010, and SO_2 during October 2010. The H_2S analyser had proved highly problematic and expensive to repair and measurements had already ceased some considerable time ago. No presentation or analysis of 2013 data for these pollutants is made within this report as all objectives set in regulation have previously been met comfortably for several years. Full details relating to these pollutants have been reported within previous LAQM reports submitted by this authority. Therefore, only NO_2, Ozone and PM_{10} (FDMS) data are reported here for 2013.

2.1.5 Cwm Level Park, Landore

The authority established a NO_x and Ozone urban background monitoring station [4] 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 analyser's are subjected to scrubbed internal generated zero air to assess the analyser's response to zero air. The NO_x analyser is subjected to traceable calibration gases 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 48 hour 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 AEA (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 an audit of the calibration gases stored on site. Data is re-scaled by Ricardo AEA following the authority supplying routine monthly calibration reports. The L10

[4] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

Map 4 Cwm Level Park Monitoring

span gas cylinders (NO and NO_2) 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 map 4. The boundary of part of the Swansea Air Quality Management Area 2010 (former Hafod AQMA) is shown as the black/yellow dashed line.

There are no “major” sources close 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 2013 of 14,184 vehicles. Some light industry / warehouse front the site but are insignificant as a source. Receptor dwellings are within 100m of the site.

2.1.6 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 (former Hafod AQMA). These measurements take place at first floor level - a height of approximately 3 - 4 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. Map 5 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 2011 of 15,880 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. Habits of a lifetime may prove difficult to break!

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 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.

Map 5 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[5].

The DOAS system returns data in the form 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

[5] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

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.

Monitoring data from the site has been subject to interruption as the property owner at the transmitter site ❶ undertook extensive renovation works to the property. The transmitter head was removed from the front façade during these works to prevent damage. The equipment was removed from the façade of the property at 11:00 on the 22nd April 2005 and was replaced at 10:00 16th May 2006. There is therefore, significant data loss for both 2005 and 2006, with in total, just over a years worth of monitoring data being lost. This is frustrating and regrettable but the loss is outside of the control of this authority.

To compound and frustrate matters further an Area Renewals Project commenced during January 2008 to properties at the receiving end ❷ of the open path measurement. This renewal project resulted in scaffolding erected to the front facades of the terrace properties blocking the light path to the receiver between the 3rd January 2008 and July 2008. Full functionality was not restored until the site had been serviced and calibrated on the 26th August 2008.

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 frequency of zero/span calibration has been subject to discussions with Opsis as noticeable drop off in lamp intensity was noticed for the NO channel (which is deep down in the spectrum) during the 5th and 6th months after renewal. Changing the Xenon lamps every 4 months has resolved this data issue concern.

2.1.7 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 2013 of 20,376 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.

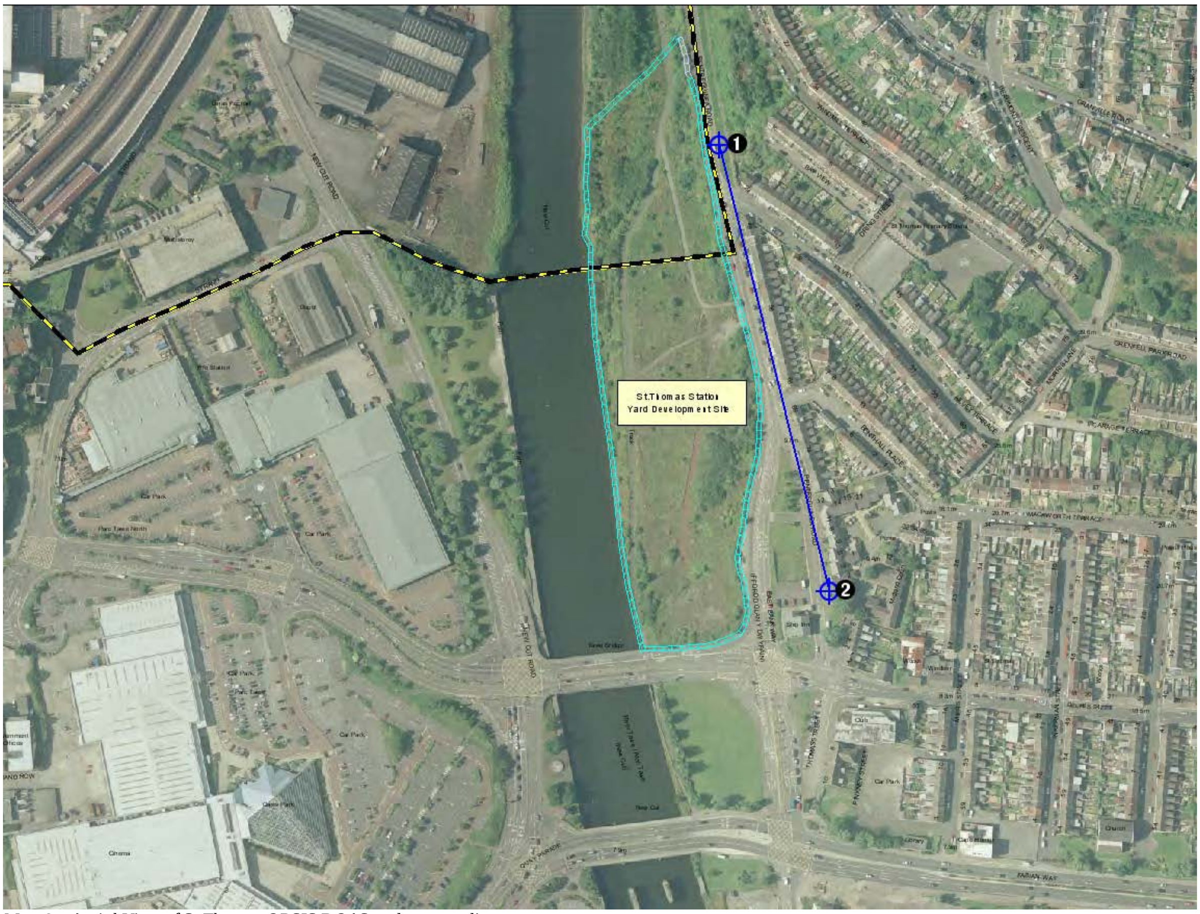
Photo 1 - St Thomas DOAS Transmitter

Photo 2 - St Thomas DOAS Receiver Station

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[6].

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 map 6 below. 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 map 6.

[6] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*



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

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.

2.1.8 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.

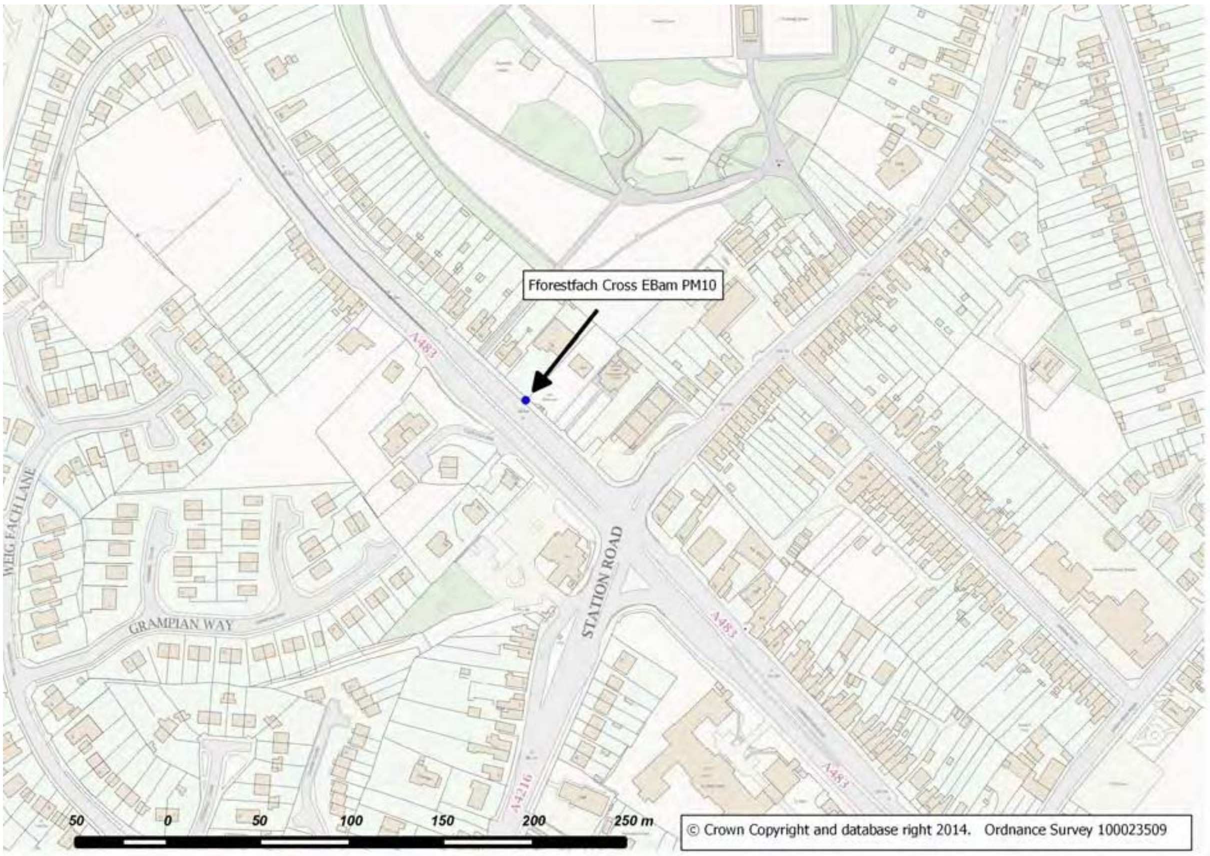
The EBam PM_{10} is similar in operation to the MetOne Bam 1020 deployed at the Swansea AURN approximately 2.3Km away in a south-easterly direction on Carmarthen Road. The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[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

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

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 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 map 7.



Map 7 – Fforestfach Cross EBam PM_{10}

2.1.9 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 2013 was 20,640. A summary of the composition of the flow during 2013 is given below:

Vehicle Class	Flow %	Mean Speed (km/h)
Motorcycles	0.8	31.9
Cars or light Vans	93.3	37.5
Cars or light Vans with Trailer	0.1	28.5
Heavy Van, Mini bus, L/M/HGV	4.6	34.2
Articulated lorry, HGV+Trailer	0.2	27.3
Bus	0.9	27.7

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[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

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

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 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 map 8.

Map 8 – Uplands Cresent EBam PM_{10}

2.1.10 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.

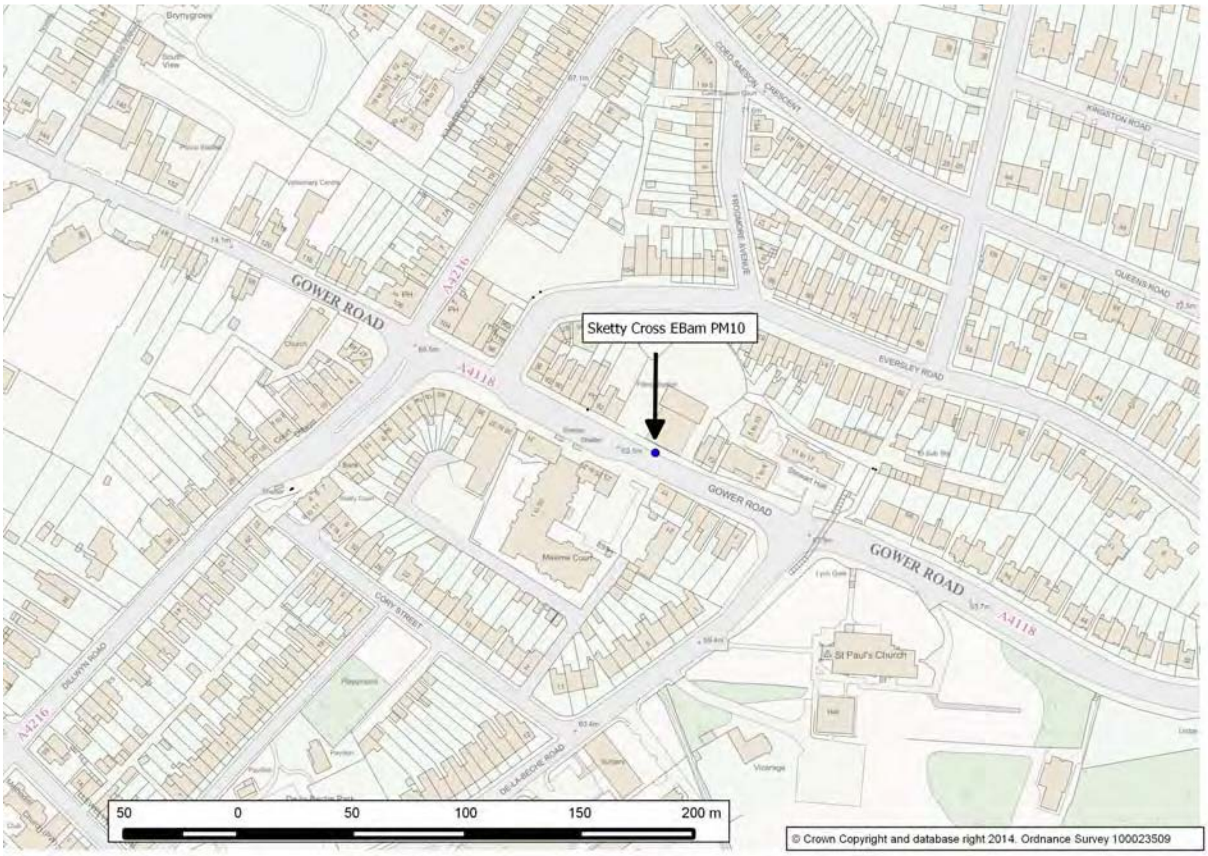
The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[9]. Installation and operation of the MetOne EBam has been undertaken in accordance with 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

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

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 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 map 9.



Map 9 – Uplands Cresent EBam PM_{10}

2.1.11 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.

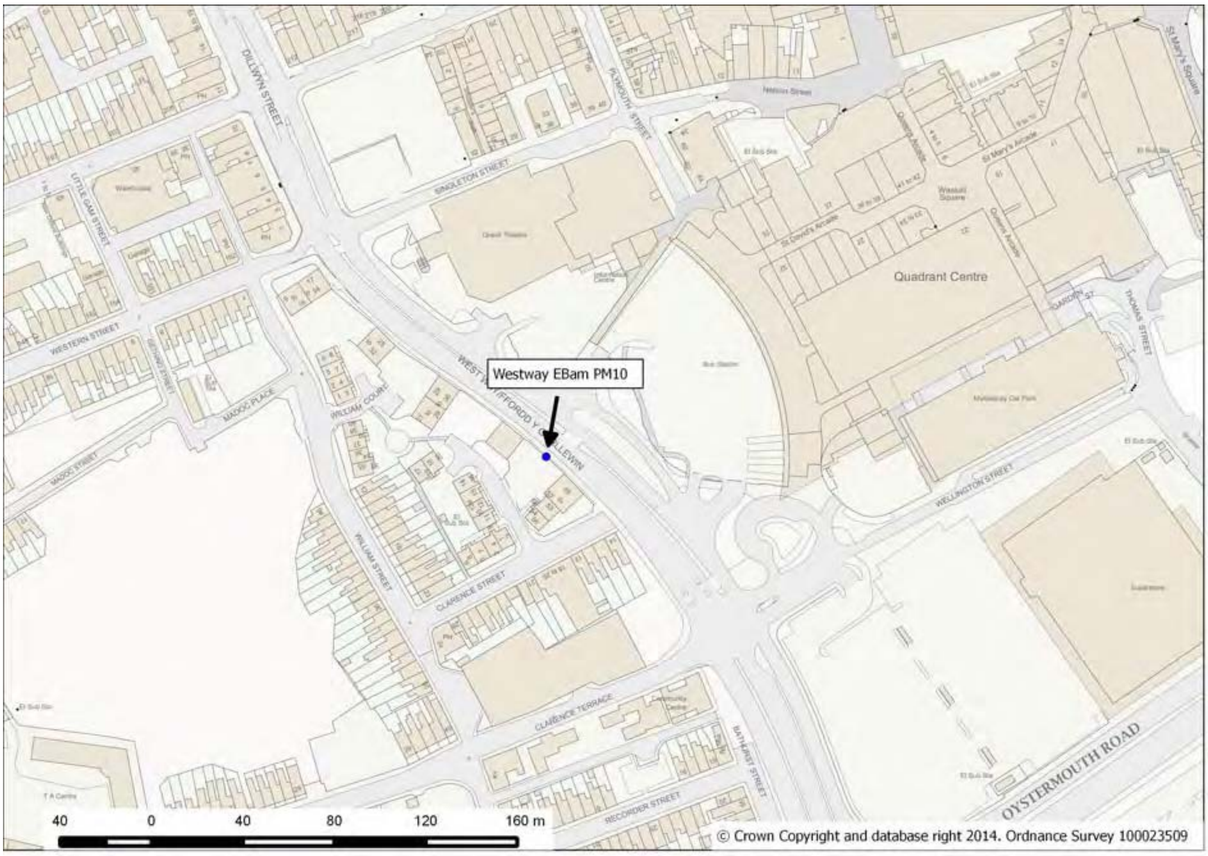
The EBam has not demonstrated equivalency with the EU reference gravimetric method whilst the MetOne Bam 1020 PM_{10} at the Swansea AURN has demonstrated equivalency during previous trial undertaken during 2006[10]. Installation and operation of the MetOne EBam has been undertaken in accordance with 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

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

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 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 map 10.



Map 10 – Westway EBam PM_{10}

2.1.12 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 2013 was 32,232. A summary of the composition of the flow during 2013 is given below:

Vehicle Class	Flow %	Mean Speed (km/h)
Unclassified vehicles **	4.5	0.0
Motorcycles	1.0	48.9
Cars or light Vans	89.0	48.6
Cars or light Vans with Trailer	0.2	39.7
Heavy Van, Mini bus, L/M/HGV	4.0	46.2
Articulated lorry, HGV+Trailer	0.4	42.8
Bus	0.9	42.6

** Data loss during 2013 was due to construction of a “living wall” within the central reservation of Fabian Way where the loop tails from westbound lanes (inbound) 3 and 4 were damaged.

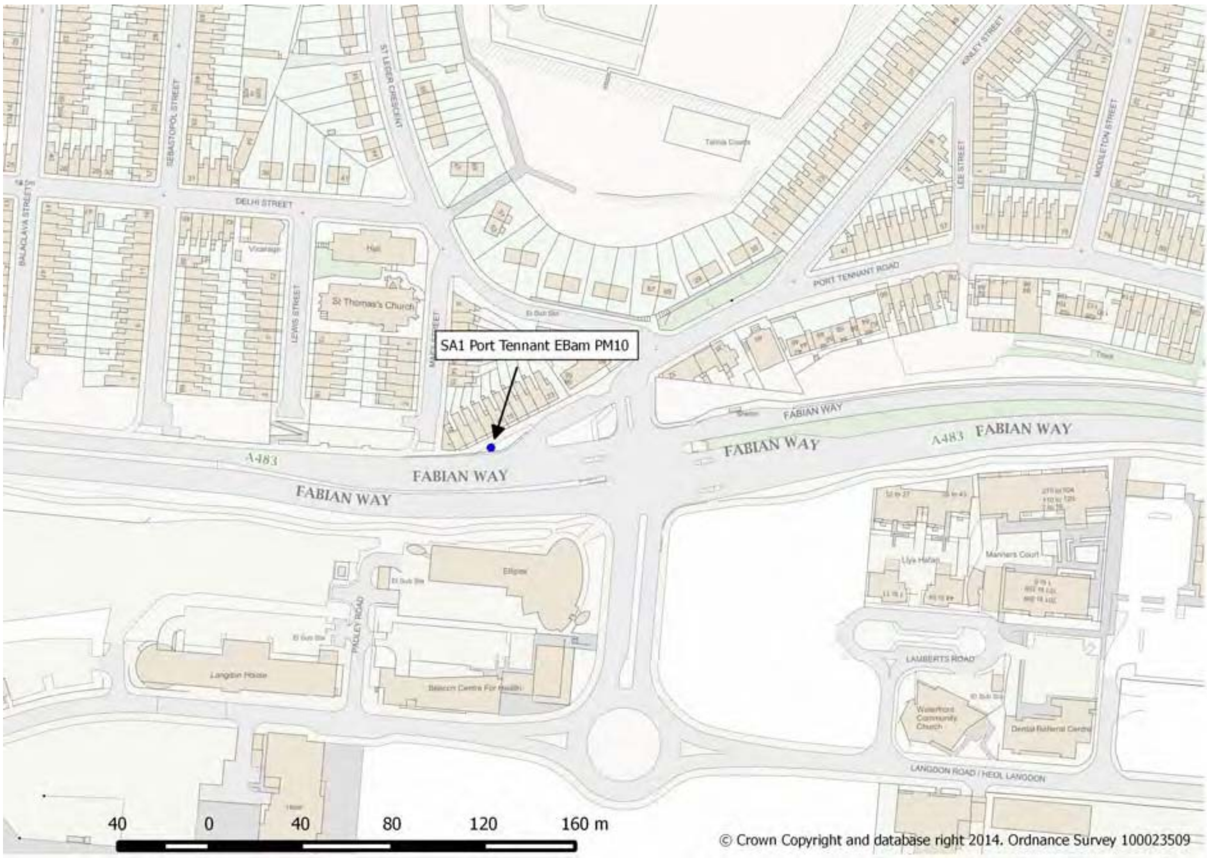
Whilst relatively “free flow” is achieved at the ATC site, traffic queues back from the signal controlled junction in both directions. Therefore, significant stationary traffic queues west past the block of terraced housing on Port Tennant Road (their facades are within 6m of the EBam itself) and also 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[11]. 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.

[11] 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 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 map 11



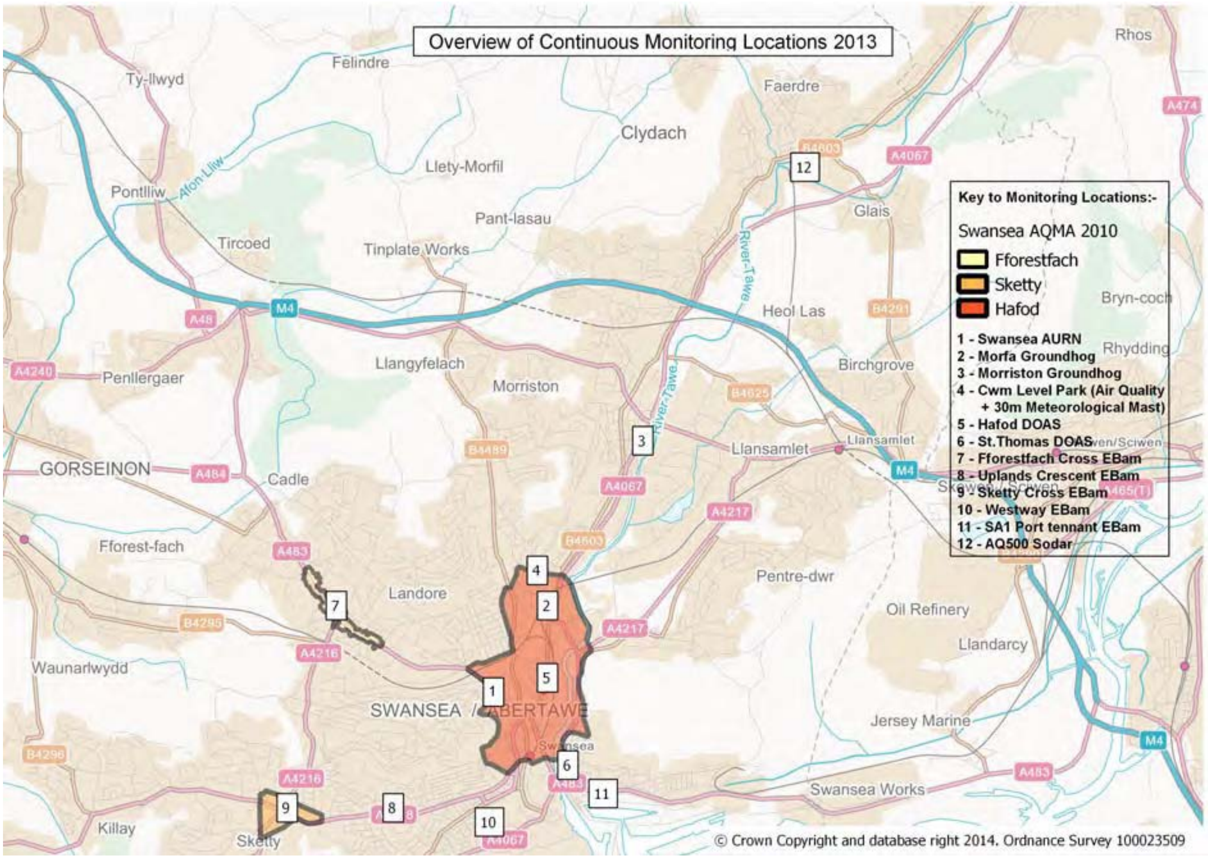
Map 11 - SA1 Port Tennant EBam PM_{10}

2.1.13 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 map 12. Also included within map 12 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 includes a dedicated 30m mast at Cwm Level Park and a AQ500 SODAR remote sensing instrument capable of wind speed/direction measurements every 15m up to its maximum height range of 300m located within the Vale nickel refinery in Glais further north and up the Swansea Valley. It is envisaged that this meteorological monitoring 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. However, during 2013 the AQ500 Sodar has been turned off due to noise nuisance complaints being received from local residents by Vale. It is hoped this will be a temporary issue whilst a new site is found.

From map 12, the reader will no doubt realise that no continuous and automatic chemiluminescent NOx 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.



Map 12 – Overview of continuous monitoring locations 2013

Table 2 below details the commencement date of monitoring at each of the automatic sites, pollutants monitored and other site criteria details.

Site Name	Site ID	Site Type	Commencement Date of Measurements	Pollutants Monitored	IN AQMA	Inlet height	Relevant Exposure	Distance to kerb of nearest road	Worst-case Location
Swansea Roadside AURN	**1**	Roadside	**20th Septembe r 2006**	NO_2, PM_{10}, $PM_{2.5}$	Y	2.5m	Y (12m)	4m	N
Morfa Groundhog	**2**	Roadside	**24th July 2000**	NO_2,PM_{10} ,	Y	2.5m	Y (34m)	5m	Y
Morriston Groundhog	**3**	Roadside	**11th October 2000**	NO_2, PM_{10}, and Ozone	N	2.5m	Y (22m)	4m	N
Cwm Level Park	**4**	Urban Back ground	**(O_3) 28th November 2008** **(NOx) 21st January 2009**	NO_2 and Ozone	Y	1.5m	N (100m)	78m	N/A
Hafod DOAS	**5**	Roadside	**8th January 2004**	NO, NO_2 Ozone and Benzene	Y	N/A	Y (0.2m)	1.7 m	Y
St Thomas DOAS	**6**	Roadside	**4th May 2005**	SO_2, NO_2 Ozone and Benzene	N	N/A	Y(2m) Varies along path	1.7 m	N
Fforestfach Cross	**7**	Roadside	**October 2012**	PM_{10}	Y	5m			
Uplands Crescent	**8**	Roadside	**October 2012**	PM_{10}		5m			
Sketty Cross	**9**	Roadside	**October 2012**	PM_{10}	Y	5m			
Westway Quadrant Bus Station	**10**	Roadside	**August 2012**	PM_{10}		5m			
SA1 Junction Port Tennant	**11**	Roadside	**November 2012**	PM_{10}		5m			
AQ500 Sodar	**12**	N/A	**N / A**	Wind Speed and Direction 15m-300m	N	N/A	N/A	N/A	N/A

Table 2 Automatic Continuous Measurements Commencement Dates

2.1.14 Additional Continuous Monitoring

2.1.15 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 ploycyclic 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 bezo(a)pyrene and these are reproduced below as table 3.

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

Table 3 - 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 2.1.4 for site location of the Morriston Groundhog and section 2.1.8 for spatial location). 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 due to continued breakdown repair costs and analytical costs in April 2013

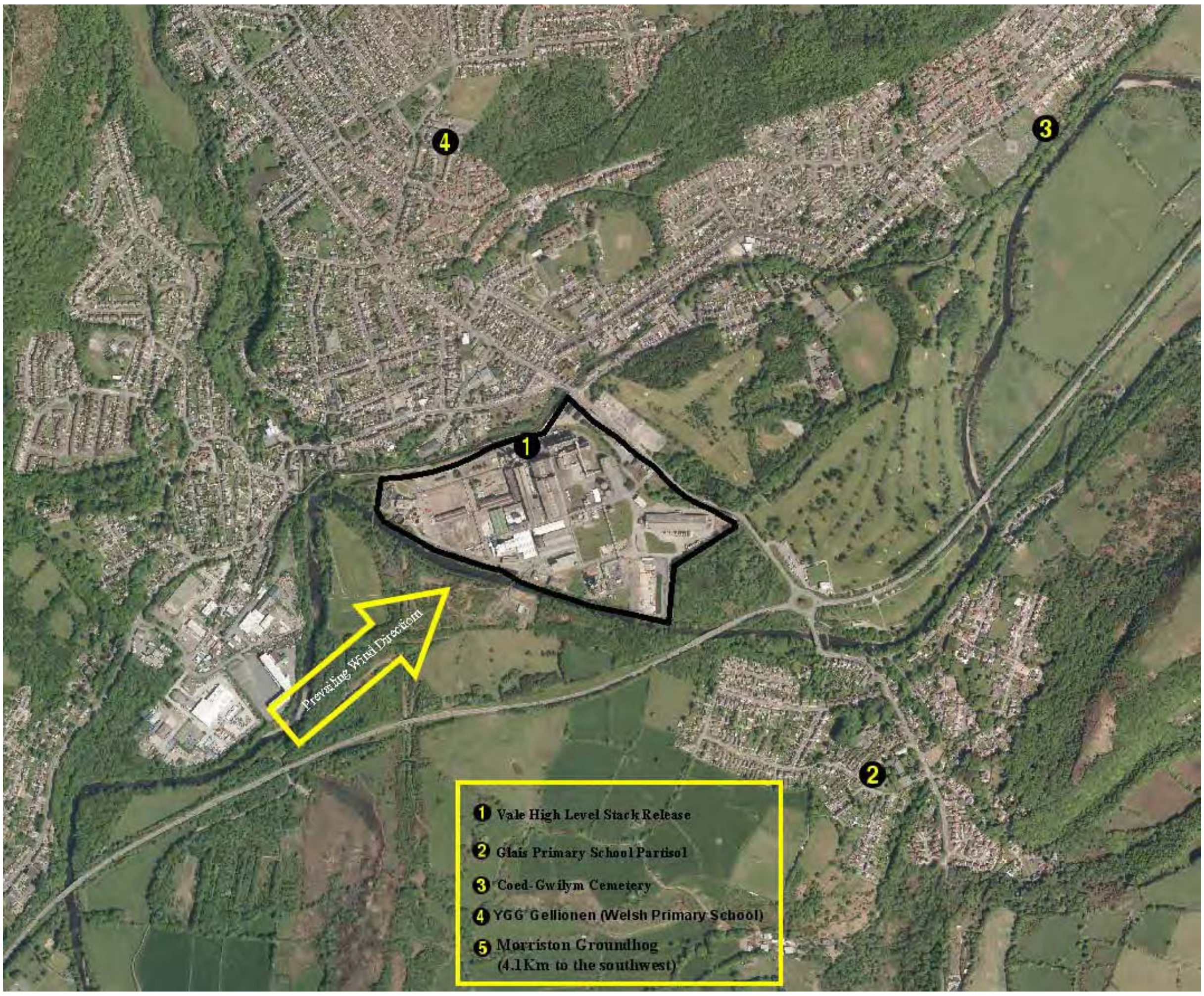
A further site has been established to the north of the high level stack release point during November 2007 at YGG Gellionnen ❹ (Welsh Primary School). The site is located on top of a flat roof within the school complex and has an uninterrupted view down to the refinery complex. This authority continued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

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 form 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. Monitoring is undertaken using Partisol 2025 units with automatic filter cartridge exchange. NPL will continue to undertake all analysis from filters exposed at these sites to maintain comparability with the analysis undertaken from the two sites that form part of the UK heavy Metals Monitoring Network.

All monitoring locations (both UK Network sites and the two Swansea funded sites) have/had an Industrial classification[13]. Data from 2014 will only be captured from points directly to the north and south of the high level stack release point.

The location of Vale and the sampling locations can be seen within map 13.



Map 13 Heavy Metals Monitoring, Vale, Glais

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[13] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

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), 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.

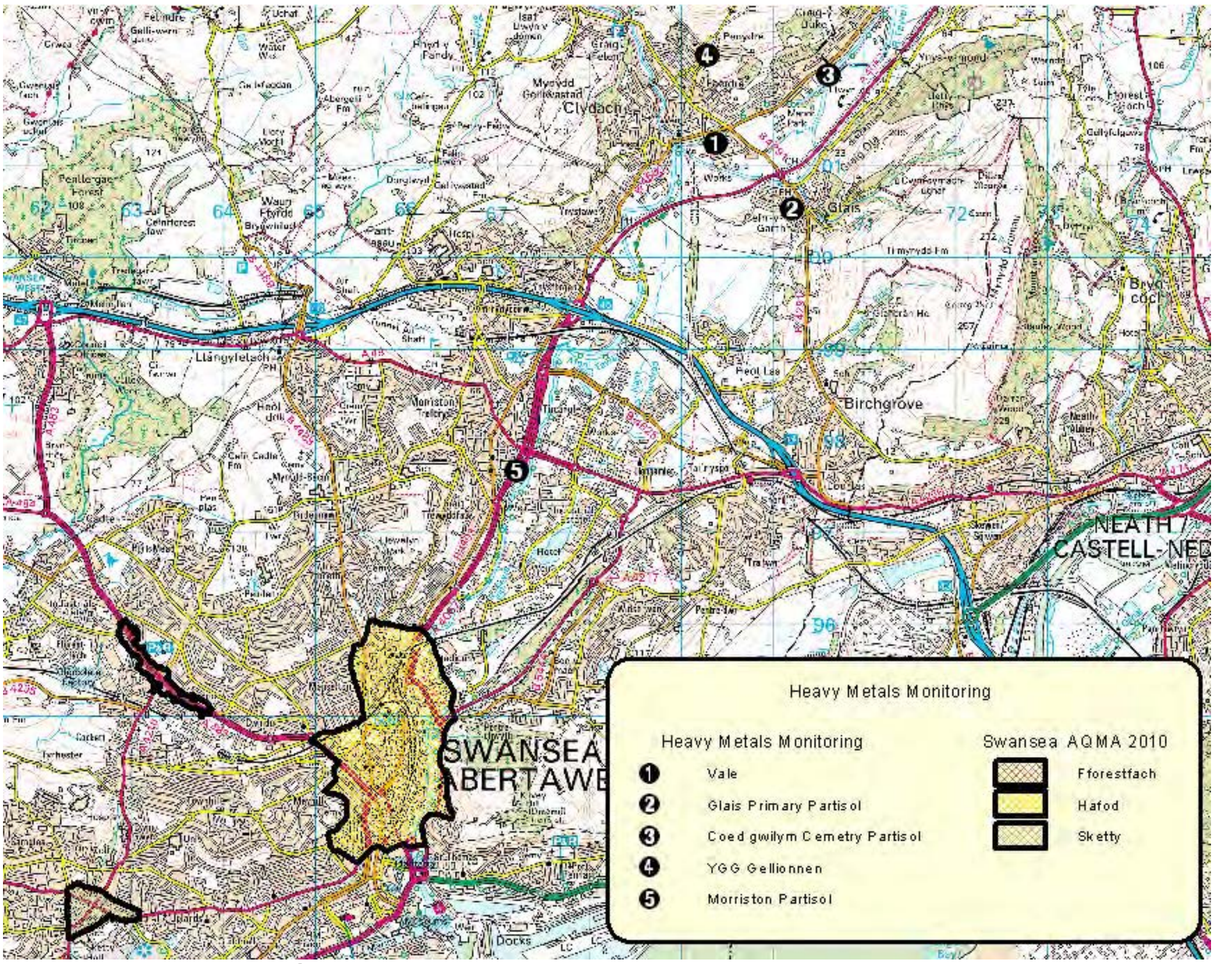
The amount of each metal in solution (and its uncertainty) was then determined by a method of generalised least squares using XGenline (an NPL-developed program) to construct a calibration curve[14].

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:

[14] 2008 NPL Report-AS 34 (March 2009) Annual Report for 2008 on the UK Heavy Metals Monitoring Network

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

Again, in order for the reader to be aware spatially of the UK Heavy Metal Monitoring sites within Swansea, the monitoring locations are presented below within map 9, with the Swansea Air Quality Management Area 2010 (former Hafod AQMA) indicated for reference purposes.



Map 14 Swansea *UK Heavy Metal Monitoring Sites*

2.1.16 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 complaint 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.

2.1.17 Non-Automatic Monitoring

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 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 3 below.

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

[15] *Source LAQM.TG(09) Appendix A page A1-20 Table A1.4*

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 3 and a map showing the monitoring locations is included below as map 15. Due to the number of passive diffusion tube locations, it is not possible to label the site numbers within map15. For clarity and completeness, the additional areas that make up The Swansea Air Quality Management Area 2010 (presented to Council in August 2010) are shown within map 15.

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
1	262046	196420	Roadside	NO_2		Y (0.1m)	3m	
4	262497	192857	Roadside	NO_2	**Y**	Y (0.1m)	4m	
5	262548	192943	Roadside	NO_2	**Y**	Y (0.1m)	3m	
6	262612	192995	Roadside	NO_2	**Y**	Y (0.1m)	4.5m	
7	262691	192852	Roadside	NO_2	**Y**	Y (0.1m)	2m	
8	262990	195820	Roadside	NO_2	**Y**	Y (0.1m)	3m	
9	263190	195205	Roadside	NO_2		Y (0.1m)	6m	
10	263219	195513	Roadside	NO_2	**Y**	Y (0.1m)	5m	
11	263344	195474	Roadside	NO_2	**Y**	Y (0.1m)	2m	
12	263680	195103	Roadside	NO_2	**Y**	Y (0.1m)	2m	
13	264830	193066	Roadside	NO_2		Y (0.1m)	8m	
14	265285	192696	Roadside	NO_2		Y (0.1m)	2.5m	
15	265334	192608	Roadside	NO_2		Y (0.1m)	12m	
16	265339	192534	Roadside	NO_2		Y (0.1m)	11m	
17	265496	192408	Roadside	NO_2		Y (0.1m)	5m	
18	265526	195807	Roadside	NO_2	**Y**	Y (0.1m)	2m	
19	265597	194061	Roadside	NO_2	**Y**	Y (0.1m)	5m	
20	265594	194175	Roadside	NO_2	**Y**	Y (0.1m)	1.5m	
21	265634	195316	Roadside	NO_2	**Y**	Y (0.1m)	2m	
22	265682	195374	Roadside	NO_2	**Y**	Y (0.1m)	2m	
23	265728	195494	Roadside	NO_2	**Y**	Y (0.1m)	2m	
25	265845	195547	Roadside	NO_2	**Y**	Y (0.1m)	3.5m	
26	265876	194318	Roadside	NO_2	**Y**	Y (0.1m)	2m	
27	265922	194428	Roadside	NO_2	**Y**	Y (0.1m)	2m	
28	265949	194891	Roadside	NO_2	**Y**	Y (0.1m)	14m	
29	265973	195222	Roadside	NO_2	**Y**	Y (0.1m)	3.5m	
31	266153	196003	Roadside	NO_2		Y (0.1m)	2.5m	
32	266209	193867	Roadside	NO_2		Y (0.1m)	5m	
33	266236	193488	Roadside	NO_2		Y (0.1m)	5m	
34	266272	196168	Roadside	NO_2		Y (0.1m)	1.5m	
35	266314	193298	Roadside	NO_2		Y (0.1m)	2m	
36	266455	193300	Roadside	NO_2		Y (0.1m)	2m	
38	266662	193181	Roadside	NO_2		Y (0.1m)	6m	
40	266951	198278	Roadside	NO_2		Y (0.1m)	8m	
41	266953	198085	Roadside	NO_2		Y (0.1m)	2m	
43	267093	198063	Roadside	NO_2		Y (0.1m)	2m	
44	267639	199543	Roadside	NO_2		Y (0.1m)	23m (M4)	
45	267661	199451	Roadside	NO_2		Y (0.1m)	10m (M4)	
48	268011	193101	Roadside	NO_2		Y (0.1m)	9m	
49	268501	197329	Roadside	NO_2		Y (0.1m)	6m	
50	268530	197419	Roadside	NO_2		Y (0.1m)	6m	
51	268593	197434	Roadside	NO_2		Y (0.1m)	5m	
54	268693	197416	Roadside	NO_2		Y (0.1m)	9m	
55	268789	197420	Roadside	NO_2		Y (0.1m)	4m	
56 *	269306	198661	Roadside	NO_2		Y (166m)	2m	Y
58	264052	192884	Roadside	NO_2		Y (8m)	2m	Y
59	265918	194463	Roadside	NO_2	**Y**	Y (0.2m)	1.5m	
60	265036	192931	Roadside	NO_2		Y (0.1m)	2m	
61	264959	192878	Roadside	NO_2		Y (0.1m)	2m	
63	262675	192775	Roadside	NO_2	**Y**	Y (6.0m)	1.5m	Y

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
64	262719	192840	Roadside	NO_2	**Y**	Y (3.0m)	1m	Y
65	262735	192855	Roadside	NO_2	**Y**	Y (0.1m)	5m	
66	262802	192829	Roadside	NO_2	**Y**	Y (0.1m)	8m	
67	265903	193683	Roadside	NO_2	**Y**	Y (5.0m)	1m	Y
68	265573	193432	Roadside	NO_2		Y (0.1m)	6m	
69	265543	193450	Roadside	NO_2		Y (4m)	3m	Y
70	266649	195435	Roadside	NO_2		Y (7m)	1m	Y
71 **	266514	195485	Roadside	NO_2		Y (138m)	2m	Y
72	264091	192900	Roadside	NO_2		Y (0.1m)	18m	
73	264138	192868	Roadside	NO_2		Y (0.1m)	9m	
74	264163	192853	Roadside	NO_2		Y (0.1m)	12m	
75	264072	192869	Roadside	NO_2		Y (0.1m)	8m	
76	263968	192880	Roadside	NO_2		Y (0.1m)	9m	
78	263819	192948	Roadside	NO_2		Y (0.1m)	7m	
79	263842	192896	Roadside	NO_2		Y (0.1m)	10m	
83	262785	192838	Roadside	NO_2	**Y**	Y (0.1m)	7.5m	
84	262714	192839	Roadside	NO_2	**Y**	Y (0.1m)	6.5m	
85	262702	192847	Roadside	NO_2	**Y**	Y (0.1m)	6.5m	
86	262704	192865	Roadside	NO_2	**Y**	Y (0.1m)	4.5m	
87	262697	192798	Roadside	NO_2	**Y**	Y (0.1m)	6m	
88	262605	192916	Roadside	NO_2	**Y**	Y (0.1m)	4m	
89	262587	192956	Roadside	NO_2	**Y**	Y (0.1m)	4.5m	
90	262631	192996	Roadside	NO_2	**Y**	Y (0.1m)	4.5m	
91	262534	192950	Roadside	NO_2	**Y**	Y (0.1m)	3m	
92	262545	192869	Roadside	NO_2	**Y**	Y (3.0m)	4.5m	
93	263406	195534	Roadside	NO_2		Y (0.1m)	2m	
94	263444	195572	Roadside	NO_2		Y (0.1m)	2m	
95	262815	196090	Roadside	NO_2		Y (0.1m)	8m	
96	262922	195950	Roadside	NO_2		Y (0.1m)	3m	
97	262946	195902	Roadside	NO_2	**Y**	Y (0.1m)	4m	
98	263142	195548	Roadside	NO_2	**Y**	Y (0.1m)	4m	
99	263387	195332	Roadside	NO_2	**Y**	Y (0.1m)	2m	
100	263470	195250	Roadside	NO_2	**Y**	Y (0.1m)	4m	
101	263843	195047	Roadside	NO_2	**Y**	Y (0.1m)	4m	
102	266379	193307	Roadside	NO_2		Y (0.1m)	2m	
103	268526	197359	Roadside	NO_2		Y (0.1m)	3m	
104	268538	197389	Roadside	NO_2		Y (0.1m)	8m	
105	268562	197472	Roadside	NO_2		Y (0.1m)	6.5m	
106	268496	197476	Roadside	NO_2		Y (0.1m)	5m	
107	268765	197420	Roadside	NO_2		Y (0.1m)	5m	
108	267608	199461	Roadside	NO_2		Y (0.1m)	15m (M4)	
109	267510	199487	Roadside	NO_2		Y (0.1m)	16.5 (M4)	
110	267369	199521	Roadside	NO_2		Y (0.1m)	35m (M4)	
111	267705	199426	Roadside	NO_2		Y (0.1M)	17m (M4)	
112	264868	192814	Roadside	NO_2		Y (6.0M)	0.5m	Y
113	264654	192662	Roadside	NO_2		Y (0.1m)	5.5m	
114	264622	192971	Roadside	NO_2		Y (0.1m)	7m	
115	265031	193097	Roadside	NO_2		Y (0.1m)	5m	
116	265192	193138	Roadside	NO_2		Y (0.1m)	4m	

Table 3 Passive NO_2 Diffusion Tube Monitoring Locations

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
117	265288	193211	Roadside	NO_2		Y (0.1m)	5.5m	
⊗118	265483	193385	Roadside	NO_2		Y (17M)	7m	
119	265522	193390	Roadside	NO_2		Y (0.1M)	2m	
120	265570	193366	Roadside	NO_2		N (6.0M)	2m	Y
121	265706	193662	Roadside	NO_2	**Y**	Y (0.1M)	3m	
122	265694	193505	Roadside	NO_2		Y (0.5M)	3m	
123	265655	193423	Roadside	NO_2		Y (0.1M)	4m	
⊗124	265651	193253	Roadside	NO_2		Y (2M)	4m	
⊗125	265641	193162	Roadside	NO_2		Y (3m)	1m	Y
⊗126	265475	193144	Roadside	NO_2		Y (10m)	5m	
⊗127	265348	193110	Roadside	NO_2		Y(10m)	1m	
⊗128	265297	193085	Roadside	NO_2		N (>50m)	4.5m	
⊗129	265153	193098	Roadside	NO_2		Y (5m)	7m	
⊗130	265139	192912	Roadside	NO_2		Y (27m)	3.5m	Y
131	265137	192846	Roadside	NO_2		Y(30m)	5m	
132	265229	192753	Roadside	NO_2		Y (5M)	2m	Y
133	265350	192566	Roadside	NO_2		Y (0.1m)	2m	
⊗134	265113	192903	Roadside	NO_2		Y(0.1m)	4m	
^135	262605	192916	Roadside	NO_2	**Y**	Y(0.1m)	4m	
^136	262612	192995	Roadside	NO_2	**Y**	Y(0.1m)	4.5m	
^137	262631	192996	Roadside	NO_2	**Y**	Y(0.1m)	4.5m	
138	266779	199246	Roadside	NO_2		Y(0.1m)	3m	
139	266867	199030	Roadside	NO_2		Y(0.1m)	1.5m	
140	266863	199009	Roadside	NO_2		Y(0.1m)	1.5m	
141	266979	198772	Roadside	NO_2		Y(0.1m)	2m	
142	267017	198710	Roadside	NO_2		Y(0.1m)	2m	
143	267089	198608	Roadside	NO_2		Y(0.1m)	2m	
144	267141	198591	Roadside	NO_2		Y(0.1m)	2m	
145	267139	198578	Roadside	NO_2		Y(0.1m)	2m	
146	267156	198571	Roadside	NO_2		Y(0.1m)	2m	
147	267165	198580	Roadside	NO_2		Y(0.1m)	2m	
148	267170	198564	Roadside	NO_2		Y(0.1m)	2m	
149	267204	198561	Roadside	NO_2		Y(0.1m)	4m	
150	267205	198545	Roadside	NO_2		Y(0.1m)	3m	
151	267192	198518	Roadside	NO_2		Y(0.1m)	3m	
155	269009	201280	Roadside	NO_2		Y(0.1m)	2.5m	
156	269059	201296	Roadside	NO_2		Y(0.1m)	4m	
158	269480	201441	Roadside	NO_2		Y(0.1m)	3m	
159	269171	201620	Roadside	NO_2		Y(0.1m)	5m	
160	269049	201744	Roadside	NO_2		Y(0.1m)	3m	
162	259553	203379	Roadside	NO_2		Y(0.1m)	1m	
163	259287	203556	Roadside	NO_2		Y(0.1m)	2m	
164	259195	203667	Roadside	NO_2		Y(0.1m)	2m	
165	259149	203675	Roadside	NO_2		Y(0.1m)	2m	
166	259148	203690	Roadside	NO_2		Y(0.1m)	2.5m	
167	259126	203700	Roadside	NO_2		Y(0.1m)	4.5m	
168	259115	203705	Roadside	NO_2		Y(0.1m)	4.5m	
169	259013	203747	Roadside	NO_2		Y(0.1m)	4.5m	
170	258971	203797	Roadside	NO_2		Y(0.1m)	4.5m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
171	258917	203826	Roadside	NO_2		Y(0.1m)	4.5m	
172	258887	203859	Roadside	NO_2		Y(0.1m)	4.5m	
173	259250	203708	Roadside	NO_2		Y(0.1m)	5.5m	
174	259253	203660	Roadside	NO_2		Y(0.1m)	6m	
175	259251	203638	Roadside	NO_2		Y(0.1m)	8.5m	
176	258872	203691	Roadside	NO_2		Y(0.1m)	5m	
177	258896	203697	Roadside	NO_2		Y(0.1m)	1m	
178	258986	203684	Roadside	NO_2		Y(0.1m)	1m	
180	259064	197781	Roadside	NO_2		Y(0.1m)	1.5m	
182	259050	197790	Roadside	NO_2		Y(0.1m)	2m	
183	259036	197795	Roadside	NO_2		Y(0.1m)	2.5m	
197	258797	198701	Roadside	NO_2		Y(0.1m)	2m	
198	258811	198701	Roadside	NO_2		Y(0.1m)	2m	
199	254703	195764	Roadside	NO_2		Y(0.1m)	2m	
201	254522	195859	Roadside	NO_2		Y(0.1m)	2m	
206	261565	188211	Roadside	NO_2		Y(0.1m)	1.5m	
207	261561	188222	Roadside	NO_2		Y(0.1m)	2.5m	
208	261541	188215	Roadside	NO_2		Y(0.1m)	2.5m	
209	261534	188198	Roadside	NO_2		Y(0.1m)	1.5m	
210	261516	188207	Roadside	NO_2		Y(0.1m)	2.5m	
211	261501	188188	Roadside	NO_2		Y(0.1m)	1.5m	
212	261486	188200	Roadside	NO_2		Y(0.1m)	2.5m	
213	261490	188186	Roadside	NO_2		Y(0.1m)	1.5m	
214	261315	188193	Roadside	NO_2		Y(0.1m)	4m	
215	261299	188191	Roadside	NO_2		Y(0.1m)	4m	
216	261276	188190	Roadside	NO_2		Y(0.1m)	4m	
238	266902	197660	Roadside	NO_2		Y(0.1m)	3.5m	
239	266181	196022	Roadside	NO_2		Y(0.1m)	1.5m	
240	266169	195995	Roadside	NO_2		Y(0.1m)	1.5m	
241	266159	196013	Roadside	NO_2		Y(0.1m)	1.5m	
242	265655	193423	Roadside	NO_2		Y(0.1m)	4m	
243	265474	194949	Roadside	NO_2		Y(0.1m)	4m	
244	265466	194930	Roadside	NO_2	**Y**	Y(0.1m)	2m	
245	265448	194922	Roadside	NO_2	**Y**	Y(0.1m)	2m	
246	265425	194927	Roadside	NO_2		Y(0.1m)	4m	
247	265394	194899	Roadside	NO_2	**Y**	Y(0.1m)	2m	
248	265342	194894	Roadside	NO_2		Y(0.1m)	4m	
249	265326	194871	Roadside	NO_2	**Y**	Y(0.1m)	2m	
250	265274	194867	Roadside	NO_2		Y(0.1m)	4m	
251	265263	194845	Roadside	NO_2	**Y**	Y(0.1m)	2m	
252	265226	194830	Roadside	NO_2	**Y**	Y(0.1m)	2m	
253	265194	194833	Roadside	NO_2		Y(0.1m)	4m	
254	265142	194816	Roadside	NO_2		Y(0.1m)	2m	
255	265098	194825	Roadside	NO_2		Y(0.1m)	2m	
256	264995	194777	Roadside	NO_2		Y(0.1m)	2m	
258	254906	189110	Roadside	NO_2		Y(0.1m)	1.5m	
265	266375	198023	Roadside	NO_2		Y(0.1m)	2m	
267	266382	198028	Roadside	NO_2		Y(0.1m)	2m	
268	266419	198053	Roadside	NO_2		Y(0.1m)	3m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
271	266879	198078	Roadside	NO_2		Y(0.1m)	1.5m	
272	266888	198074	Roadside	NO_2		Y(0.1m)	1.5m	
274	269487	201451	Roadside	NO_2		Y(0.1m)	6m	
275	265658	194856	Roadside	NO_2	**Y**	Y(2.0m)	1.5m	
276	265610	194871	Roadside	NO_2	**Y**	Y(0.1m)	3m	
277	265596	194875	Roadside	NO_2	**Y**	Y(0.1m)	3m	
278	265573	194882	Roadside	NO_2	**Y**	Y(0.1m)	3m	
279	265555	194926	Roadside	NO_2	**Y**	Y(0.1m)	1.5m	
280	265542	194980	Roadside	NO_2	**Y**	Y(2.0m)	1m	
281	265542	194872	Roadside	NO_2	**Y**	Y(3.0m)	1m	
282	265540	194840	Roadside	NO_2	**Y**	Y(3.0m)	1m	
283	265436	195937	Roadside	NO_2		Y(0.1m)	2m	
284	265452	195899	Roadside	NO_2		Y(0.1m)	2m	
285	266955	197415	Roadside	NO_2		Y(0.1m)	2m	
286	266938	197377	Roadside	NO_2		Y(0.1m)	4m	
287	265715	193902	Roadside	NO_2	**Y**	Y(0.1m)	2m	
288	265698	193878	Roadside	NO_2	**Y**	Y(0.1m)	2m	
289	265702	193842	Roadside	NO_2	**Y**	Y(0.1m)	2m	
290	263014	195737	Roadside	NO_2	**Y**	Y(0.1m)	2m	
291	267952	193121	Roadside	NO_2		Y(0.1m)	5m	
292	263833	196108	Roadside	NO_2		Y(0.1m)	27m	
293	262302	196688	Roadside	NO_2		Y(0.1m)	7m	
294	262342	196742	Roadside	NO_2		Y(0.1m)	10m	
295	258998	198698	Roadside	NO_2		Y(5m)	0.5m	Y
296	259054	198679	Roadside	NO_2		Y(0.1m)	3m	
297	258957	198628	Roadside	NO_2		Y(0.1m)	1.9m	
298	258985	198613	Roadside	NO_2		Y(0.1m)	1.9m	
299	259010	198619	Roadside	NO_2		Y(0.1m)	1.9m	
300	259043	198602	Roadside	NO_2		Y(0.1m)	1.9m	
301	259054	198611	Roadside	NO_2		Y(0.1m)	1.9m	
302	259088	198603	Roadside	NO_2		Y(0.1m)	1.9m	
303	259107	198582	Roadside	NO_2		Y(0.1m)	1.9m	
304	259170	198554	Roadside	NO_2		Y(0.1m)	1.9m	
305	259183	198561	Roadside	NO_2		Y(0.1m)	1.9m	
306	259217	198544	Roadside	NO_2		Y(1.5m)	0.4m	
307	259267	198520	Roadside	NO_2		Y(0.1m)	1.9m	
308	259294	198507	Roadside	NO_2		Y(0.1m)	1.9m	
309	259325	198492	Roadside	NO_2		Y(0.1m)	1.9m	
310	259338	198486	Roadside	NO_2		Y(0.1m)	1.9m	
311	259326	198479	Roadside	NO_2		Y(0.1m)	1.9m	
312	259313	198486	Roadside	NO_2		Y(0.1m)	1.9m	
313	259295	198495	Roadside	NO_2		Y(0.1m)	1.9m	
314	259268	198508	Roadside	NO_2		Y(0.1m)	1.9m	
315	259219	198529	Roadside	NO_2		Y(0.5m)	1.4m	
316	259208	198504	Roadside	NO_2		Y(0.1m)	1.9m	
317	259216	198496	Roadside	NO_2		Y(0.1m)	1.9m	
318	259194	198450	Roadside	NO_2		Y(0.1m)	1.9m	
319	259178	198442	Roadside	NO_2		Y(0.1m)	1.9m	
320	259096	198241	Roadside	NO_2		Y(0.1m)	7m	

Site Name	OS Grid Ref Easting	OS Grid Ref Northing	Site classification	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
321	259036	198246	Roadside	NO_2		Y(0.1m)	1.9m	
322	259007	198241	Roadside	NO_2		Y(0.1m)	1.9m	
323	266765	193224	Roadside	NO_2		Y(0.1m)	3m	

Table 3 – Nitrogen Dioxide Passive Diffusion Tubes 2013

*** 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 worse case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area.

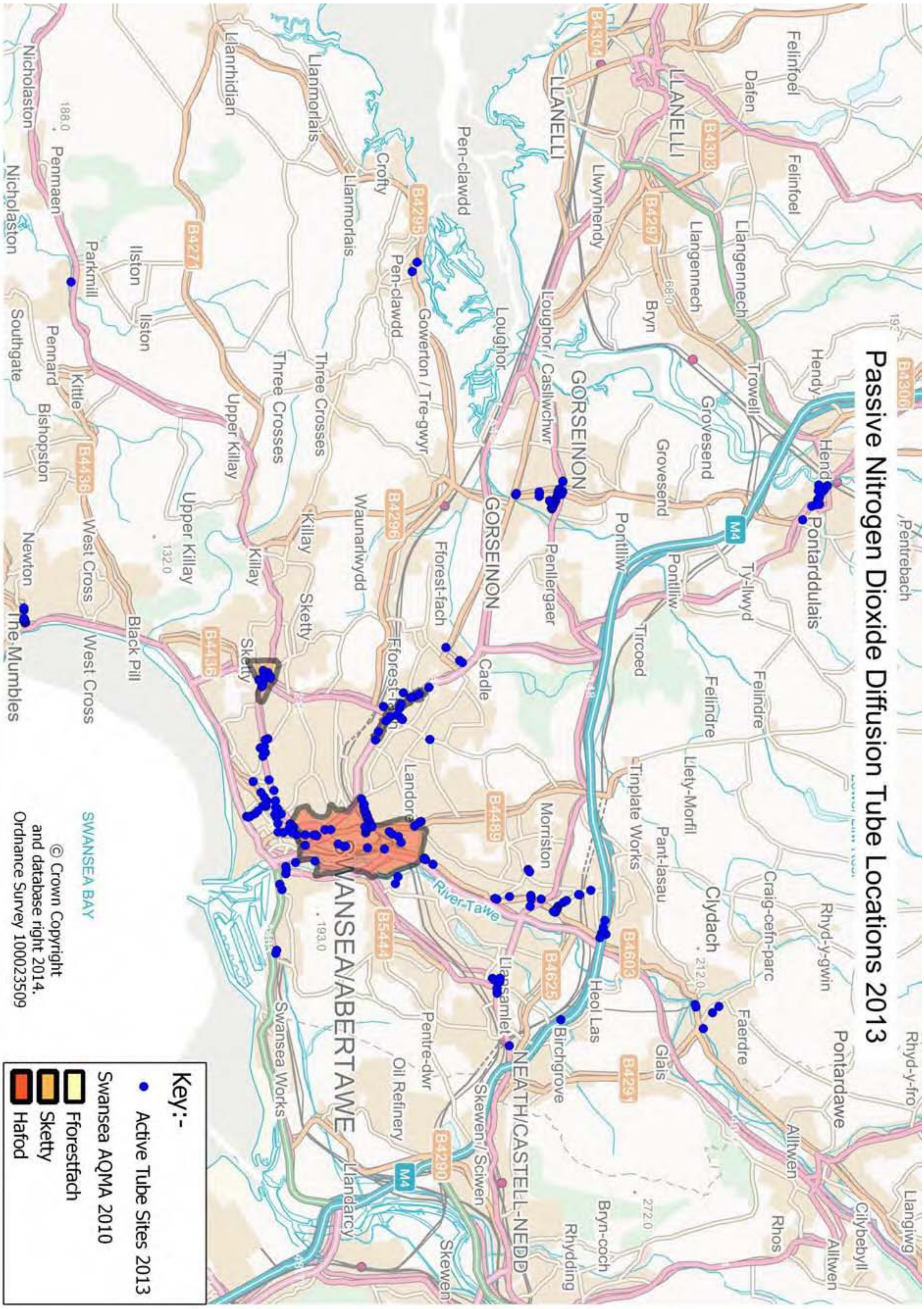
The contract for the supply and analysis of all passive diffusion tubes has been awarded to Environmental Scientifics Group (ESG) Moorbrook Southmead Industrial Estate Didcot, Oxon. Previously this group was known as Harwell Scientifics.

This contract laboratory has been operating for over 20 years and has extensive UKAS accreditation. In addition, all work is accredited to BS EN ISO 9001. Its predecessor the EMS Division, Harwell, carried out Swansea's original NO_2 mapping in 1985/86.

All samples have been analysed in accordance with the Harwell Scientifics standard operating procedure HS/GWI/1015 issue14. This method meets the guidelines set out in DEFRA's "Diffusion Tubes for Ambient NO2 Monitoring:Practical Guidance". All tubes are prepared by spiking acetone:triethanolamine (50:50) onto grids prior to the tubes being assembled. The tubes were desorbed with distilled water and the extract analysed using a segmented flow auto-analyser with ultraviolet detection. The analytical methods employed by Environmental Scientifics Group follow the procedures set out in the Harmonisation Practical Guidance.

ESG take part in the Workplace Analysis Scheme for Proficiency (WASP) operated by HSL. The WASP scheme is an independent proficiency testing scheme operated by the Health and Safety Laboratory (HSL). Each month a diffusion tube doped with nitrite is distributed to each participating laboratory; participants then analyse the tube and report the results to HSL. The nominal mass of nitrite on the doped tubes is different each month, and is intended to reflect the range encountered in actual monitoring. The latest results from Harwell Scientifics participation in the WASP scheme are enclosed as Annexe 3. For the purpose of diffusion tube QA/QC in the context of Local Air Quality Management, Ricardo AEA carry out an assessment of laboratory performance for each full calendar year. This was based on the following criteria, which were agreed with DEFRA and HSL:

1. Participating laboratories must complete at least 10 of the 12 monthly WASP rounds.
2. The year's single worst result is ignored: this makes some limited allowance for one-off problems with analytical equipment etc.
3. Each laboratory's monthly standardised results are then combined to give a standard uncertainty for the full year, expressed as a relative standard deviation (%RSD)
4. The RSD must be within 15%Non-Automatic Monitoring



Map 15 – Location of Passive Nitrogen Dioxide Diffusion Tubes 2013

2.1.18 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 AEA) 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 four 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 2013.

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. AEA Energy and Environment undertake the QA/QC work on behalf of DEFRA at the Swansea AURN site.

The bias correction to be used for diffusion tube exposure during 2013 in Swansea is therefore 0.85. A spreadsheets containing the automatic real-time data and the passive diffusion tube data used to derived 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

This section has been divided by pollutant and also whether the automatic monitoring location is either within, or outside of an existing AQMA as recommended in Box 5.2 of Chapter 5 of LAQM.TG(09).

2.2.1 Nitrogen Dioxide

2.2.2 Automatic Real-Time Nitrogen Dioxide Data

Measurements are undertaken with Advanced Pollution Instrumentation (API) 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 AEA 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 AEA also undertake QA/QC procedures on behalf of the Welsh Air Quality Forum and Welsh Assembly. 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. Sections 2.1.6 and section 2.1.7 refer to the data collection methodology for the Hafod and St.Thomas DOAS systems. Annual means derived for 2013 are given below within table 4 along with those for previous years 2009-2012.

[17] LAQM.TG(09) Appendix A1 - Reporting of Monitoring data – Calculation of Exceedence Statistics A1.216 page A1-47

Site ID (see table2 above)	Location	Within AQMA	Data Capture 2013 %	Annual mean (ug/m³)				
				2009	2010	2011	2012	2013
1	Swansea AURN ** (12m)	Y	99.32%	**26.3** (33.2)	**27.8** (36.1)	**25.6** (32.38)	**26.0** (30.66)	**26.8** (31.15)
2	Morfa Groundhog ** (34m)	Y	N/A	**22.5** (36.38)	**22.3** (37.7)	N/A	N/A	n/a
3	Morriston Groundhog ** (22m)	N	98.12%	**22.3** (29.34)	**22.6** (30.5)	**21.1** (27.25)	**23.4** (28.10)	**23.2** (28.58)
4	Cwm Level Park ** (100m)	Y	98.62%	**18.72**	**23.38**	**20.87**	**19.61**	**18.54**
5	Hafod DOAS	Y	99.8%	**53.44**	**58.60**	**57.61**	**52.60**	**50.68**
6	St.Thomas DOAS	N	99.57%	34.71	**45.88**	**40.89**	**38.62**	**39.45**

Table 4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

** 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.09 box 5.2(2) page 5-5 and also box 2.3 page2-6. The supporting simple calculator Excel spreadsheet (Issue 4: 25/01/11) has been downloaded from
http://laqm.defra.gov.uk/documents/NO2withDistancefromRoadsCalculatorIssue4.xls

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 2013) were downloaded from
http://laqm.defra.gov.uk/maps/maps2010.html
and overlain on a GIS background map within Quantum GIS v1.8. 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 5 below were used:

Site ID (see table 4 above)	Location	Background NO_2 Concentrations (ug/m³)				
		2009	2010	2011	2012	2013
1	Swansea AURN)	15.9	16.3	16.3	19.57	19.01
2	Morfa Groundhog)	15.5	16.1	N/A	N/A	N/A
3	Morriston Groundhog	16.8	17.8	17.8	19.71	19.03

Table 5 – Background NO2 concentrations

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 as guidance within LAQM.TG(09) (within box 2.3) indicates that the correction method within the simple calculator is setup to work at a distance of 0.1 to 50m form the kerb.

From table 4 it can be seen that the Hafod DOAS continues to experience annual mean NO_2 concentrations above the objective level. 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. However, the annual mean for 2013 is so close to the objective level that it is probably prudent to err on the side of caution and take the view that compliance is in doubt. Improvements with the more recent returned annual means to that of 2010 are possibly 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 have both seen a marginal increase in measured annual mean concentrations during 2013. In the case of Swansea AURN, following the correction in concentrations from roadside to façade, a very small increase in the derived annual mean concentration has been observed and in the case of the Morriston Groundhog site a very small decrease in the derived annual mean façade corrected concentration. Interestingly, the Hafod DOAS whilst continuing to see exceedences of the 1 hour objective during 2013 continues to exhibit an overall downward trend in the number of hourly objective exceedences "long term" seen at the site during the period 2008-2013.

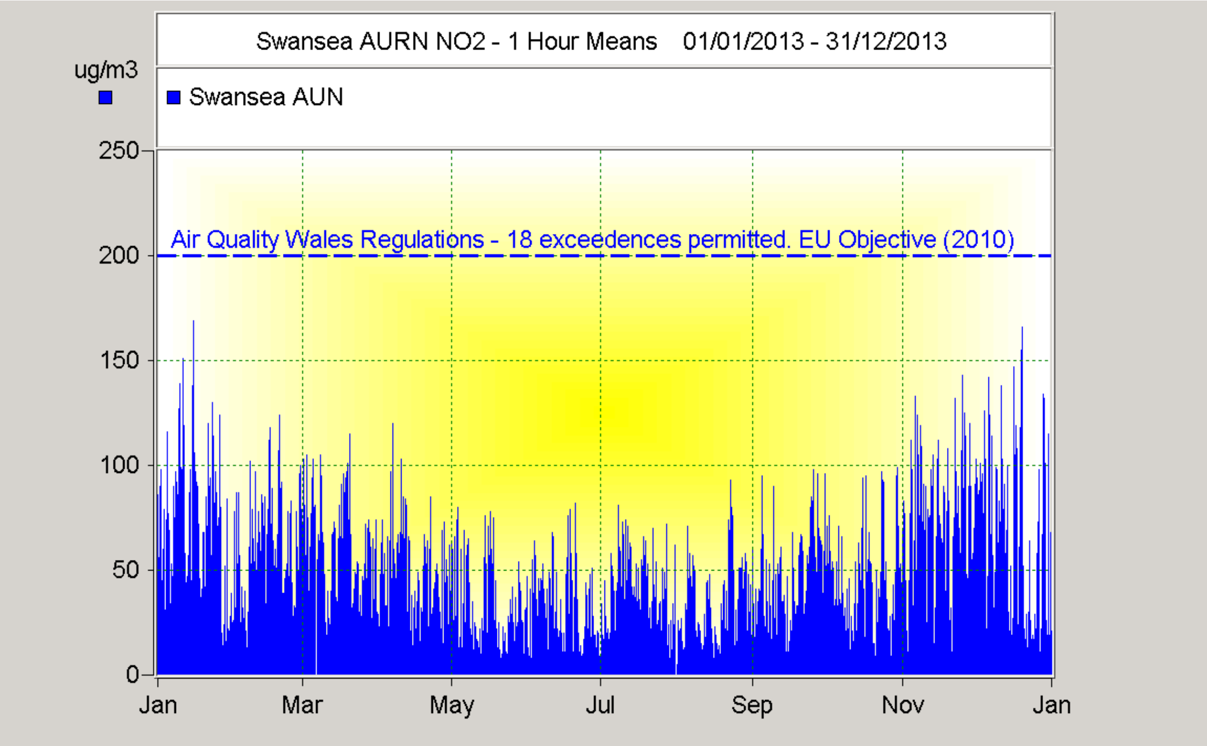
The data obtained from the Hafod DOAS is an open path, spatial measurement along a 250m path length within 0.2m of the terrace facades, running parallel to the terraced housing. On the opposite side of the road to the measurement path is a passive diffusion tube measurement site located at the Hafod Post Office (site 59 in table 7 of NO_2 tube results within section 2.3 below). The bias corrected annual mean of 47.99ug/m^3 for 2013 (100% data capture) from this site also indicates exceedence of the annual mean objective within this street canyon. Passive NO_2 diffusion sites 26 and 27 are located south of the Hafod DOAS along Neath Road, approximately 50m and 140m from the DOAS Transmitter. These sites indicate marginal compliance but remain at risk of exceedence of the annual mean objective with bias corrected annual means of 39.11ug/m^3 and 38.03ug/m^3 respectively

Table 5 below indicates assessments from all stations in respect of the number of exceedences of the 1-hour NO_2 objective. Where data capture rates are below 90% the 99.8th percentile is presented in brackets.

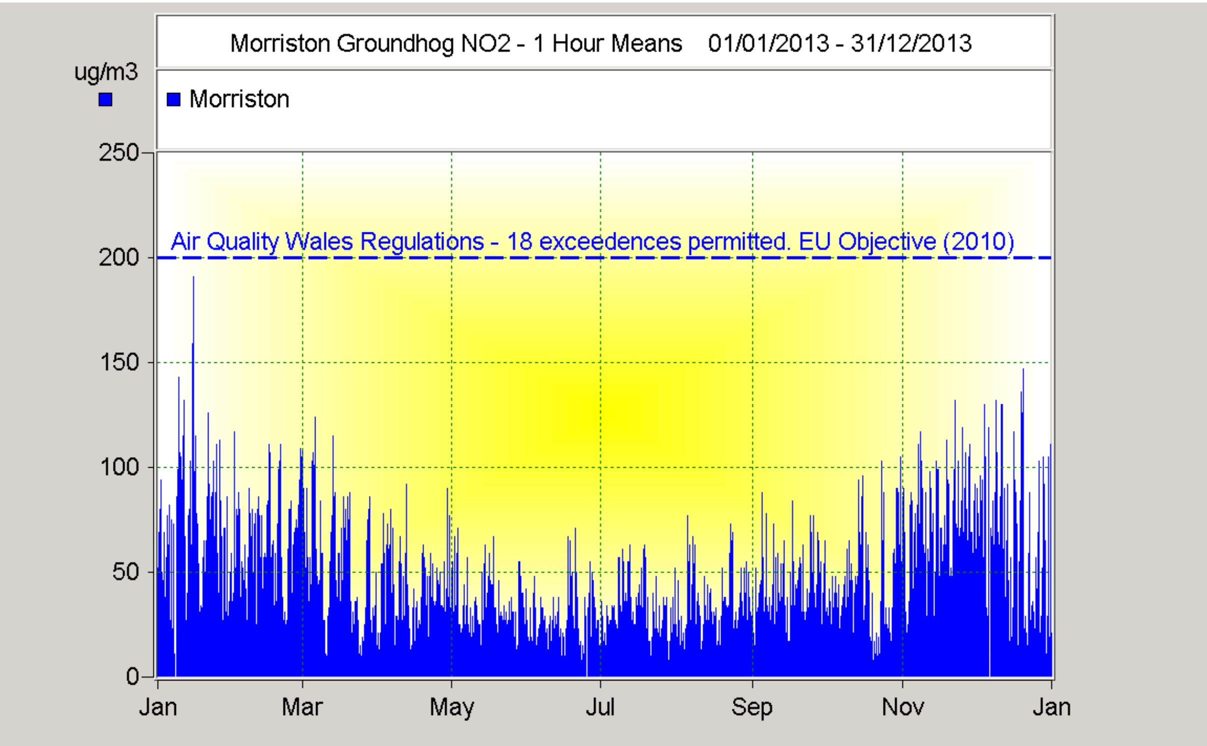
Site ID (see table 4 above)	Location	Within AQMA	Data Capture 2013 %	Number of Exceedences of hourly mean (200 μg/m^3)					
				2008	2009	2010	2011	2012	2013
1	Swansea AURN	**Y**	99.32%	0	0	0	1	0	0
2	Morfa Groundhog	**Y**	N/A	1	0 **(149.0)	1	N/A	N/A	N/A
3	Morriston Groundhog	**N**	98.12%	1 **(123.95)	0	0	0	0	0
4	Cwm Level Park	**Y**	98.62%	-	0 **(92.0)	0	0	0	0
5	Hafod DOAS	**Y**	99.8%	7 **(199.54)	11	20 **(203.13)	16	5	6
6	St.Thomas DOAS	**N**	99.57%	0	0	0	0	0	0

Table5 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
** Data capture rate below 90% 99.8th percentile presented in brackets

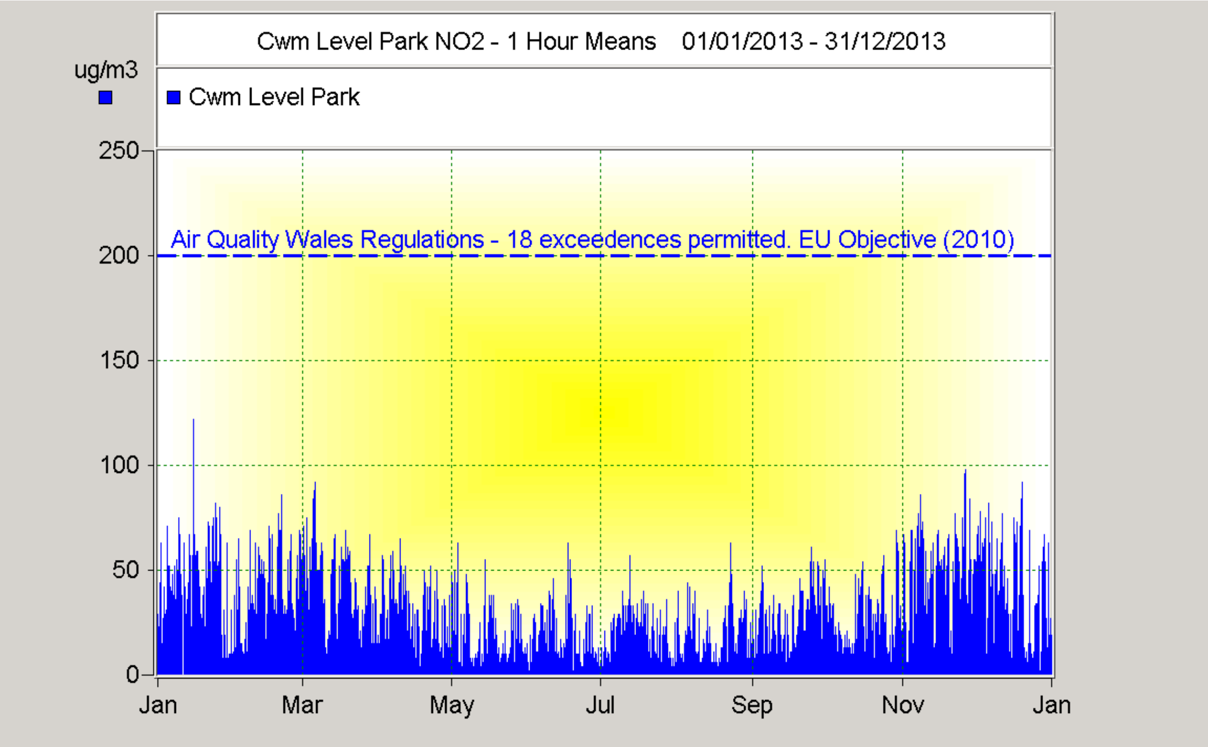
Graphs 1-5 below show the $NO_2$1-hour means for 2013 from the 5 automatic and continuous sites now within Swansea.



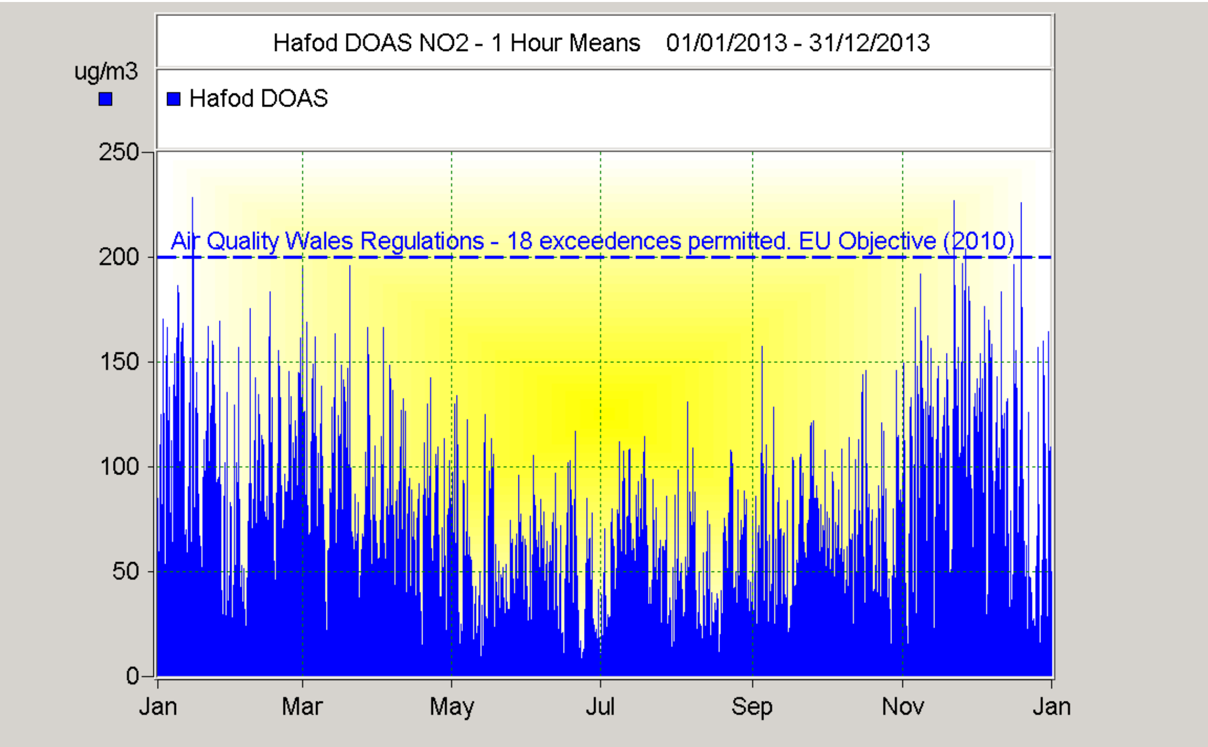
Graph 1 – NO_2 1- hour means Swansea AURN 2013



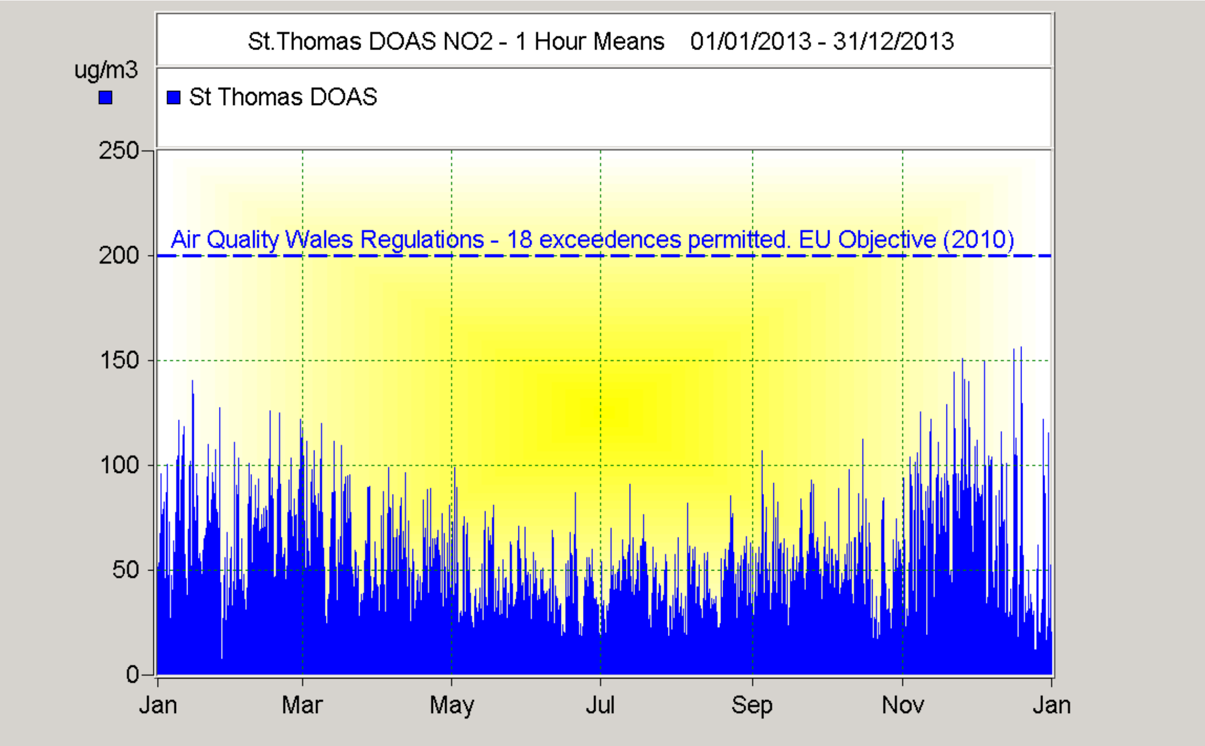
Graph 2 - NO_2 1- hour means Morriston Groundhog 2013



Graph 3 - NO_2 1- hour means Cwm Level Park 2013



Graph 4 - NO_2 1- hour means Hafod DOAS 2013

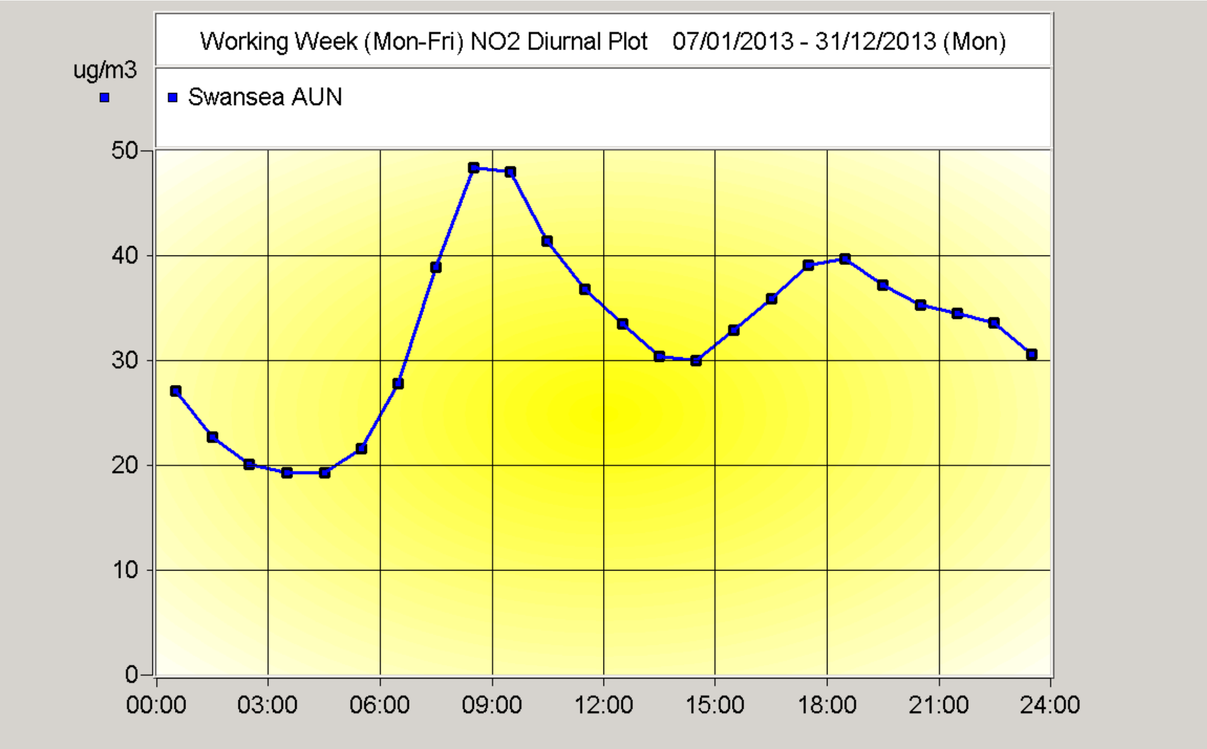


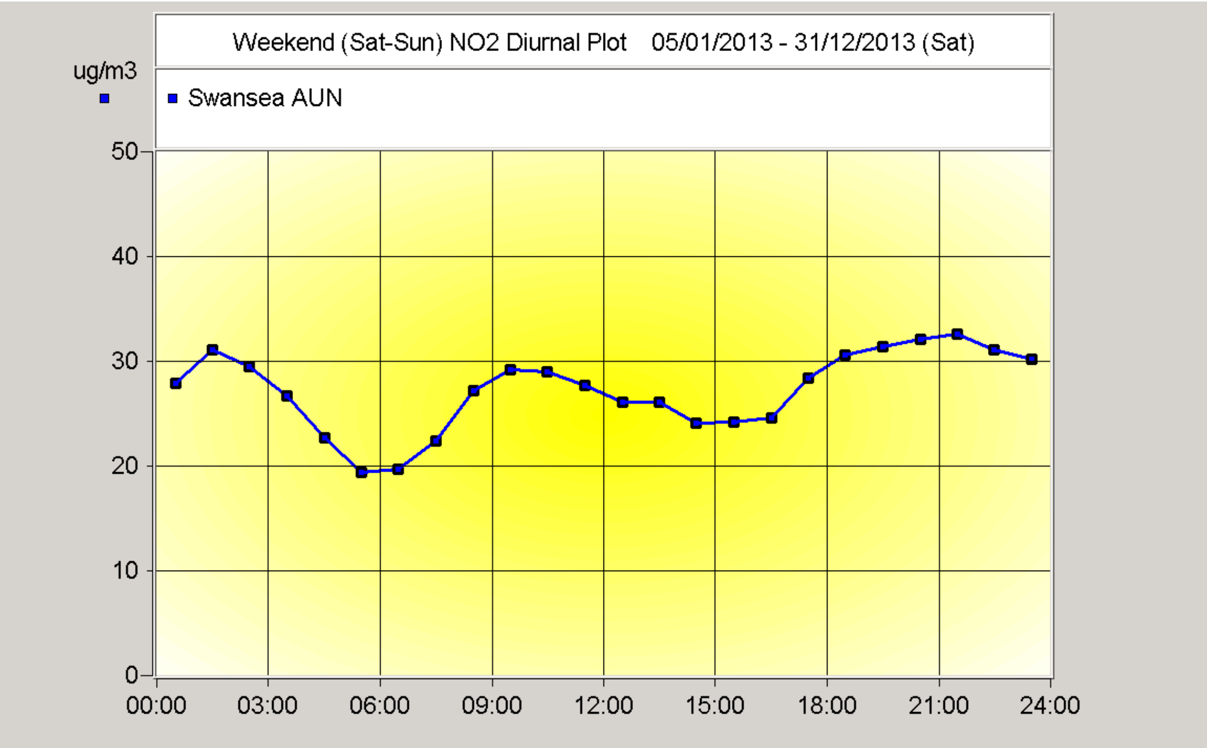
Graph 5 - NO_2 1- hour means St.Thomas DOAS 2013

Within Graph 4 above, the hourly exceedences seen at the Hafod DOAS occurred during the winter months of January, November and December 2013. These winter months, where hourly exceedences are seen, are typically typified by cool, calm stable meteorological conditions overnight with the lower valley area witnessing inversions leading into the am rush hour. As has been seen previously, these inversion periods do not disperse until late morning and after the am rush hour has passed.

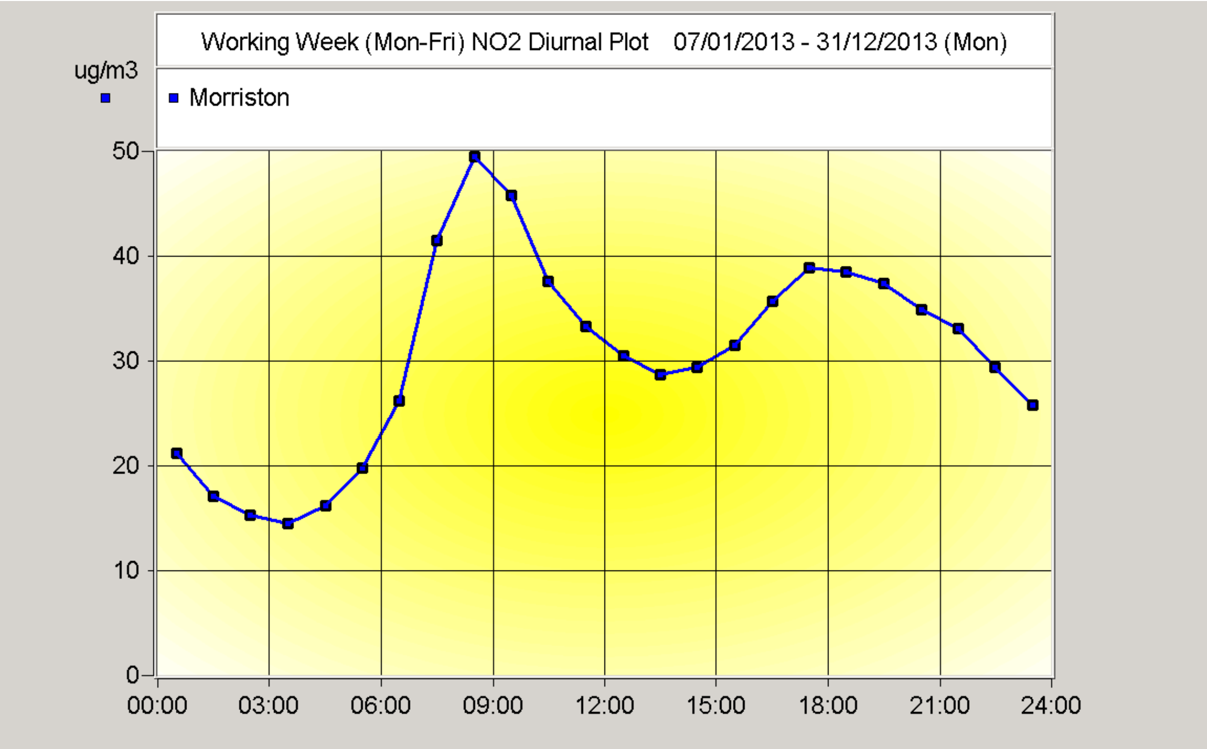
Diurnal NO_2 profiles of the working week (Mon – Fri) and the weekend (Sat – Sun) for each site are provided below within diurnal plots 1-5. Again, as would be expected, the weekday peak concentrations are seen at each site during the am period with the pm period being much smoother. The am peak is thought likely to be influenced more by the prevailing meteorological conditions during the morning period which are then dispersed before the pm period i.e. wintertime inversions. A completely different profile is obtained for the weekend period.

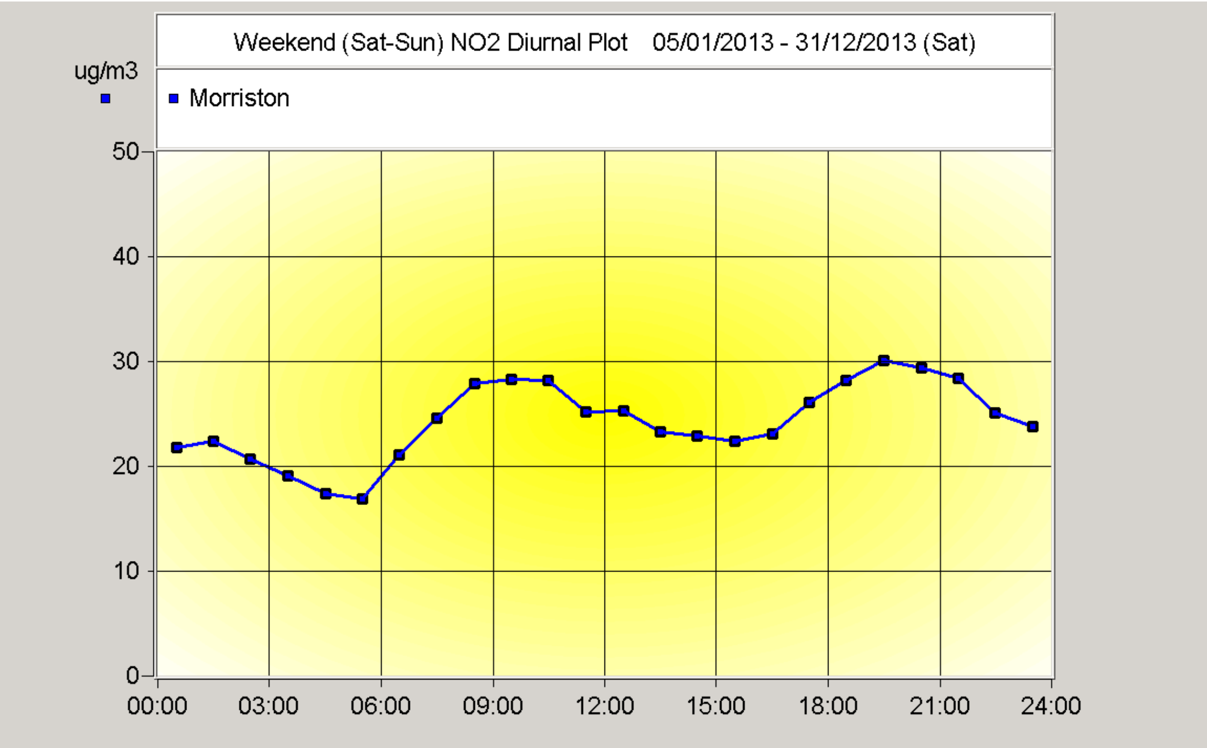
The weekday profiles raise the question whether the authority should, as part of its Air Quality Action Plan, concentrate efforts on reducing the NO_2 impact solely around the am peak traffic period of 7-10am. Thought is still being given as to what effect this may have on the overall NO_2 annual mean and 1 hour objectives and is expanded on below. Whatever traffic management measures are introduced into the Nowcaster forecast system being developed for such situations, to achieve widespread compliance with the objectives, will obviously require detailed and thorough planning.



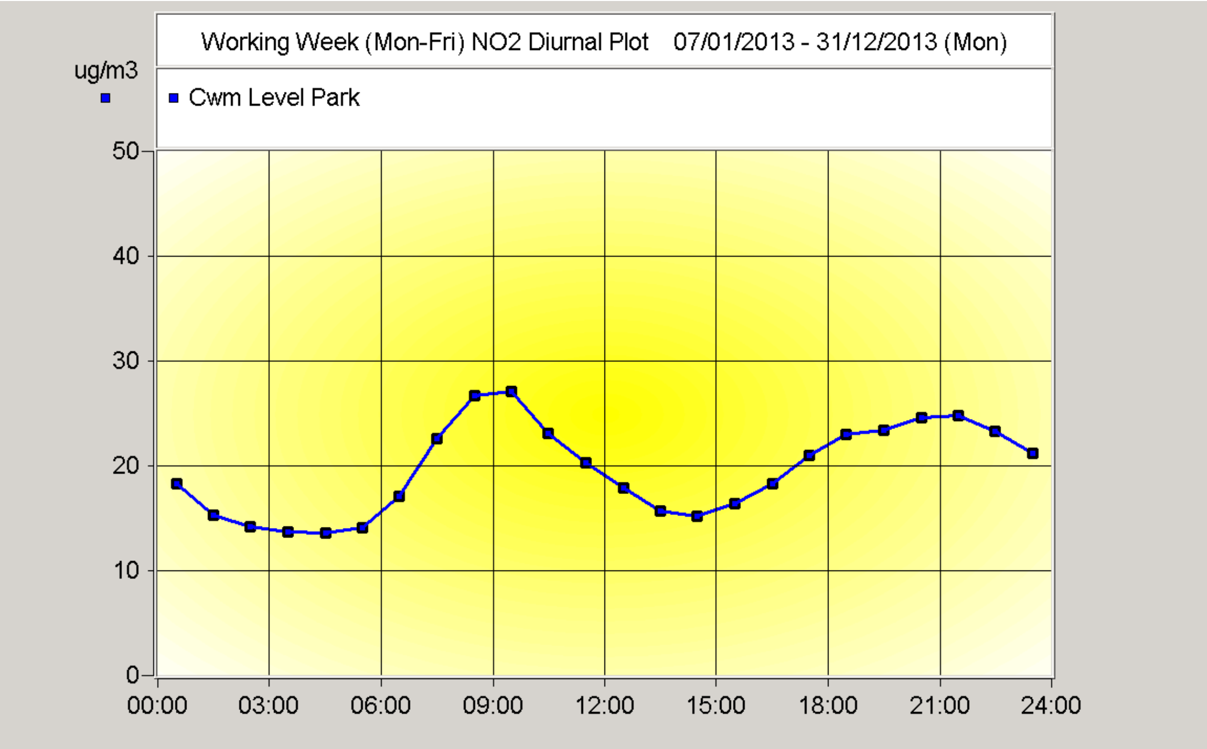


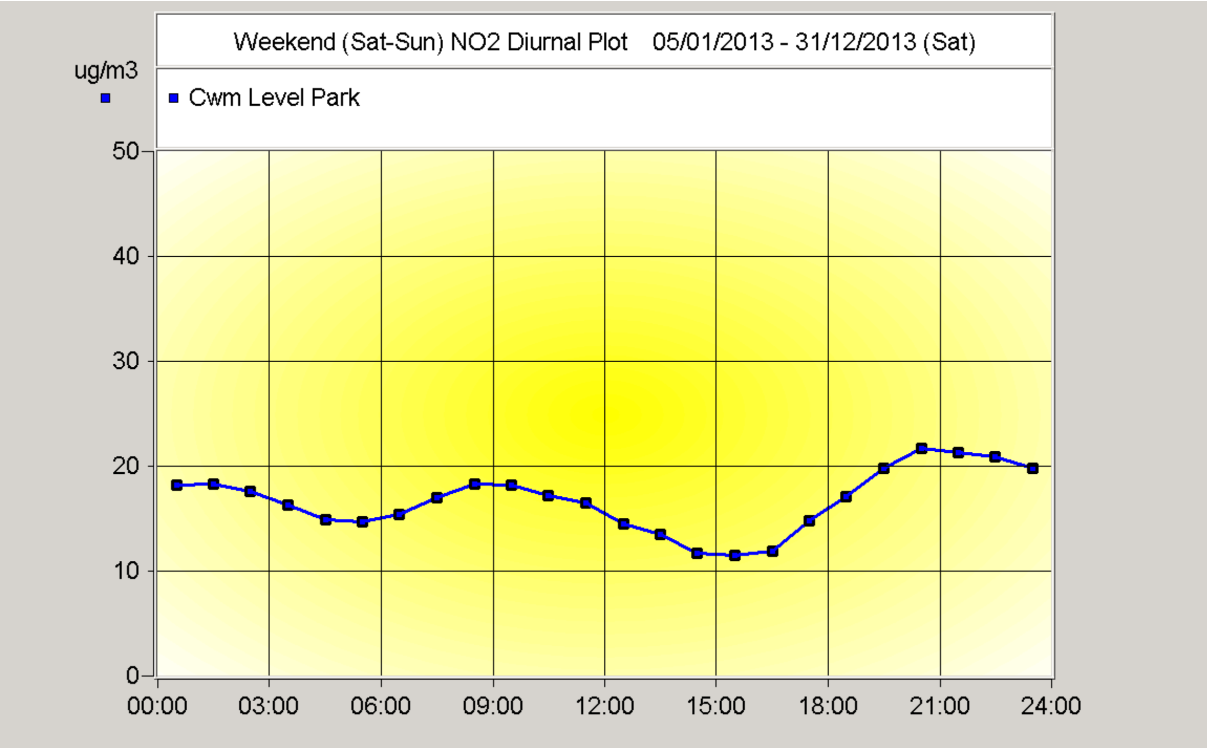
NO_2 Diurnal Profile 1 – Swansea AURN 2013 (top weekday profile, bottom weekend profile)



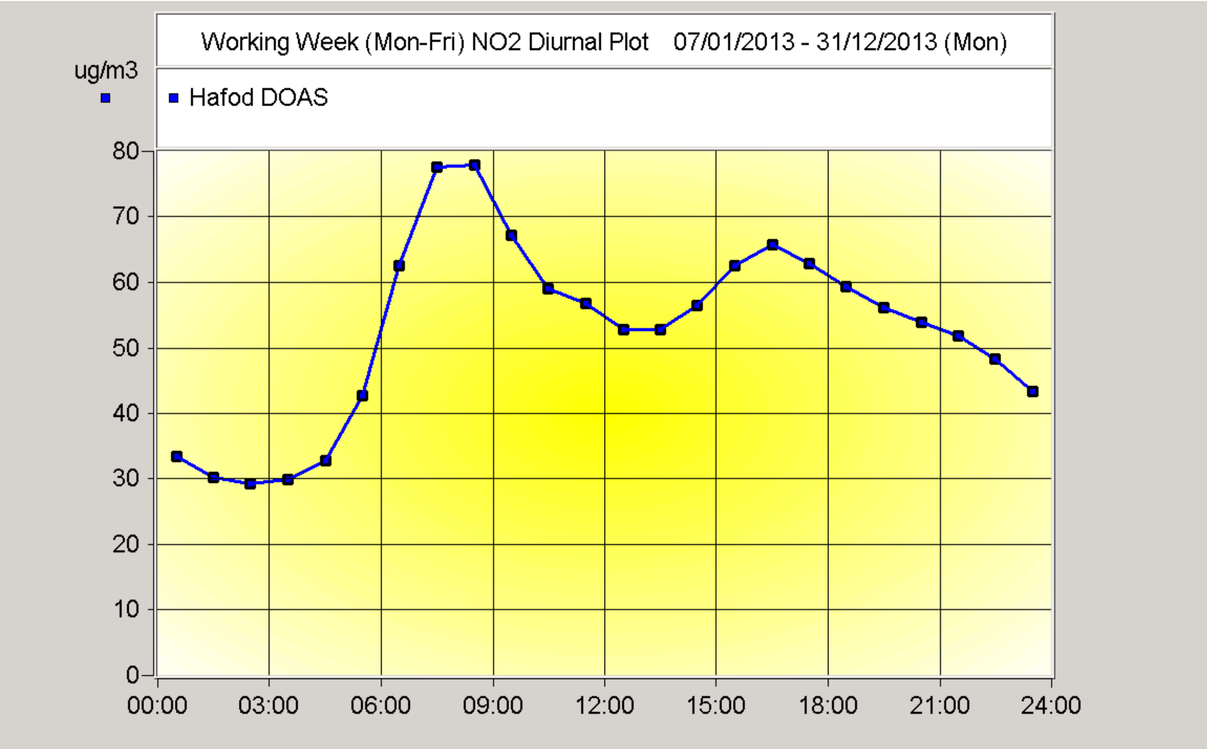


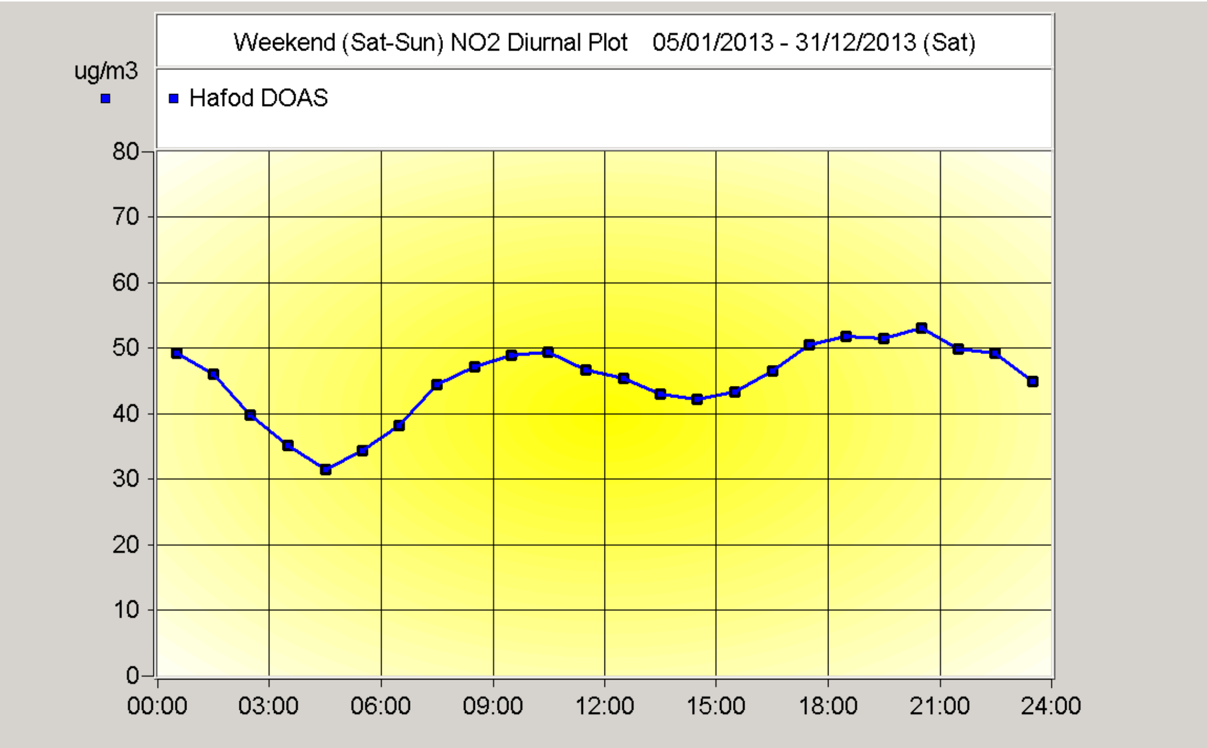
NO_2 Diurnal Profile 2 – Morriston Groundhog 2013 (top weekday profile, bottom weekend profile)



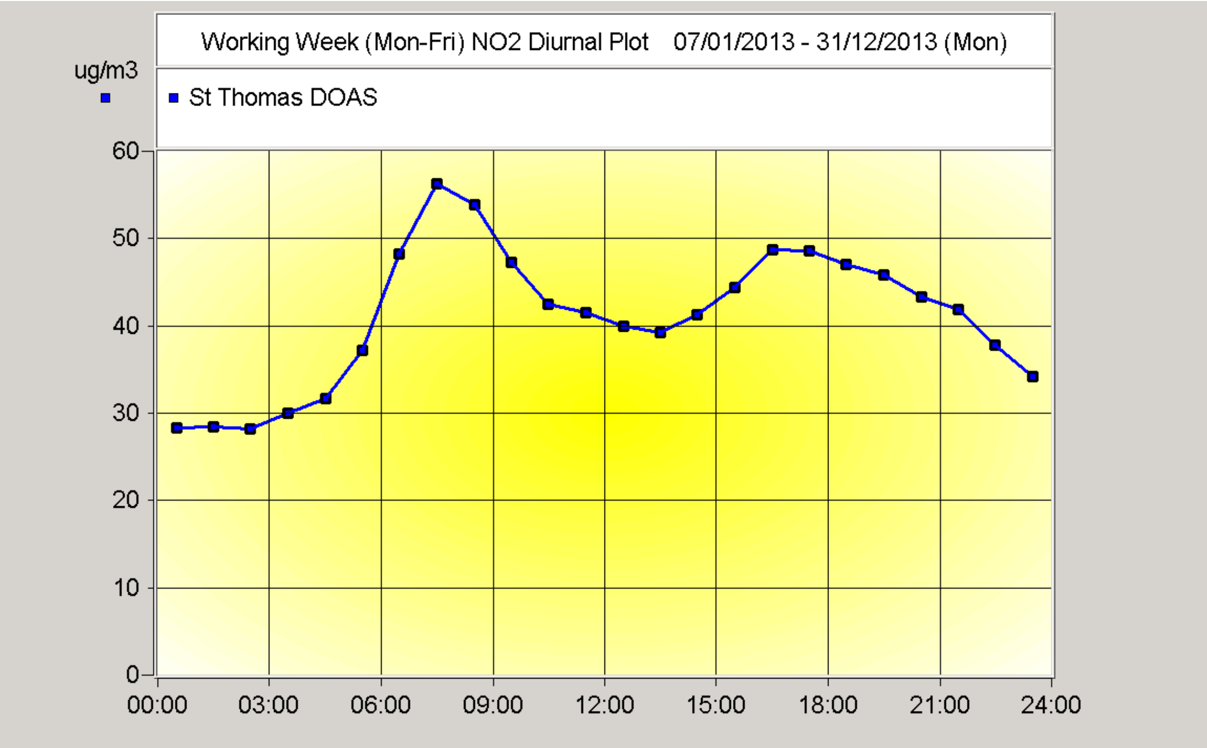


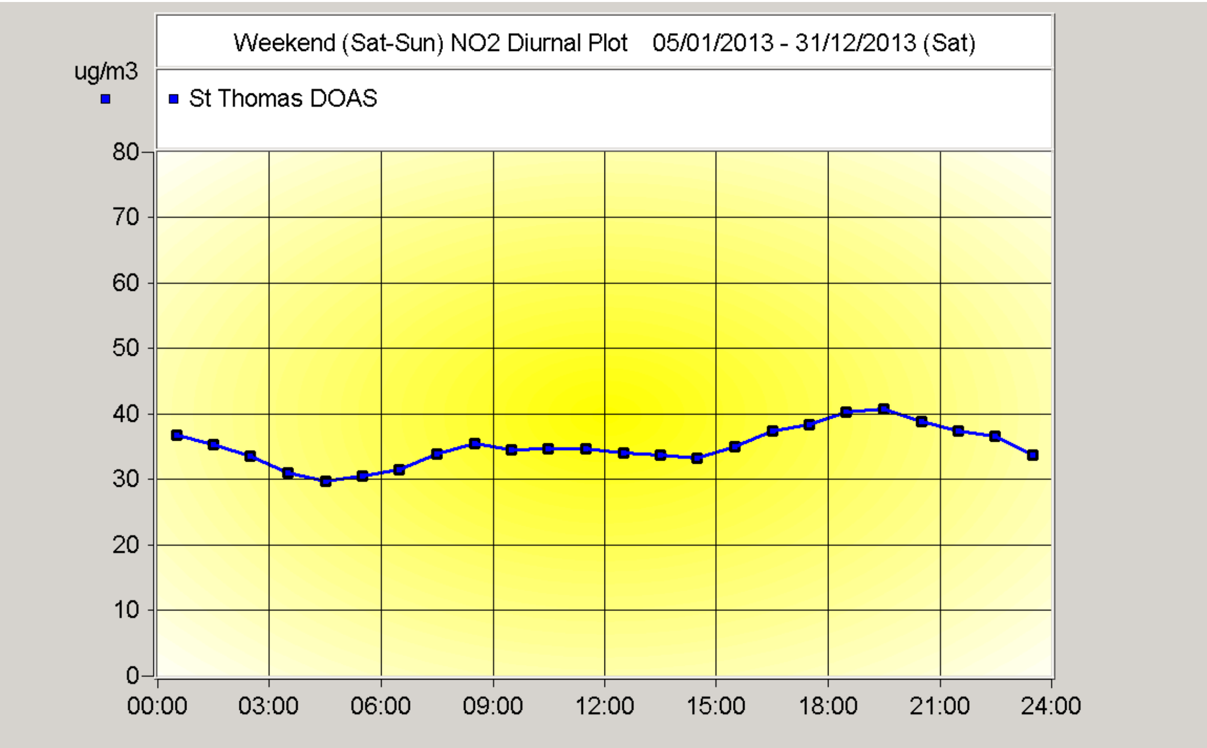
NO_2 Diurnal Profile 3 – Cwm Level Park 2013 (Urban background site) (top weekday profile, bottom weekend profile)





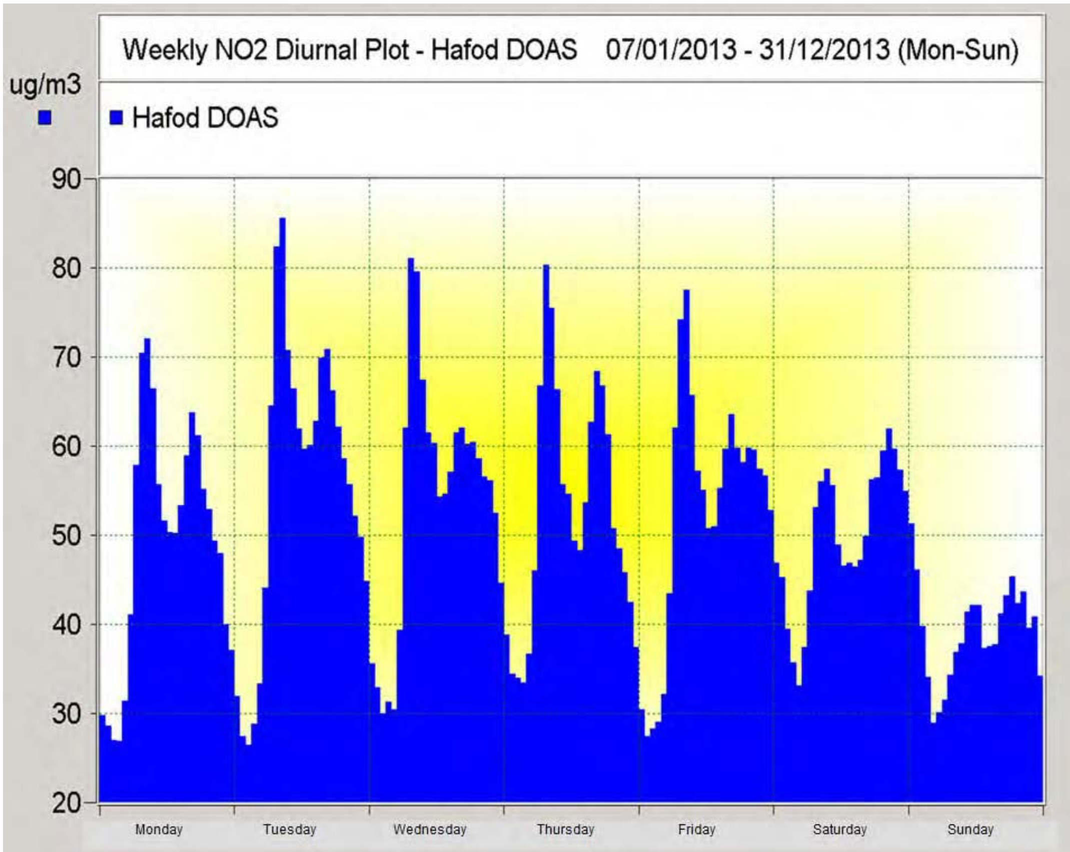
NO_2 Diurnal Profile 4 –Hafod DOAS 2013 (top weekday profile, bottom weekend profile)





NO_2 Diurnal Profile 5 – St Thomas DOAS 2013 (top weekday profile, bottom weekend profile)

The diurnal weekday profile obtained for the Hafod DOAS is both interesting and concerning in that can these profiles be better explained and more importantly what practicable measures would reduce the impact of the morning rush hour along this street canyon. Early thoughts 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. 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 a diurnal profile 6.



NO_2 Diurnal Profile16 – Weekly – Hafod DOAS 2013

It was reported in the Progress Report 2013 that budgetary restrictions will delay even the consideration of implementation of this system. This view remains unchanged during 2014 and is now looking extremely unlikely that this option can be taken forward in any meaningful way.

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.

LAQM.TG (09) provides a method within box 2.1 page 2-4 to project measured annual mean roadside nitrogen dioxide concentrations to future years. The supporting adjustment factor table was updated during January 2012 in view of the release of updated vehicle emission factors and is obtainable from http://laqm.defra.gov.uk/documents/Is_the_example_in_Box_2.1_TG09_correct.pdf

It is noted that in addition to the above, from http://laqm.defra.gov.uk/whatsnew.html that Defra produced a further update to the previously revised future year projection guidance by way of a further note entitled "Note on Projecting NO_2 concentrations" [18] dated 30th April 2012. Box 2.1 page 2-4 of LAQM.TG(09) has now also been updated "live" at http://laqm.defra.gov.uk/documents/LAQM-TG-(09)-Dec-12.pdf with the latest future year adjustment factors.

The April 2012 note sets out additional alternative methods to project measured NO_2 concentrations to future years. As a result, this authority is considering the implications raised with some of the alternative methods mentioned within this note but have decided to undertake within this Progress Report the more simplistic revised approach detailed within section 2.4. This alternative projection method assumes an average national reduction trend in NO_2 concentrations of 0.68% per year at roadside stations and 0.87% reduction per year at background stations. The adjustment factors presented within table 2 of the April 2012 update are presented as the UK averages of the site classifications i.e. roadside. This newly adopted method allows the comparison of the LAQM.TG(09) (Dec12) future year projections revised

[18] http://laqm.defra.gov.uk/review-and-assessment/modelling.html#ProjectingNO2Note and http://laqm.defra.gov.uk/documents/BureauVeritas_NO2Projections_2766_Final-30_04_2012.pdf

guidance now issued to the additional revised note dated April 2012. This method produces a range of predicted future year concentrations as to where the NO_2 concentration is likely to lie.

Using the above rational, Table 6 indicates the range of predicted NO_2 concentrations in 2014 - 2020 at the 4 automatic roadside sites and the urban background site in Swansea. Where applicable, the correction derived for distance from the roadside measurement location to the nearest receptor location is given in bold within table 6. It is this figure in bold that has been used to calculate the future year projections. The actual measured roadside concentration is given in brackets for information.

Site ID	Location	Within AQMA?	Annual mean adjusted for distance from road to nearest receptor where applicable	Future Years Projection Ranges expressed in ug/m^3 (* at nearest receptor location) LAQM.TG(09) (Jan 12) method first, Revised April 2012 method last Predicted exceedence of annual mean objective highlighted in **bold red** Prediction within 3ug/m^3 of annual mean objective highlighted in **bold blue**						
			2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
1	*Swansea AURN	Y	**26.8** (31.15)	25.6 to 26.60	24.4 to 26.43	22.9 to 26.27	21.5 to 26.07	20.1 to 25.90	18.7 to 25.73	17.3 to 25.56
3	*Morriston Groundhog	N	**23.2** (28.58	22.1 to 23.03	21.1 to 22.88	19.8 to 22.74	18.6 to 22.57	17.4 to 22.42	16.2 to 22.28	14.9 to 22.13
4	** Cwm Level Park (Urban Background)	Y	**18.54**	17.7 to 18.38	16.9 to 18.22	15.9 to 18.07	14.9 to 17.91	13.9 to 17.75	12.9 to 17.59	11.9 to 17.44
5	Hafod DOAS	Y	**50.68**	**48.4** to **50.31**	**46.1** to **49.99**	**43.4** to **49.67**	**40.7** to **49.30**	**38.0** to 48.98	35.3 to **48.66**	32.6 to **48.34**
6	St.Thomas DOAS	N	**39.45**	**37.70** to **39.16**	35.9 to **38.91**	33.8 to **38.66**	31.7 to **38.37**	29.6 to **38.13**	27.5 to **37.88**	25.4 to **37.63**

Table 6 – Predicted Future Years Roadside NO_2 2014-2020

*** Urban background site included for sake of completeness. Revised April 2012 method includes background factors*

It is thought that table 6 above now indicates a more realistic range of predicted NO_2 concentrations in future years. In light of past experience with LAQM work and projecting future year concentrations of roadside NO_2 it would seem wise to look to the higher threshold of the range indicated as this appears to be more “real world”.

From table 6, the realistic view can be taken that the Hafod DOAS will continue to experience exceedences of the annual mean until at least 2020 (and probably far beyond) given current thinking (using the Revised April 2012 method), with the St Thomas DOAS remaining at risk of exceedence of the annual mean objective as well up to 2020 (using the Revised April 2012 method). The revised LAQM.TG(09) revision of December 2012 paints a different, and probably highly unrealistic impression that compliance will be seen at the Hafod DOAS in 2018 and that the St.Thomas DOAS is only at risk of exceedence of the annual mean objective until 2015. All other stations exhibit existing full compliance with the annual mean objective.

2.2.3 Nitrogen Dioxide Diffusion Tube Monitoring

All data presented within table 7 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[19]. 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.

The authority has steadily increased it passive diffusion tube network over the years with the biggest increases being seen in the last 3 years. The total number of sites operational during 2013 was 246, exposed on a monthly basis. Sites 1 to 296 are reported below and form the additional monitoring outlined within the Updating and Screening Assessment 2009, with an update being made within the Progress Report 2010. These additional sites became necessary as a result of the revised guidance within LAQM.TG(09) requiring assessment of narrow/congested streets that have an annual daily flow greater than 5000 vehicles. Sites 275 to 291 represent yet more additional monitoring partly in direct response to local residents concerns following alteration of road junctions. Please not that following budgetary restraints 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 for completeness, these sites are annotated within table 3 and highlighted within the results table 7 below. Sites 292 – 296 again represented additional monitoring as a result of local developments with sites 297 – 322 commencing during July 2012 as a result of highway alterations within the Gorseinon area. Sites 297-322 ceased measurements in January 2014 following completion of the highway alterations within Lime Street, Gorseinon as it became apparent that the highway alteration had little effect on the air quality within Lime Street and Trinity Street Gorseinon.

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

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

highlighted in bold blue. **Table 7 indicates the bias corrected annual means including any correction necessary for distance to nearest receptor from the sampling location - see table 3 for distance to nearest receptor. The relevant distance correction (where applicable) is given within table 8 for sake of completeness**.

Box-Whisker Plots are provided for all sites within Annexe 5. Please note that RAW, uncorrected for bias data is presented within the box-whisker plots.

Site ID	X Coordinate	Y Coordinate	Within AQMA ?	Data Capture 2013 %	Annual Mean concentrations 2013 (ug/m3) Adjusted for tube bias and distance to receptor
1	262046	196420		100	24.38
4	262497	192857	Y	83	29.92
5	262548	192943	Y	100	34.78
6	262612	192995	Y	100	30.65
7	262691	192852	Y	100	**46.74**
8	262990	195820	Y	92	**44.77**
9	263190	195205		92	30.03
10	263219	195513	Y	100	25.29
11	263344	195474	Y	92	**39.45**
12	263680	195103	Y	100	**40.22**
13	264830	193066		92	29.30
14	265285	192696		100	28.69
15	265334	192608		100	26.91
16	265339	192534		100	31.63
18	265526	195807	Y	83	**47.01**
19	265597	194061	Y	100	**43.75**
20	265594	194175	Y	92	36.50
21	265634	195316	Y	100	30.04
22	265682	195374	Y	100	33.89
23	265728	195494	Y	100	30.93
25	265845	195547	Y	100	27.88
26	265876	194318	Y	92	**39.11**
27	265922	194428	Y	100	**38.03**
28	265949	194891	Y	92	28.30
29	265973	195222	Y	92	**43.86**
31	266153	196003		100	30.81
32	266209	193867		100	35.24
33	266236	193488		100	31.09
34	266272	196168		100	31.11
35	266314	193298		75	31.27
36	266455	193300		92	30.12
38	266662	193181		100	33.56
40	266951	198278		100	28.19
41	266953	198085		100	36.54
43	267093	198063		67	**38.62**
44	267639	199543		100	25.69
45	267661	199451		100	32.06
48	268011	193101		92	23.43
49	268501	197329		92	27.74
50	268530	197419		100	32.89
51	268593	197434		100	27.94
54	268693	197416		92	31.88
55	268789	197420		100	32.39
^56 *	269306	198661		100	21.20
^58	264052	192884		100	32.50
59	265918	194463	Y	100	**47.99**
60	265036	192931		100	35.71
61	264959	192878		100	36.45
^63	262675	192775	Y	100	22.10
^64	262719	192840	Y	100	**38.90**
65	262735	192855	Y	83	22.92

Site ID	X Coordinate	Y Coordinate	Within AQMA ?	Data Capture 2013 %	Annual Mean concentrations 2013 (ug/m3) Adjusted for tube bias and distance to receptor
66	262802	192829	Y	92	29.11
^67	265903	193683	Y	100	**36.20**
68	265573	193432		100	35.72
^69	265543	193450		100	36.70
^70	266649	195435		100	24.30
^71 **	266514	195485		67	29.00
72	264091	192900		100	24.91
73	264138	192868		100	28.81
74	264163	192853		100	26.65
75	264072	192869		100	**38.41**
76	263968	192880		92	27.76
78	263819	192948		100	27.88
79	263842	192896		100	31.04
83	262785	192838	Y	100	30.33
84	262714	192839	Y	100	32.73
85	262702	192847	Y	100	36.24
86	262704	192865	Y	100	28.18
87	262697	192798	Y	100	22.11
88	262605	192916	Y	100	30.73
89	262587	192956	Y	100	21.26
90	262631	192996	Y	100	33.29
91	262534	192950	Y	100	30.68
^92	262545	192869	Y	92	27.10
93	263406	195534		100	29.25
94	263444	195572		100	28.26
95	262815	196090		100	25.85
96	262922	195950		100	27.50
97	262946	195902	Y	83	32.92
98	263142	195548	Y	92	36.67
99	263387	195332	Y	100	31.83
100	263470	195250	Y	100	27.43
101	263843	195047	Y	100	25.34
102	266379	193307		100	28.70
103	268526	197359		42	29.12
104	268538	197389		100	27.86
105	268562	197472		100	27.96
106	268496	197476		100	29.18
107	268765	197420		100	31.01
108	267608	199461		100	29.75
109	267510	199487		100	27.14
110	267369	199521		100	26.66
111	267705	199426		100	29.40
^112	264868	192814		100	27.30
113	264654	192662		100	28.79
114	264622	192971		100	29.70
115	265031	193097		92	**37.57**
116	265192	193138		100	**38.43**
117	265288	193211		100	36.61
⊗118	265483	193385		100	29.18

Site ID	X Coordinate	Y Coordinate	Within AQMA ?	Data Capture 2013 %	Annual Mean concentrations 2013 (ug/m3) Adjusted for tube bias and distance to receptor
119	265522	193390		92	32.51
⊗120	265570	193366		100	**44.94**
121	265706	193662	**Y**	92	**50.57**
122	265694	193505		92	32.49
123	265655	193423		100	**46.55**
⊗124	265651	193253		100	36.50
⊗125	265641	193162		92	36.20
⊗126	265475	193144		75	**40.71**
⊗127	265348	193110		92	**45.01**
⊗128	265297	193085		75	**40.36**
⊗129	265153	193098		83	36.50
⊗130	265139	192912		100	**41.29**
⊗131	265137	192846		92	**44.33**
132	265229	192753		92	33.81
133	265350	192566		92	26.57
⊗134	265113	192903		100	**44.54**
^135	262605	192916	**Y**	100	30.78
^136	262612	192995	**Y**	100	28.71
^137	262631	192996	**Y**	100	32.17
138	266779	199246		92	22.47
139	266867	199030		100	28.04
140	266863	199009		100	33.43
141	266979	198772		92	27.05
142	267017	198710		100	27.07
143	267089	198608		100	29.77
144	267141	198591		92	27.71
145	267139	198578		92	28.77
146	267156	198571		92	29.10
147	267165	198580		100	32.24
148	267170	198564		92	31.46
149	267204	198561		92	26.77
150	267205	198545		100	28.45
151	267192	198518		100	28.18
155	269009	201280		100	28.11
156	269059	201296		100	28.29
158	269480	201441		92	27.30
159	269171	201620		100	27.56
160	269049	201744		92	32.80
162	259553	203379		92	28.84
163	259287	203556		100	24.82
164	259195	203667		100	28.52
165	259149	203675		67	22.16
166	259148	203690		92	23.40
167	259126	203700		100	23.59
168	259115	203705		83	22.72
169	259013	203747		100	21.12
170	258971	203797		83	16.24
171	258917	203826		83	22.48
172	258887	203859		100	23.04
173	259250	203708		100	17.96
174	259253	203660		50	15.00

Site ID	X Coordinate	Y Coordinate	Within AQMA ?	Data Capture 2013 %	Annual Mean concentrations 2013 (ug/m3) Adjusted for tube bias and distance to receptor
175	259251	203638		100	15.54
176	258872	203691		83	14.85
177	258896	203697		100	12.93
178	258986	203684		100	12.59
180	259064	197781		100	30.35
182	259050	197790		100	28.15
183	259036	197795		100	30.34
197	258797	198701		100	32.92
198	258811	198701		100	35.17
199	254703	195764		100	29.20
201	254522	195859		100	26.31
206	261565	188211		100	**41.55**
207	261561	188222		83	33.84
208	261541	188215		100	36.56
209	261534	188198		100	**41.00**
210	261516	188207		100	33.58
211	261501	188188		100	33.17
212	261486	188200		83	25.63
213	261490	188186		100	33.37
214	261315	188193		92	26.77
215	261299	188191		100	23.55
216	261276	188190		100	26.38
238	266902	197660		100	29.82
239	266181	196022		92	30.10
240	266169	195995		100	32.87
241	266159	196013		83	31.60
242	265655	193423		100	**41.47**
243	265474	194949		92	35.86
244	265466	194930	Y	67	**40.14**
245	265448	194922	Y	100	**39.87**
246	265425	194927		92	26.68
247	265394	194899	Y	92	32.88
248	265342	194894		100	27.71
249	265326	194871	Y	100	31.91
250	265274	194867		92	27.45
251	265263	194845	Y	100	33.95
252	265226	194830	Y	92	29.36
253	265194	194833		100	23.76
254	265142	194816		100	24.55
255	265098	194825		100	24.37
256	264995	194777		100	**37.41**
258	254906	189110		100	26.12
265	266375	198023		100	27.65
267	266382	198028		100	28.08
268	266419	198053		100	26.12
271	266879	198078		108	28.24
272	266888	198074		92	30.54
^275	265658	194856	Y	100	24.50
276	265610	194871	Y	100	34.16
277	265596	194875	Y	92	34.23
278	265573	194882	Y	100	35.86
279	265555	194926	Y	100	**47.59**

Site ID	X Coordinate	Y Coordinate	Within AQMA ?	Data Capture 2013 %	Annual Mean concentrations 2013 (ug/m3) Adjusted for tube bias and distance to receptor
^280	265542	194980	Y	100	**39.60**
^281	265542	194872	Y	100	36.50
^282	265540	194840	Y	92	32.20
283	265436	195937		100	29.20
284	265452	195899		92	32.49
285	266955	197415		83	34.23
286	266938	197377		100	31.77
287	265715	193902	Y	92	31.87
288	265698	193878	Y	100	32.29
289	265702	193842	Y	100	34.15
290	263014	195737	Y	100	29.08
291	267952	193121		100	**43.73**
292	263833	196108		100	17.19
293	262302	196688		100	21.99
294	262342	196742		92	25.26
295 ***	258998	198698		92	29.80
296	259054	198679		100	35.06
297	258957	198628		100	18.67
298	258985	198613		100	21.21
299	259010	198619		100	18.69
300	259043	198602		100	19.77
301	259054	198611		58	22.23
303	259107	198582		92	22.22
304	259170	198554		100	20.44
305	259183	198561		75	20.11
306	259217	198544		100	20.80
307	259267	198520		100	21.82
308	259294	198507		100	20.34
309	259325	198492		100	20.92
310	259338	198486		100	19.61
311	259326	198479		92	20.97
312	259313	198486		100	21.12
313	259295	198495		100	20.45
314	259268	198508		100	20.29
315	259219	198529		100	20.11
316	259208	198504		100	20.94
317	259216	198496		92	20.45
318	259194	198450		100	18.52
319	259178	198442		100	19.05
320	259096	198241		100	18.69
321	259036	198246		92	19.42
322	259007	198241		100	17.89
323	266765	193224		83	32.16

Table 7- Nitrogen Dioxide Passive Diffusion Tube Results 2013

*** 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, thus site 71 has been corrected back by 10m (see table 8 below)
^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 worse case scenario to establish concentrations against the 1-hour objective fronting onto the school playground area
^ See table 8 below for Correction of NO_2 for distance from road

The distance to the nearest receptor location is given in brackets after the site name in table 3. The NO_2 annual mean at the nearest receptor location has been derived following guidance within TG.09 box 2.3 page 2-6 and use of the spreadsheet at http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html (Issue 4 dated 25/01/2011). The spreadsheet calculator has been setup to work from 0.1 to 50m only. As can be seen from table 7, 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 3 and table 7 indicate two monitoring sites (site 56 and 71) that are utilised to provide an indicative annual mean to the **nearest existing dwelling** within the development sites. Receptor locations when additional dwellings are constructed to the remainder/potential sites will be considerably closer. 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 continue apace and receptor locations will in all probability be present come the end of 2014. Site 71 is therefore presented as corrected to the proposed nearest dwelling (10m) with site 56 being presented with a corrected annual meas 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 below within table 8. Background 1k by 1k NO_2 concentrations (for 2013) were downloaded from http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html and overlain on a GIS background map within Quantum GIS v 2.0.1-Dufour. The background concentration required for the calculation was obtained from the nearest 1k grid square to the monitoring site. The final derived predicted annual mean concentration at the receptor location has been included within table 7 above.

Site ID	Distance of Measurement Site from Kerb	Distance of Receptor from Kerb	NO_2 Background Map Concentration (2013 dataset) ug/m^3	Measured 2013 Annual Mean ug/m^3 Corrected for bias	Predicted Annual Mean at Receptor ug/m^3
*56	2	*166	17.2	33.38	21.2
58	4	8	17.2	36.13	32.5
63	2	6	12.9	25.25	22.1
64	1	3	12.9	**46.35**	**38.9**
67	2	5	20.5	**40.46**	36.2
69	2	4	20.5	**39.84**	36.7
70	2	7	19.5	26.23	24.3
**71	2	**10	19.5	34.81	29.0
92	1	3	12.9	31.12	27.1
112	1	6	17.2	33.04	27.3
125	1	3	20.5	**40.67**	36.2
275	1	3	19.0	26.08	24.5
280	1	2	19.0	**42.91**	**39.6**
281	1	3	19.0	**41.50**	36.5
282	1	3	19.0	35.91	32.2
295	1	1.5	12.04	31.42	29.8

Table 8 – Correction of NO_2 for distance from road

* Calculated as if 50m

** Calculated as10m as development due for completion during 2014

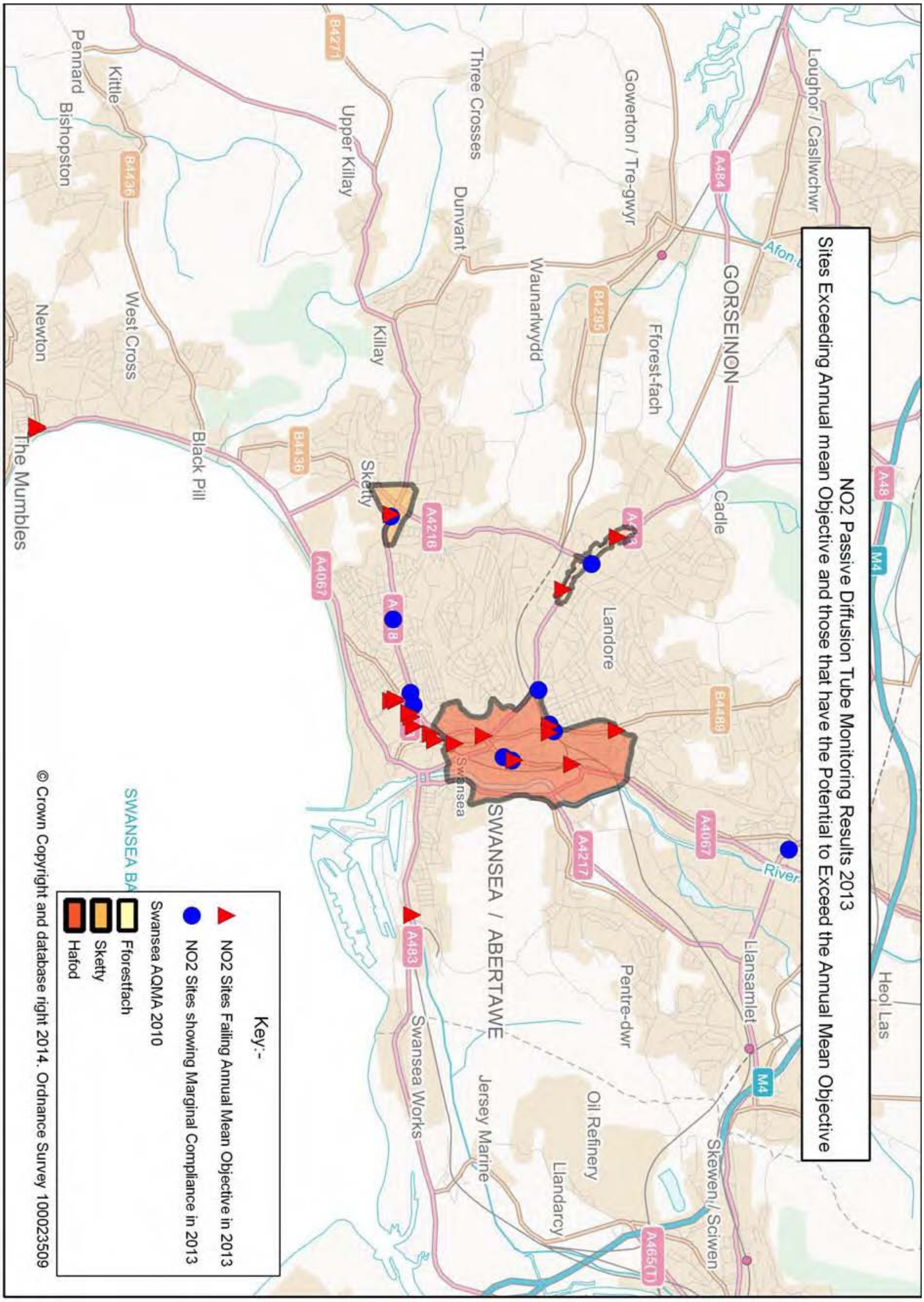
Sites 118,120,124,125,126,127,128,129,130 and 134 were sited with the main intention of assessing concentrations against the NO_2 1-hour objective within the city centre. As discussed later, Swansea city centre has seen significant change in the road network to accommodate the Metro Service. It is thought reasonable to access exposure to the 1 hour objective to the general population within the city centre area especially where this exposure can be related to an external café area type environment. 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. It is not thought that the method

within box 2.3 of TG(09) is relevant or applicable to these locations as the café environments are at an identical distance from the kerb of the same road.
From the advice on using passive diffusion tube annual mean results[20] to assess compliance with the 1 hour objective for NO_2 it is clear from the results within table 7 above, that it is unlikely that the 1 hour objective has been exceeded at any site during 2013 as all bias corrected means are below 60ug/m^3. Previously (see Progress Reports 2010 and 2011 and USA 2012) sites 59, 121, 125, 126 and 127 indicated a possible exceedence of the 1-hour objective.

A map of those sites failing the annual mean objective and those with the potential to fail the annual mean objective from the 2013 passive diffusion tube data is given below as map 16.

Sites that have returned the ten highest bias corrected annual means are discussed below. For a greater understanding of conditions affecting the site/location a picture of the surrounding area is included.

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



Map 16- Passive NO_2 Monitoring locations failing or having potential to fail annual mean objective 2013

Site 121 (2013 annual bias corrected mean of 50.57ug/m^3) is located within the existing Swansea AQMA 2010 on High Street and is shown below in photo 3. This site is situated façade at approximately 2.5m high on a block of flats opposite Swansea High Street Railway Station and outside bus stop bays. Numerous bus services operate outbound and inbound along this section of High Street. Data from the GPRS Automatic Traffic Counter (GPRS ATC site 22) located to the northern section of High Street (approx 150 yards north of photo location) is valid for this monitoring location and indicates a bus composition of 5.9% of the flow during 2013. If the total LDV/HGV composition is taken into consideration, the figure rises to 11.3%. These figures however, exhibit an overall downward trend not only in terms of traffic composition but also in terms of the returned bias corrected annual means from previous years for this site.

Year	Bias Corrected Mean ug/m^3	Bus % Composition	Total % LDV
2008	79.3	8.7	16
2009	61.19	7.4	14.3
2010	52.33	6.5	13
2011	52.71	5.6	11.7
2012	50.97	5.3	10.8
2013	50.57	5.9	11.3

Whilst this site lies within the existing Air Quality Management Area, changes to the road infrastructure outside High Street Railway station and subsequent relocation of bus stops etc appear, given the data above, to have impacted upon NO_2 concentrations seen in the area. This trend evident in the data shown above is surprising given past thinking and local knowledge of the area but none the less is a welcome trend.

The authority has decided to locate a real-time chemiluminescent NO_x analyser outside of the flats within the footway and adjacent to the bus stops. This site has been several years in the planning (as mentioned in previous reporting) but should now be established following the securing of funds during June/July 2014.

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Photo 5 – passive diffusion tube site 121

Site 59 (2013 annual bias corrected mean of 47.99ug/m^3) is located façade between the Hafod Post Office and a terraced property and as mentioned above (within sec 2.2) is directly opposite the Hafod DOAS transmitter station. The DOAS transmitter can be seen to the right of the photo fixed to the front façade to the property – site 59 is directly opposite in between the Post Office and a terraced property. The junction between Neath Road with Maliphant Street and Aberdyberthi Street are controlled via traffic control signals on each arm of the junction

These signals do hinder traffic flow down Neath Road for relatively few movements emanating from the side junctions. The annual mean returned from the real-time DOAS is 50.68µg/m^3 with 6 exceedences of the hourly objective being seen within the 250m open path measurement length during 2013. Whilst there has been no exceedence of the 18 permitted 1-hour exceedences during 2013, the results observed from year to year from the both real-time and passive methods are highly variable in their extent, but both methods continue to confirm exceedence of the annual mean objective.

Photo 6 – Passive Diffusion Site 59

It is thought that the likelihood of a combination of conditions i.e. meteorological and/or traffic flow, leading to exceedences of the 1-hour objective occurring within this street canyon remain, and can not be ignored, therefore monitoring will continue for the foreseeable future especially in light of the continued exceedence of the annual mean objective being seen. Traffic counters are located to the north (ATC site 18 within section 3) and to the south (ATC site 6 within section 3). The AADT at these sites during 2013 was 15,504 and 15,336 respectively with an HGV content of approx 8%.

Site 279 (2013 annual mean 47.59ug/m^3) is located on Llangyfelach Road, Hafod within the existing Swansea AQMA 2010 area. The diffusion tube site is located front façade of the terraced property by the signal crossing. Llangyfelach Road narrows at this location due to the railway bridge carrying the West Wales line. To the north is a junction with Courtney Street that itself has become heavily trafficked by traffic seeking a short cut to Cwmbwrla Roundabout with access to Carmarthen Road and the A483 leading to junction 47 of the M4. During 2013 site 244 located front façade to a property along Courtney Street which is within 75m of the junction with Llangyfelach Road also breached the annual mean objective with a bias corrected annual mean of 40.14ug/m^3). All vehicle are accelerating up the hill leading to site 244. Within 20m of this junction is a pedestrian crossing. To the south of the site is another junction with Pentremawr Road. Pentrehafod Comprehensive is located along Pentremawr Road. The area is heavily congested during the morning and pm periods.

Photo 7 – Passive Diffusion Site 279 Llangyfelach Road

Site 18 (2013 annual mean 47.01ug/m^3) is located front façade on a mid terraced property at Cwm Level Road, Brynhyfryd, approximately 50m from the signal controlled junction at Brynhyfryd Square with Llangyfelach Road and Penfilia Road.

Photo 8 – Passive Diffusion Site 18 Cwm Level Road

The site is just within the boundary of the existing Swansea AQMA 2010. ATC site 2 is located several hundred meters away on Cwm level Road opposite Cwm Level Park and is relevant for this tube location. ATC site 2 has an AADT during 2013 of 14,184. Traffic queues along all arms of the signal controlled junction with significant queuing during peak times. Photo 8 shows a view down Cwm Level Road from Brynhyfryd Square. Llangyfelach Road runs left/right through the photo with Penfilia Road behind and to the left of the view.

Tube site 18 is located front façade to a mid terraced property to the right of the photo between the lamppost and telegraph pole.

Site 7 Gower Road Sketty (2013 annual bias corrected mean of 46.74ug/m^3) is located front façade to a terraced property close to the mini roundabout junction of Gower Road with De la Beche Road and is shown within photo 9 below.

Photo 9 – Site 7 Gower Road, Sketty

Approximately 200m north is the signal controlled junction at Sketty Cross. Significant congestion can be seen at peak times within the area. A major comprehensive school is located along De La Beche Road with over 1100 pupils on its role. A large proportion of the pupils are from outside of its natural catchment area resulting in pupils either being bussed in or dropped off by their parents. Photo 10 below, looking north towards Sketty Cross signal controlled junction includes a view of the mini roundabout at the junction of Gower Road with De La Beche Road. Site 7 can be seen to the left of photo 10 north of this junction.

Photo 10 – View looking north to site 7

Site 123 High Street (2013 annual bias corrected mean of 46.55ug/m^3) lies just outside of the existing Swansea AQMA 2010. Within the USA 2012 submitted by the authority is was mentioned that whilst discussions had commenced with the Housing Association that manage a sheltered youth residence which forms the frontage to passive diffusion tube site 123 on High Street, that due to the budget restraints currently being imposed, there was no budget to purchase either the required enclosure or Teledyne NO_x analyser. However, funding has now been obtained but due to siting problems/issues the funding is being used to site a real-time chemiluminescent analyser to the northern section of High Street outside passive diffusion tube site 121 (see above).

Photo 11 – Middle section of High Street showing passive diffusion tube site 123 and surrounding locale.

The authority is aware of preliminary proposals for redevelopment of old commercial premises at several locations in this vicinity as well as being aware of the developments along the lower section of High Street. Details of the Urban Village development seen to the right of photo 11can be found in section 5.2.10 of the Progress Report 2011 but alterations to the approved scheme following discussions with the developers, has seen the proposals to site residential elements along the High Street frontage removed from the scheme and replaced with commercial use.

Site 127 (2013 annual bias corrected mean of 45.01ug/m^3) is located along the Kingsway in the heart of the city centre and was originally intended to assess concentrations against the 1-hour NO_2 objective. A café type environment exists within 10m of the monitoring site with outside seating for cliental provided adjacent to the busy carriageway as shown below within photo 12

Photo 12 – Passive Diffusion Tube site 127 The Kingsway

In addition, the upper floors of a commercial building virtually opposite the site have recently been converted into student accommodation and can be seen to the right of photo 12 above the bus stops. No monitoring is possible in this location due to a canopy extending over the retail food outlet. The former Kingsway Post Office building is located the same side of the carriageway as site 127 and is approximately 30 meters to the north. This building has also been converted into flats during 2012. It can be argued therefore that relevant exposure to the annual mean objective exists in this locale. Monitoring did not commence façade of the new flats during 2013 due to operational issues as indicated it would, within the Progress Report 2013. It is envisaged that this monitoring will commence during 2014 following a review of diffusion tube locations.

Site 120 (2013 annual bias corrected mean of 44.94ug/m^3) is located along Orchard Street on the inner approaches to the city centre. Orchard Street is heavily trafficked and subject to congestion on the inbound lanes during the majority of the day. An outbound lane on the other side of the dual carriageway serves mainly service buses and the Metro Service. The inbound lanes receive traffic direct from the Dyfatty interchange leading from the Hafod and A483 Carmarthen Road. ATC site 7 Dyfatty Street is a proxy for this location for an indication of AADT flows (slight increase is received from High Street direction and Plymouth Street) which during 2013 were approximately 10,000 vehicles per day. HGV content of the flow is given as 4.8% with buses 0.5% but the bus data is unreliable as the majority of buses enter Orchard Street via High Street and not from Dyfatty Street. Cars/light vans dominate the composition and account for over 94% of the flow. Photo 13 below is taken looking from tube site 120 towards new flats. Unfortunately, there is no suitable direct monitoring point suitable on the flats front façade – consideration will be given to

Photo 13 – View from site 120 Orchard Street additional monitoring located on the signal controls themselves as they are the nearest possible monitoring point to this receptor location and then back correcting the derived bias corrected annual mean to front façade.

Site 8 (2013 annual bias corrected mean of 44.771ug/m^3) is located front façade to a terraced property along the inbound dual carriageway on Carmarthen Road, Fforestfach. The site lies approximately 140m from the signal controlled junction of the A483 Carmarthen Road with the Swansea West Industrial Estate. The site lies within the existing Swansea AQMA 2010. Whilst traffic is predominantly free flowing past the site on the inbound lanes, all traffic is either accelerating from standstill at the signalled controlled junction or accelerating due to the slight incline past the site. Traffic on the outbound dual carriageway is normally congested during daytime hours with traffic queuing back from the signalled controlled junction as can be seen within photo 14 below. This view is taken looking north towards the signalled controlled junction on the outbound carriageways with the tube location front façade of the block of four terraced housing closest to the inbound carriageway mid frame of the photo.

Photo 14 – Passive Diffusion Tube site 8 Carmarthen Road, Fforestfach

The combined AADT from ATC sites 25 (outbound) and ATC site 44 (inbound) is 26,256 with the HGV content approximately 7.5%. This HGV composition of flow is likely to be higher to the north of the signal controlled junction with HGV vehicles turning right into Swansea West Industrial Park having more likely exited the M4 at junction 47.

Site 134 (2013 annual bias corrected mean of 44.54ug/m^3) and **site 131** (2013 annual bias corrected mean of 44.33ug/m^3) are located along Dillwyn Street in the heart of the city centre and are intended to assess concentrations against the 1-hour NO_2 objective as no residential dwellings are known to exist within this section of Dillwyn Street. However, café type environments do exist at locations within 10m of the monitoring sites with outside seating for clientele provided adjacent to the busy carriageway as shown within photo 15 below.

Photo 15– Café type street scene Dillwyn Street

There are additional café type environments to the north of the photo to the other side of the junction where a Mediterranean style restaurant provides its clientele with outside seating during good weather. Immediately behind/south of photo 15 is yet another café type environment, again located roadside at the signal controlled junction of The Kingsway with Dillwyn Road/St Helens Road. Clientele are again provided with outside seating areas during good weather to consume not only food/coffee/tea etc but also alcoholic beverages. This location is shown below as photo 16.

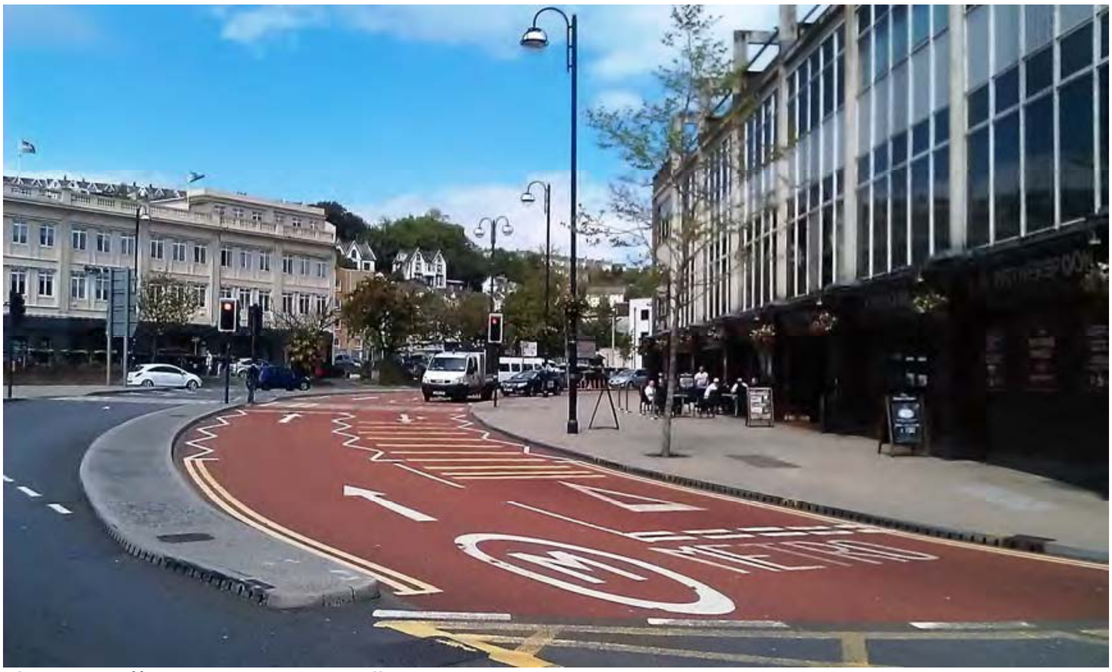


Photo 16 – Café environment Kingsway/Dillwyn Street

However, as NO_2 concentrations during 2013 have not exceeded 60ug/m^3 there are therefore, no relevant receptor locations present, as the hourly NO_2 objective is unlikely to have been breached[21].

A few other sites that have previously been highlighted within reporting are mentioned below as way of an update to that previous reporting.

Sites 206 – 213 are located around the junction of Newton Road, Mumbles with the A483 Mumbles Road, with the majority indicating a breach of the annual mean objective during 2010 when monitoring first commenced. These sites were identified during the USA 2009 as Newton Road at this location forms a narrow, congested street (mainly in summertime due to indiscriminate parking etc) with an AADT flow greater than 5000 vehicles.

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

Photo 17 – View looking south down Newton Road towards junction with A483 Mumbles Road and Swansea Bay

The junction suffers congestion mainly during the summer months due to the influx of tourists visiting both the Mumbles area and the shopping facilities along Newton Road.

Photo 18 – View looking north up Newton Road

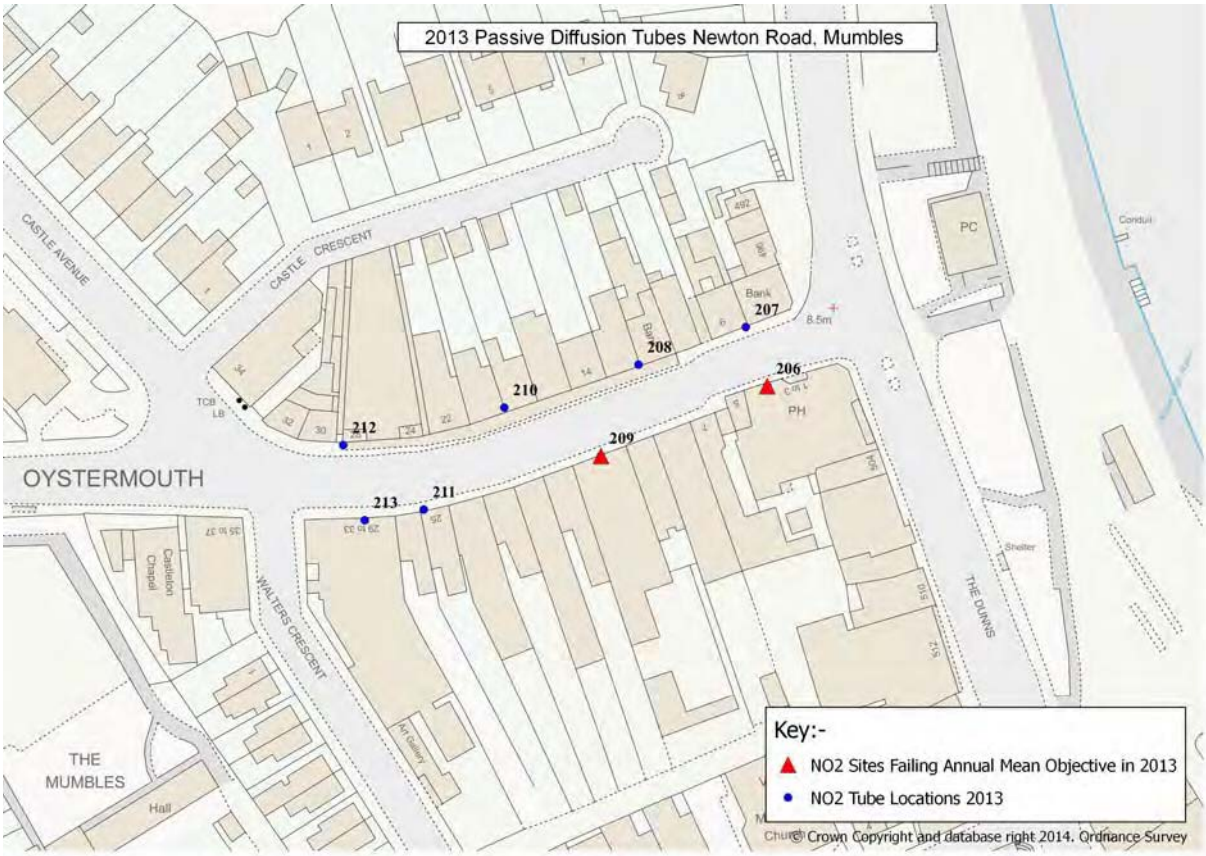
Receptor locations exist at first floor level above commercial premises. However, whilst passive diffusion tube sites are located facade to the entrance doors to the flats in between the commercial premises, on one side of the lower section of Newton Road a canopy extends along the commercial premises at first floor level. Dispersion around passive diffusion tube sites 207, 208, and 210 may be hindered under these circumstances with the returned annual means at sites painting a false picture.

Whilst this may be true for the monitoring undertaken facade underneath the canopy, sites on the opposite side of the road (left of photo 18) do not suffer from a similar situation, with sites 206, 209 and 211 and 213.

During 2011 the authority reported within its Progress Report that exceedences of the NO_2 annual mean objective had been observed at monitoring points under the canopy at sites 208 and 210. It was further reported that exceedences observed at sites on the opposite side of the road (left of photo 18 above) do not suffer from a similar situation of poor dispersion/circulation, with sites 206, 209 and 213 exceeding the annual mean objective. Site 211 was within 0.55ug/m^3 of exceeding the annual mean objective so in practical terms it was also be taken to exhibit probable exceedence of the annual mean objective. It was stated within section 10.1 Conclusions from New Monitoring Data that additional monitoring would be undertaken at 1st floor level above the canopy at façade of the flats above the commercial premise. This has not been implemented as during the risk assessment undertaken it was determined that to change the diffusion tubes would present staff with unacceptable risks both from traffic and the height of working. The monitoring sites have, and will therefore remain, he same as described above.

Results from 2012 indicated that sites 206 and 207 were exceeding the annual mean objective with sites 208 and 209 being within 3ug/m^3 of exceeding the annual mean objective so in practical terms they were also taken to exhibit probable exceedence of the annual mean objective. Results from 2013 indicate that sites 206 (41.55ug/m^3) and site 209 (41ug/m^3) are exceeding the annual mean. All other sites along Newton Road indicate full compliance with the annual mean objective during 2013. It is interesting to note that once again, it is only those sites not directly under the commercial premises canopy that have exceeded the annual mean objective during 2013.

Map 17 below shows the monitoring locations along Newton Road during 2013



Map 17 Passive NO_2 monitoring locations Newton Road, Mumbles 2013

Table 9 below summarises the annual mean concentrations at sites 206-213 since monitoring began in 2010. There is a pronounced overall downward trend at all sites, with, it can be argued, sites 206 and 209 now only marginally failing the annual mean objective. With this in mind, and in anticipation of the overall downward trend continuing to be seen in future years, it is proposed to adopt a “do nothing” attitude in respect of declaration of an AQMA certainly in the immediate future.

Site ID	Annual mean concentrations($\mu g/m^3$ Adjusted for bias			
	2010	2011	2012	2013
206	**51.37**	**47.05**	**45.60**	**41.55**
207	**45.70**	34.51	**41.17**	33.84
208	**46.18**	**37.59**	**37.48**	36.56
209	**46.87**	**44.72**	**39.40**	**41.00**
210	**43.61**	31.66	34.47	33.58
211	**39.49**	34.34	35.45	33.17
212	27.40	27.04	27.18	25.63
213	**40.24**	**37.79**	35.09	33.37

Table 9 – NO2 annual means Newton Road 2010-2013

Site 291 (2013 annual bias corrected mean of 43.73ug/m^3) is located on the outbound A483 towards junction 42 of the M4. The site is located front facade of a terraced property that is within 4 meters of the A483 and close to a bus stop and is shown below to the right within photo 19.

Photo 19 – Site 291 Vale of Neath A483

It should be noted that few scheduled services stop and use the pull in lay bye style bus stop and that, at this location, the outbound flow of traffic is free flowing. There is a signal controlled junction with the Swansea Docks and the A483 entrance 200 meters westwards towards the city centre. This signal controlled junction results in queuing traffic on the opposite dual carriageway of the A483 past NO_2 tube site 48 at Bevans Row. It is curious that free flow conditions outside site 291 result in an exceedence of the annual mean objective whilst queuing traffic past site 48 Bevans Row results in compliance with the objective. This is worth further investigation but initial thoughts are that this is an effect of traffic accelerating away from the signal controlled junction.

It was reported within the authorities Progress Report 2013 that the number of passive NO_2 diffusion tube locations along Bevans Row would increase to verify the findings. Unfortunately, due to operational issues this has not happened

Table 10 below details the annual NO_2 bias corrected annual means for sites 1-323 between 2007-2013. Those sites that have been decommissioned have been removed from the 2013 dataset reported (see also table 3) but the historical annual means will continue to be presented to present an overall context and for completeness sake. Whilst there is evidence of a slight overall downward trend with annual mean concentrations between 2007 and 2013, numerous sites still exhibit a breach of the annual mean objective with numerous others also showing the potential to breach the annual mean objective.

A map of those sites failing the annual mean objective and those with the potential to fail the annual mean objective from the 2013 passive diffusion tube data is given above as map 16.

As additional numerous sites have continued to exhibit bias corrected concentrations below 30ug/m3 for several years, a further decision may be made to cease measurements at these sites to both ease the workload and costs associated with this work. The exception to the above is where those sites are within, or near to, the Swansea Air Quality Management Area where these sites may prove useful in assessing the benefit if any of measures taken within the AQMA.

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (µg / m³) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
1	262046	196420		26.7	24.2	25.42	30.83	27.35	25.18	24.38
2	262095	196500		18.1	16.3	17.73	20.08	-	-	-
3	262161	196513		22.2	20.1	22.79	23.95	-	-	-
4	262497	192857	Y	33.9	30.8	33.25	35.07	29.97	29.73	29.92
5	262548	192943	Y	35.1	32.2	34.22	**42.06**	33.42	34.06	34.78
6	262612	192995	Y	32.0	29.8	28.71	34.62	29.29	29.20	30.65
7	262691	192852	Y	**50.0**	**48.5**	**53.02**	**58.76**	**50.93**	**49.39**	**46.74**
8	262990	195820	Y	**46.0**	**42.4**	**44.59**	**46.81**	**41.81**	**41.80**	**44.77**
9	263190	195205		30.3	28.6	29.00	31.41	27.65	26.63	30.03
10	263219	195513	Y	24.8	24.2	26.03	29.98	25.28	23.40	25.29
11	263344	195474	Y	**39.1**	**37.8**	**37.08**	**43.92**	**37.21**	34.03	**39.45**
12	263680	195103	Y	**42.3**	**40.7**	**43.92**	**48.15**	**43.96**	**43.20**	**40.22**
13	264830	193066		30.8	28.9	29.90	32.83	28.03	28.99	29.30
14	265285	192696		30.0	25.2	25.23	32.66	26.99	25.57	28.69
15	265334	192608		27.7	26.1	25.73	32.76	27.33	26.69	26.91
16	265339	192534		34.5	30.7	30.73	**38.61**	30.85	30.41	31.63
17	265496	192408		26.0	22.8	21.22	30.40	-	-	
18	265526	195807	Y	**46.4**	**44.9**	**47.87**	**51.23**	**49.10**	**44.74**	**47.01**
19	265597	194061	Y	**48.2**	**42.6**	**44.92**	**52.20**	**45.84**	**45.33**	**43.75**
20	265594	194175	Y	**40.7**	**39.9**	**42.42**	**45.51**	**37.41**	36.65	36.50
21	265634	195316	Y	32.8	31.7	32.04	33.65	30.62	30.57	30.04
22	265682	195374	Y	36.6	35.7	34.57	**37.93**	33.73	31.23	33.89
23	265728	195494	Y	36.0	34.1	33.57	36.53	33.97	33.18	30.93
24	265760	192420		23.6	20.6	19.65	27.50	-	-	-
25	265845	195547	Y	28.9	27.7	29.82	31.43	28.91	28.83	27.88
26	265876	194318	Y	**42.1**	**41.7**	**40.20**	**45.81**	**40.78**	**40.31**	**39.11**
27	265922	194428	Y	**41.3**	**37.8**	**43.14**	**45.39**	**39.95**	**37.05**	**38.03**
28	265949	194891	Y	31.6	29.4	30.18	33.48	30.29	30.11	28.30
29	265973	195222	Y	**58.4**	**56.3**	**52.00**	**53.38**	**53.48**	**47.60**	**43.86**
30	266080	192516		24.6	20.1	21.35	25.92	-	-	
31	266153	196003		33.4	32.4	32.39	**37.79**	31.70	33.26	30.81
32	266209	193867		34.0	31.3	32.11	**38.82**	33.24	31.53	35.24
33	266236	193488		32.7	31.0	30.86	**38.09**	32.11	32.59	31.09
34	266272	196168		36.1	32.7	31.18	**39.60**	34.47	31.39	31.11
35	266314	193298		**38.6**	35.9	36.23	**40.67**	**40.39**	33.46	31.27
36	266455	193300		34.0	31.0	30.03	34.42	33.58	31.65	30.12
37	266515	193213		26.5	24.2	23.88	28.33	-	-	-
38	266662	193181		35.5	33.1	35.34	**39.05**	**37.23**	35.40	33.56
39	266905	193271		26.7	25.2	25.70	28.35	-	-	-
40	266951	198278		29.7	28.2	28.71	31.80	27.77	30.47	28.19
41	266953	198085		33.4	**37.3**	**41.59**	**41.38**	**40.54**	**38.32**	36.54
42	267084	198274		31.3	34.8	**43.17**	**38.59**	**-**	-	-
43	267093	198063		35.1	34.4	36.19	**42.60**	34.88	**38.01**	**38.62**
44	267639	199543		28.3	29.0	29.71	28.37	30.01	28.67	25.69
45	267661	199451		**39.4**	35.5	**37.79**	**43.87**	33.82	33.84	32.06
46	267752	193218		16.7	16.0	15.91	17.71	-	-	-
47	267908	199773		24.1	23.9	25.19	26.83	-	-	-
48	268011	193101		24.3	25.2	23.88	27.08	23.98	23.52	23.43
49	268501	197329		29.9	29.6	29.43	32.35	28.28	26.67	27.74
50	268530	197419		**39.7**	35.3	**37.99**	**41.14**	35.38	33.84	32.89
51	268593	197434		30.7	32.2	30.98	34.19	30.31	30.54	27.94

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (µg / m³) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
52	268643	197245		20.9	22.5	24.20	24.42	-	-	-
53	268652	197508		23.4	22.9	23.67	25.93	-	-	-
54	268693	197416		34.3	34.6	35.44	33.14	36.31	34.66	31.88
55	268789	197420		36.2	35.3	33.50	36.93	36.10	33.36	32.39
56	269306	198661		**39.1**	**23**	22.80	22.4	21.70	22.30	21.20
57	269395	199042		15.9	15.4	15.51	15.73	-	-	
58	264052	192884		**41.7**	**33.6**	34.90	**41.7**	32.50	**37.90**	32.50
59	265918	194463	Y	**60.5**	**53.9**	**49.76**	**60.33**	**53.98**	**53.85**	**47.99**
60	265036	192931		**38.7**	**37.1**	35.30	**42.75**	**39.62**	35.74	35.71
61	264959	192878		**38.2**	**38.0**	**38.24**	**40.21**	**38.82**	**40.07**	36.45
62	266698	195335		**38.4**	29.0	17.82	26.83	-	-	
63	262675	192775	Y	35.4	**21.6**	22.00	25.9	23.20	21.80	22.10
64	262719	192840	Y	**65.1**	**42.4**	**40.10**	**44.9**	**39.01**	**40.50**	**38.90**
65	262735	192855	Y	**37.1**	27.0	26.47	29.59	25.49	24.69	22.92
66	262802	192829	Y	**44.3**	32.8	30.98	36.04	30.52	31.62	29.11
67	265903	193683	Y	**69.3**	**38.2**	**39.80**	**46.3**	**39.40**	35.40	36.20
68	265573	193432		**42.0**	34.4	34.64	**41.51**	**39.26**	**39.68**	35.72
69	265543	193450		**60.8**	**42.1**	**43.60**	**50.9**	**40.80**	**42.30**	36.70
70	266649	195435		**38.1**	23.3	22.90	25.7	24.40	24.30	24.30
71	266514	195485		**41.8**	19.9	19.80	20.9	20.10	23.40	29.00
72	264091	192900		-	25.1	23.86	31.40	25.52	25.53	24.91
73	264138	192868		-	34.0	34.62	35.36	33.17	33.09	28.81
74	264163	192853		-	28.9	28.76	32.85	28.19	29.01	26.65
75	264072	192869		-	35.1	**42.09**	**45.19**	**42.01**	**41.09**	**38.41**
76	263968	192880		-	26.1	26.30	31.70	27.01	27.86	27.76
77	263856	192931		-	22.8	23.14	26.89	-	-	-
78	263819	192948		-	27.5	27.83	33.17	29.09	29.80	27.88
79	263842	192896		-	33.0	33.95	**37.13**	36.77	31.84	31.04
80	263558	192833		-	24.8	24.34	26.53	-	-	-
81	262940	192775	Y	-	23.3	23.30	27.79	-	-	-
82	262851	192805	Y	-	26.0	24.60	28.32	25.56	-	-
83	262785	192838	Y	-	29.8	28.60	35.51	30.58	30.36	30.33
84	262714	192839	Y	-	**37.3**	**37.57**	**39.42**	36.44	36.82	32.73
85	262702	192847	Y	-	**38.6**	**39.58**	**41.89**	**38.05**	**39.19**	36.24
86	262704	192865	Y	-	30.8	28.90	33.25	27.94	29.33	28.18
87	262697	192798	Y	-	21.3	21.16	23.93	22.23	22.26	22.11
88	262605	192916	Y	-	**37.3**	35.21	**38.27**	32.19	33.63	30.73
89	262587	192956	Y	-	22.4	24.17	25.99	23.12	22.37	21.26
90	262631	192996	Y	-	34.2	35.74	**37.93**	34.43	32.77	33.29
91	262534	192950	Y	-	31.7	30.62	**37.50**	32.73	30.20	30.68
92	262545	192869	Y	-	32.0	34.62	33.7	28.70	26.10	27.10
93	263406	195534		-	29.9	30.94	33.38	31.39	27.27	29.25
94	263444	195572		-	29.6	31.05	30.34	29.38	28.63	28.26
95	262815	196090		-	29.1	28.88	34.29	28.64	26.57	25.85
96	262922	195950		-	27.9	28.99	31.05	29.46	25.87	27.50
97	262946	195902	Y	-	36.6	33.84	**39.95**	35.00	34.78	32.92
98	263142	195548	Y	-	**40.5**	**40.62**	**41.01**	**37.29**	36.92	36.67
99	263387	195332	Y	-	32.5	29.16	**37.64**	30.58	30.27	31.83
100	263470	195250	Y	-	28.7	28.13	31.78	26.06	27.97	27.43
101	263843	195047	Y	-	29.8	28.27	30.97	27.26	27.17	25.34
102	266379	193307		-	29.4	29.99	33.13	29.54	29.66	28.70

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (μg / m³) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
103	268526	197359		-	33.4	31.06	35.11	32.42	29.46	29.12
104	268538	197389		-	29.4	28.41	31.70	28.55	28.24	27.86
105	268562	197472		-	32.3	30.11	30.33	28.90	29.24	27.96
106	268496	197476		-	33.8	33.64	34.66	33.38	29.44	29.18
107	268765	197420		-	35.0	34.27	36.16	33.53	33.99	31.01
108	267608	199461		-	31.4	30.10	35.76	30.58	29.46	29.75
109	267510	199487		-	28.1	27.06	32.44	25.12	25.85	27.14
110	267369	199521		-	27.7	26.18	30.46	26.34	28.57	26.66
111	267705	199426		-	32.9	30.63	34.62	28.70	30.38	29.40
112	264868	192814		-	26.0	26.20	30.3	27.90	28.10	27.30
113	264654	192662		-	21.8	28.76	36.16	31.18	30.42	28.79
114	264622	192971		-	32.5	33.19	33.92	29.99	29.07	29.70
115	265031	193097		-	**38.8**	**40.48**	**45.67**	**41.44**	**41.89**	**37.57**
116	265192	193138		-	**41.5**	**42.87**	**48.73**	**41.92**	**41.49**	**38.43**
117	265288	193211		-	**39.4**	**38.32**	**47.27**	**39.71**	**39.32**	36.61
118	265483	193385		-	29.3	32.02	**38.58**	32.96	31.76	29.18
119	265522	193390		-	32.2	35.43	**40.81**	36.56	31.75	32.51
120	265570	193366		-	**46.5**	**44.16**	**57.75**	**51.29**	**44.81**	**44.94**
121	265706	193662	Y	-	**79.3**	**61.19**	**52.33**	**52.71**	**50.97**	**50.57**
122	265694	193505		-	**39.5**	**37.21**	**47.39**	**37.12**	34.42	32.49
123	265655	193423		-	**54.4**	**51.27**	**51.80**	**50.96**	**48.75**	**46.55**
124	265651	193253		-	**44.1**	**46.68**	**51.72**	**45.58**	**41.93**	36.50
125	265641	193162		-	**51.4**	**59.48**	**50.5**	**42.10**	**41.80**	36.20
126	265475	193144		-	**38.9**	**48.41**	**62.03**	**41.96**	**41.64**	**40.71**
127	265348	193110		-	**40.9**	**37.71**	**61.83**	**56.19**	**48.72**	**45.01**
128	265297	193085		-	**41.1**	**42.82**	**51.71**	**42.37**	**43.18**	**40.36**
129	265153	193098		-	36.1	35.34	**40.51**	35.42	34.74	36.50
130	265139	192912		-	**53.5**	**42.92**	**43.92**	**43.32**	**42.05**	**41.29**
131	265137	192846		-	**58.3**	**46.69**	**50.19**	**46.62**	**45.86**	**44.33**
132	265229	192753		-	32.7	32.39	**39.43**	36.82	34.97	33.81
133	265350	192566		-	26.8	27.05	33.15	30.34	21.46	26.57
134	265113	192903		-	**50.5**	**45.02**	**47.74**	**49.41**	**45.67**	**44.54**
135	262605	192916	Y	-	-	-	35.60	29.29	27.71	30.78
136	262612	192995	Y	-	-	-	33.32	28.09	27.59	28.71
137	262631	192996	Y	-	-	-	**37.13**	34.46	32.39	32.17
138	266779	199246		-	-	-	26.22	24.16	22.58	22.47
139	266867	199030		-	-	-	31.87	28.29	27.75	28.04
140	266863	199009		-	-	-	**39.36**	35.01	33.92	33.43
141	266979	198772		-	-	-	30.00	28.55	26.27	27.05
142	267017	198710		-	-	-	33.45	30.65	28.80	27.07
143	267089	198608		-	-	-	**37.32**	32.94	31.52	29.77
144	267141	198591		-	-	-	30.26	27.30	27.80	27.71
145	267139	198578		-	-	-	33.83	33.47	30.31	28.77
146	267156	198571		-	-	-	35.76	34.62	33.13	29.10
147	267165	198580		-	-	-	32.97	28.21	28.97	32.24
148	267170	198564		-	-	-	33.86	31.33	29.82	31.46
149	267204	198561		-	-	-	31.17	27.11	26.36	26.77
150	267205	198545		-	-	-	31.42	29.50	28.45	28.45
151	267192	198518		-	-	-	30.92	27.01	27.14	28.18
152	267081	198268		-	-	-	29.60	-	-	-
153	268845	201137		-	-	-	28.20	-	-	-

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g/m^3$) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
154	268870	201267		-	-	-	27.98	-	-	-
155	269009	201280		-	-	-	30.76	28.36	30.05	28.11
156	269059	201296		-	-	-	31.79	29.51	29.16	28.29
157	269173	201355		-	-	-	28.79	-	-	-
158	269480	201441		-	-	-	30.89	28.37	29.24	27.30
159	269171	201620		-	-	-	31.63	30.26	29.42	27.56
160	269049	201744		-	-	-	34.94	34.35	34.73	32.80
161	268938	201929		-	-	-	19.77	-	-	-
162	259553	203379		-	-	-	31.59	26.12	28.89	28.84
163	259287	203556		-	-	-	27.11	22.72	22.48	24.82
164	259195	203667		-	-	-	31.90	28.99	28.70	28.52
165	259149	203675		-	-	-	24.52	23.86	20.70	22.16
166	259148	203690		-	-	-	28.89	23.99	24.26	23.40
167	259126	203700		-	-	-	25.73	23.83	23.16	23.59
168	259115	203705		-	-	-	23.26	22.49	21.74	22.72
169	259013	203747		-	-	-	24.97	26.06	21.04	21.12
170	258971	203797		-	-	-	19.95	18.43	17.57	16.24
171	258917	203826		-	-	-	28.08	28.14	24.14	22.48
172	258887	203859		-	-	-	26.00	28.36	26.56	23.04
173	259250	203708		-	-	-	20.96	19.35	19.58	17.96
174	259253	203660		-	-	-	19.60	16.46	16.57	15.00
175	259251	203638		-	-	-	18.05	20.68	15.11	15.54
176	258872	203691		-	-	-	15.00	12.98	12.67	14.85
177	258896	203697		-	-	-	14.87	13.29	14.14	12.93
178	258986	203684		-	-	-	14.94	14.74	12.85	12.59
179	259059	197831		-	-	-	29.13	-	-	-
180	259064	197781		-	-	-	32.43	32.49	31.00	30.35
181	259010	197817		-	-	-	27.49	-	-	-
182	259050	197790		-	-	-	30.96	29.37	27.58	28.15
183	259036	197795		-	-	-	34.37	32.08	31.04	30.34
184	259014	197797		-	-	-	28.82	-	-	-
185	258919	197820		-	-	-	26.46	-	-	-
186	258711	197868		-	-	-	23.64	-	-	-
187	258206	198239		-	-	-	18.28	-	-	-
188	258197	198219		-	-	-	17.15	-	-	-
189	258270	198257		-	-	-	16.79	-	-	-
190	258260	198237		-	-	-	17.17	-	-	-
191	258338	198270		-	-	-	17.45	-	-	-
192	257422	198542		-	-	-	16.02	-	-	-
193	257371	198522		-	-	-	21.34	-	-	-
194	257958	198581		-	-	-	19.41	-	-	-
195	257972	198563		-	-	-	26.32	-	-	-
196	258046	198558		-	-	-	22.61	-	-	-
197	258797	198701		-	-	-	**38.71**	33.73	35.24	32.92
198	258811	198701		-	-	-	**38.49**	36.97	36.45	35.17
199	254703	195764		-	-	-	34.16	29.05	29.53	29.20
200	254582	195821		-	-	-	27.71	-	-	-
201	254522	195859		-	-	-	30.47	28.39	28.60	26.31
202	254437	195879		-	-	-	23.13	-	-	-
203	254294	195885		-	-	-	25.57	-	-	-
204	253777	195926		-	-	-	18.53	-	-	-

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g / m^3$) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
205	253758	195939		-	-	-	22.91	-	-	-
206	261565	188211		-	-	-	**51.37**	**47.05**	**45.60**	**41.55**
207	261561	188222		-	-	-	**45.70**	34.51	**41.17**	33.84
208	261541	188215		-	-	-	**46.18**	**37.59**	**37.48**	36.56
209	261534	188198		-	-	-	**46.87**	**44.72**	**39.40**	**41.00**
210	261516	188207		-	-	-	**43.61**	31.66	34.47	33.58
211	261501	188188		-	-	-	**39.49**	34.34	35.45	33.17
212	261486	188200		-	-	-	27.40	27.04	27.18	25.63
213	261490	188186		-	-	-	**40.24**	**37.79**	35.09	33.37
214	261315	188193		-	-	-	30.17	25.36	25.39	26.77
215	261299	188191		-	-	-	28.61	22.93	23.66	23.55
216	261276	188190		-	-	-	30.74	25.94	26.07	26.38
217	260357	188240		-	-	-	20.60	-	-	-
218	260384	188206		-	-	-	29.64	-	-	-
219	260419	188172		-	-	-	24.64	-	-	-
220	261194	188163		-	-	-	22.70	-	-	-
221	260454	188171		-	-	-	21.22	-	-	-
222	260469	188182		-	-	-	24.74	-	-	-
223	266899	197354		-	-	-	25.61	-	-	-
224	266881	197389		-	-	-	26.85	-	-	-
225	266861	197432		-	-	-	27.53	-	-	-
226	266829	197472		-	-	-	27.33	-	-	-
227	266836	197484		-	-	-	25.70	-	-	-
228	266779	197578		-	-	-	24.43	-	-	-
229	266772	197621		-	-	-	22.56	-	-	-
230	266777	197651		-	-	-	26.39	-	-	-
231	268802	197666		-	-	-	23.96	-	-	-
232	266825	197654		-	-	-	27.63	-	-	-
233	266823	197668		-	-	-	26.07	-	-	-
234	266858	197671		-	-	-	24.15	-	-	-
235	266874	197657		-	-	-	26.97	-	-	-
236	266886	197658		-	-	-	29.39	-	-	-
237	266885	197676		-	-	-	25.90	-	-	-
238	266902	197660		-	-	-	36.38	32.78	33.13	29.82
239	266181	196022		-	-	-	**37.70**	33.64	31.18	30.10
240	266169	195995		-	-	-	**40.14**	36.36	34.40	32.87
241	266159	196013		-	-	-	36.92	31.39	33.21	31.60
242	265655	193423		-	-	-	**45.21**	**46.01**	**44.28**	**41.47**
243	265474	194949		-	-	-	**41.64**	33.82	**37.40**	35.86
244	265466	194930	Y	-	-	-	**47.92**	**38.33**	**43.78**	**40.14**
245	265448	194922	Y	-	-	-	**49.14**	**41.03**	**41.93**	**39.87**
246	265425	194927		-	-	-	33.12	26.92	28.67	26.68
247	265394	194899	Y	-	-	-	**39.76**	35.47	29.76	32.88
248	265342	194894		-	-	-	31.71	25.22	27.35	27.71
249	265326	194871	Y	-	-	-	**40.58**	33.94	34.74	31.91
250	265274	194867		-	-	-	32.99	28.20	27.17	27.45
251	265263	194845	Y	-	-	-	**38.17**	30.76	31.94	33.95
252	265226	194830	Y	-	-	-	33.69	31.94	30.52	29.36
253	265194	194833		-	-	-	29.98	24.59	25.10	23.76
254	265142	194816		-	-	-	30.41	23.45	25.48	24.55
255	265098	194825		-	-	-	29.09	24.86	21.69	24.37

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations ($\mu g/m^3$) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
256	264995	194777		-	-	-	**45.60**	**39.81**	**40.14**	**37.41**
257	254817	189135		-	-	-	21.32	-	-	-
258	254906	189110		-	-	-	31.14	26.30	28.30	26.12
259	254949	189113		-	-	-	20.10	-	-	-
260	254970	189116		-	-	-	19.06	-	-	-
261	254991	189115		-	-	-	22.75	-	-	-
262	255056	189118		-	-	-	12.93	-	-	-
263	262444	193447		-	-	-	20.38	-	-	-
264	262251	193293		-	-	-	18.44	-	-	-
265	266375	198023		-	-	-	33.26	31.81	29.04	27.65
266	266380	198043		-	-	-	23.98	-	-	
267	266382	198028		-	-	-	32.14	30.76	28.27	28.08
268	266419	198053		-	-	-	31.05	29.00	25.78	26.12
269	266458	198111		-	-	-	27.34	-	-	-
270	266896	198084		-	-	-	27.21	-	-	-
271	266879	198078		-	-	-	35.52	32.38	30.44	28.24
272	266888	198074		-	-	-	36.22	28.91	32.56	30.54
273	267060	198234		-	-	-	31.92	-	-	-
274	269487	201451		-	-	-	25.97	-	-	-
275	265658	194856	Y	-	-	-	-	26.00	25.20	24.50
276	265610	194871	Y	-	-	-	-	36.03	32.51	34.16
277	265596	194875	Y	-	-	-	-	**37.05**	**39.35**	34.23
278	265573	194882	Y	-	-	-	-	**39.11**	34.70	35.86
279	265555	194926	Y	-	-	-	-	**50.24**	**55.51**	**47.59**
280	265542	194980	Y	-	-	-	-	**37.90**	**40.80**	**39.60**
281	265542	194872	Y	-	-	-	-	36.00	36.70	36.50
282	265540	194840	Y	-	-	-	-	33.80	35.70	32.20
283	265436	195937		-	-	-	-	30.35	31.51	29.20
284	265452	195899		-	-	-	-	33.28	32.62	32.49
285	266955	197415		-	-	-	-	**37.51**	33.41	34.23
286	266938	197377		-	-	-	-	36.68	34.27	31.77
287	265715	193902	Y	-	-	-	-	30.76	29.72	31.87
288	265698	193878	Y	-	-	-	-	33.38	32.86	32.29
289	265702	193842	Y	-	-	-	-	**37.33**	35.86	34.15
290	263014	195737	Y	-	-	-	-	27.86	27.88	29.08
291	267952	193121		-	-	-	-	**41.79**	**45.22**	**43.73**
292	263833	196108		-	-	-	-	**-**	17.86	17.19
293	262302	196688		-	-	-	-	**-**	18.26	21.99
294	262342	196742		-	-	-	-	**-**	25.18	25.26
295	258998	198698		-	-	-	-	**-**	29.33	29.80
296	259054	198679		-	-	-	-	**-**	31.61	35.06
297	258957	198628		-	-	-	-	**-**	-	18.67
298	258985	198613		-	-	-	-	**-**	-	21.21
299	259010	198619		-	-	-	-	**-**	-	18.69
300	259043	198602		-	-	-	-	**-**	-	19.77
301	259054	198611		-	-	-	-	**-**	-	22.23
302	259088	198603		-	-	-	-	**-**	-	-
303	259107	198582		-	-	-	-	**-**	-	22.22
304	259170	198554		-	-	-	-	**-**	-	20.44
305	259183	198561		-	-	-	-	**-**	-	20.11
306	259217	198544		-	-	-	-	**-**	-	20.80
307	259267	198520		-	-	-	-	**-**	-	21.82
308	259294	198507		-	-	-	-	**-**	-	20.34

Site ID	X Coordinate	Y Coordinate	Within AQMA?	Annual mean concentrations (µg / m³) Adjusted for bias						
				2007	2008	2009	2010	2011	2012	2013
309	259325	198492		-	-	-	-	-	-	20.92
310	259338	198486		-	-	-	-	-	-	19.61
311	259326	198479		-	-	-	-	-	-	20.97
312	259313	198486		-	-	-	-	-	-	21.12
313	259295	198495		-	-	-	-	-	-	20.45
314	259268	198508		-	-	-	-	-	-	20.29
315	259219	198529		-	-	-	-	-	-	20.11
316	259208	198504		-	-	-	-	-	-	20.94
317	259216	198496		-	-	-	-	-	-	20.45
318	259194	198450		-	-	-	-	-	-	18.52
319	259178	198442		-	-	-	-	-	-	19.05
320	259096	198241		-	-	-	-	-	-	18.69
321	259036	198246		-	-	-	-	-	-	19.42
322	259007	198241		-	-	-	-	-	-	17.89
323	266765	193224		-	-	-	-	-	-	32.16

Table 10 – NO_2 Annual Mean concentrations 2007- 2013

LAQM.TG (09) provides a method within box 2.1 page 2-4 to project measured annual mean roadside nitrogen dioxide concentrations to future years. The supporting adjustment factor table was updated during January 2012 in view of the release of updated vehicle emission factors and is obtainable from http://laqm.defra.gov.uk/documents/Is_the_example_in_Box_2.1_TG09_correct.pdf

It is noted that in addition to the above, from http://laqm.defra.gov.uk/whatsnew.html that DEFRA have produced another update to the previously revised future year projection guidance by way of a further note entitled “Note on Projecting NO2 concentrations” [22] dated April 2012. This note sets out additional alternative methods to project measured NO_2 concentrations to future years. As a result, this authority is considering the implications raised with some of the alternative methods mentioned within this note but have decided to undertake within this Progress Report the more simplistic revised approach detailed within section 2.4. This alternative projection method assumes an average national reduction trend in NO_2 concentrations of 0.68% per year at roadside stations and 0.87% reduction per year at background stations. The adjustment factors presented within table 2 of the April 2012 update are presented as the UK averages of the site classifications i.e. roadside. This newly adopted method allows the comparison of the LAQM.TG(09) revised guidance future year projections issued during January 2010 to the additional revised note dated April

[22] http://laqm.defra.gov.uk/review-and-assessment/modelling.html#ProjectingNO2Note and http://laqm.defra.gov.uk/documents/BureauVeritas_NO2Projections_2766_Final-30_04_2012.pdf

2012. This method produces a range of predicted future year concentrations as to where the NO_2 concentration is likely to lie. Using a combination of these methods the full range of future year projections are presented within table 11 below.

Site ID	Within AQMA ?	Future Years Projections – Rounded to nearest whole number in ug/m^3 Left cell (white) = LAQM.TG(09) method Right cell (shaded) = Revised method dated April 2012															
		2014		2015		2016		2017		2018		2019		2020		2025	
1		23	24	22	24	21	24	20	24	18	24	17	23	16	23	13	-
4	Y	29	30	27	30	26	29	24	29	22	29	21	29	19	29	16	-
5	Y	33	35	32	34	30	34	28	34	26	34	24	33	22	33	18	-
6	Y	29	30	28	30	26	30	25	30	23	30	21	29	20	29	16	-
7	Y	45	46	42	46	40	46	38	45	35	45	33	45	30	45	25	-
8	Y	43	44	41	44	38	44	36	44	34	43	31	43	29	43	24	-
9		29	30	27	30	26	29	24	29	23	29	21	29	19	29	16	-
10	Y	24	25	23	25	22	25	20	25	19	24	18	24	16	24	13	-
11	Y	38	39	36	39	34	39	32	38	30	38	28	38	25	38	21	-
12	Y	38	40	37	40	34	39	32	39	30	39	28	39	26	38	21	-
13		28	29	27	29	25	29	24	29	22	28	20	28	19	28	16	-
14		27	28	26	28	25	28	23	28	22	28	20	28	18	27	15	-
15		26	27	24	27	23	26	22	26	20	26	19	26	17	26	14	-
16		30	31	29	31	27	31	25	31	24	31	22	30	20	30	17	-
18	Y	45	47	43	46	40	46	38	46	35	45	33	45	30	45	25	-
19	Y	42	43	40	43	37	43	35	43	33	42	31	42	28	42	23	-
20	Y	35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
21	Y	29	30	27	30	26	29	24	29	23	29	21	29	19	29	16	-
22	Y	32	34	31	33	29	33	27	33	25	33	24	33	22	32	18	-
23	Y	30	31	28	31	26	30	25	30	23	30	22	30	20	29	16	-
25	Y	27	28	25	28	24	27	22	27	21	27	19	27	18	27	15	-
26	Y	37	39	36	39	33	38	31	38	29	38	27	38	25	37	21	-
27	Y	36	38	35	38	33	37	31	37	29	37	27	37	24	36	20	-
28	Y	27	28	26	28	24	28	23	28	21	27	20	27	18	27	15	-
29	Y	42	44	40	43	38	43	35	43	33	42	31	42	28	42	23	-
31		29	31	28	30	26	30	25	30	23	30	21	30	20	29	16	-
32		34	35	32	35	30	35	28	34	26	34	25	34	23	34	19	-
33		30	31	28	31	27	30	25	30	23	30	22	30	20	30	17	-
34		30	31	28	31	27	30	25	30	23	30	22	30	20	30	17	-
35		30	31	28	31	27	31	25	30	23	30	22	30	20	30	17	-
36		29	30	27	30	26	30	24	29	23	29	21	29	19	29	16	-
38		32	33	31	33	29	33	27	33	25	32	23	32	22	32	18	-
40		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
41		35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
43		37	38	35	38	33	38	31	38	29	37	27	37	25	37	21	-
44		25	26	23	25	22	25	21	25	19	25	18	25	17	25	14	-
45		31	32	29	32	27	31	26	31	24	31	22	31	21	31	17	-
48		22	23	21	23	20	23	19	23	18	23	16	22	15	22	12	-
49		26	28	25	27	24	27	22	27	21	27	19	27	18	26	15	-
50		31	33	30	32	28	32	26	32	25	32	23	32	21	31	17	-
51		27	28	25	28	24	27	22	27	21	27	19	27	18	27	15	-
54		30	32	29	31	27	31	26	31	24	31	22	31	21	30	17	-
55		31	32	29	32	28	32	26	32	24	31	23	31	21	31	17	-
56		20	21	19	21	18	21	17	21	16	20	15	20	14	20	11	-
58		31	32	30	32	28	32	26	32	24	31	23	31	21	31	17	-
59	Y	46	48	44	47	41	47	39	47	36	46	33	46	31	46	25	-
60		34	35	32	35	31	35	29	35	27	35	25	34	23	34	19	-
61		35	36	33	36	31	36	29	35	27	35	25	35	23	35	19	-
63	Y	21	22	20	22	19	22	18	21	17	21	15	21	14	21	12	-
64	Y	37	39	35	38	33	38	31	38	29	38	27	37	25	37	21	-
65	Y	22	23	21	23	20	22	18	22	17	22	16	22	15	22	12	-
66	Y	28	29	26	29	25	29	23	28	22	28	20	28	19	28	15	-
67	Y	35	36	33	36	31	35	29	35	27	35	25	35	23	35	19	-
68		34	35	32	35	31	35	29	35	27	35	25	34	23	34	19	-
69		35	36	33	36	31	36	29	36	28	35	26	35	24	35	19	-
70		23	24	22	24	21	24	20	24	18	23	17	23	16	23	13	-

Site ID	Within AQMA ?	Future Years Projections – Rounded to nearest whole number in ug/m^3 Left cell (white) = LAQM.TG(09) method Right cell (shaded) = Revised method dated April 2012															
		2014		2015		2016		2017		2018		2019		2020		2025	
71		28	29	26	29	25	28	23	28	22	28	20	28	19	28	15	-
72		24	25	23	25	21	24	20	24	19	24	17	24	16	24	13	-
73		27	29	26	28	25	28	23	28	22	28	20	28	19	27	15	-
74		25	26	24	26	23	26	21	26	20	26	19	26	17	25	14	-
75		37	38	35	38	33	38	31	37	29	37	27	37	25	37	20	-
76		26	28	25	27	24	27	22	27	21	27	19	27	18	26	15	-
78		27	28	25	28	24	27	22	27	21	27	19	27	18	27	15	-
79		30	31	28	31	27	30	25	30	23	30	22	30	20	30	16	-
83	Y	29	30	28	30	26	30	24	30	23	29	21	29	20	29	16	-
84	Y	31	32	30	32	28	32	26	32	25	32	23	31	21	31	17	-
85	Y	35	36	33	36	31	36	29	35	27	35	25	35	23	35	19	-
86	Y	27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
87	Y	21	22	20	22	19	22	18	22	17	21	15	21	14	21	12	-
88	Y	29	31	28	30	26	30	25	30	23	30	21	30	20	29	16	-
89	Y	20	21	19	21	18	21	17	21	16	21	15	20	14	20	11	-
90	Y	32	33	30	33	28	33	27	32	25	32	23	32	21	32	18	-
91	Y	29	30	28	30	26	30	25	30	23	30	21	29	20	29	16	-
92	Y	26	27	25	27	23	27	22	26	20	26	19	26	17	26	14	-
93		28	29	27	29	25	29	23	28	22	28	20	28	19	28	16	-
94		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
95		25	26	23	25	22	25	21	25	19	25	18	25	17	25	14	-
96		26	27	25	27	24	27	22	27	21	27	19	26	18	26	15	-
97	Y	31	33	30	32	28	32	26	32	25	32	23	32	21	31	17	-
98	Y	35	36	33	36	31	36	29	36	27	35	26	35	24	35	19	-
99	Y	30	32	29	31	27	31	26	31	24	31	22	31	20	30	17	-
100	Y	26	27	25	27	23	27	22	27	21	27	19	26	18	26	15	-
101	Y	24	25	23	25	22	25	20	25	19	24	18	24	16	24	13	-
102		27	28	26	28	25	28	23	28	22	28	20	28	18	27	15	-
103		28	29	26	29	25	29	23	28	22	28	20	28	19	28	15	-
104		27	28	25	27	24	27	22	27	21	27	19	27	18	27	15	-
105		27	28	25	28	24	27	22	27	21	27	19	27	18	27	15	-
106		28	29	27	29	25	29	23	28	22	28	20	28	19	28	16	-
107		30	31	28	31	27	30	25	30	23	30	22	30	20	30	16	-
108		28	30	27	29	25	29	24	29	22	29	21	29	19	28	16	-
109		26	27	25	27	23	27	22	26	20	26	19	26	17	26	14	-
110		25	26	24	26	23	26	21	26	20	26	19	26	17	25	14	-
111		28	29	27	29	25	29	24	29	22	28	21	28	19	28	16	-
112		26	27	25	27	23	27	22	27	20	26	19	26	18	26	15	-
113		27	29	26	28	25	28	23	28	22	28	20	28	19	27	15	-
114		28	29	27	29	25	29	24	29	22	29	21	29	19	28	16	-
115		36	37	34	37	32	37	30	37	28	36	26	36	24	36	20	-
116		37	38	35	38	33	38	31	37	29	37	27	37	25	37	20	-
117		35	36	33	36	31	36	29	36	27	35	26	35	24	35	19	-
118		28	29	27	29	25	29	23	28	22	28	20	28	19	28	16	-
119		31	32	30	32	28	32	26	32	24	31	23	31	21	31	17	-
120		43	45	41	44	38	44	36	44	34	43	31	43	29	43	24	-
121	Y	48	50	46	50	43	50	41	49	38	49	35	49	33	48	27	-
122		31	32	30	32	28	32	26	32	24	31	23	31	21	31	17	-
123		44	46	42	46	40	46	37	45	35	45	32	45	30	44	25	-
124		35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
125		35	36	33	36	31	35	29	35	27	35	25	35	23	35	19	-
126		39	40	37	40	35	40	33	40	31	39	28	39	26	39	22	-
127		43	45	41	44	39	44	36	44	34	44	31	43	29	43	24	-
128		39	40	37	40	35	40	32	39	30	39	28	39	26	38	21	-
129		35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
130		39	41	38	41	35	40	33	40	31	40	29	40	27	39	22	-

Site ID	Within AQMA ?	Future Years Projections – Rounded to nearest whole number in ug/m^3 Left cell (white) = LAQM.TG(09) method Right cell (shaded) = Revised method dated April 2012															
		2014		2015		2016		2017		2018		2019		2020		2025	
131		42	44	40	44	38	43	36	43	33	43	31	43	29	42	24	-
132		32	34	31	33	29	33	27	33	25	33	24	32	22	32	18	-
133		25	26	24	26	23	26	21	26	20	26	19	26	17	25	14	-
134		43	44	40	44	38	44	36	43	33	43	31	43	29	42	24	-
135	Y	29	31	28	30	26	30	25	30	23	30	21	30	20	29	16	-
136	Y	27	28	26	28	25	28	23	28	22	28	20	28	18	27	15	-
137	Y	31	32	29	32	28	32	26	31	24	31	22	31	21	31	17	-
138		21	22	20	22	19	22	18	22	17	22	16	22	14	21	12	-
139		27	28	25	28	24	27	23	27	21	27	20	27	18	27	15	-
140		32	33	30	33	29	33	27	33	25	32	23	32	22	32	18	-
141		26	27	25	27	23	27	22	26	20	26	19	26	17	26	14	-
142		26	27	25	27	23	27	22	26	20	26	19	26	17	26	14	-
143		28	30	27	29	25	29	24	29	22	29	21	29	19	28	16	-
144		26	28	25	27	24	27	22	27	21	27	19	27	18	26	15	-
145		27	29	26	28	25	28	23	28	22	28	20	28	19	27	15	-
146		28	29	26	29	25	29	23	28	22	28	20	28	19	28	15	-
147		31	32	29	32	28	32	26	31	24	31	22	31	21	31	17	-
148		30	31	29	31	27	31	25	31	24	30	22	30	20	30	17	-
149		26	27	24	26	23	26	21	26	20	26	19	26	17	26	14	-
150		27	28	26	28	24	28	23	28	21	27	20	27	18	27	15	-
151		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
155		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
156		27	28	26	28	24	28	23	28	21	27	20	27	18	27	15	-
158		26	27	25	27	23	27	22	27	20	26	19	26	18	26	15	-
159		26	27	25	27	24	27	22	27	21	27	19	26	18	26	15	-
160		31	33	30	32	28	32	26	32	25	32	23	31	21	31	17	-
162		28	29	26	28	25	28	23	28	22	28	20	28	19	28	15	-
163		24	25	23	24	21	24	20	24	19	24	17	24	16	24	13	-
164		27	28	26	28	24	28	23	28	21	28	20	27	18	27	15	-
165		21	22	20	22	19	22	18	22	17	21	15	21	14	21	12	-
166		22	23	21	23	20	23	19	23	18	23	16	22	15	22	12	-
167		23	23	21	23	20	23	19	23	18	23	16	23	15	23	13	-
168		22	23	21	22	19	22	18	22	17	22	16	22	15	22	12	-
169		20	21	19	21	18	21	17	21	16	20	15	20	14	20	11	-
170		16	16	15	16	14	16	13	16	12	16	11	16	10	15	9	-
171		21	22	20	22	19	22	18	22	17	22	16	22	14	21	12	-
172		22	23	21	23	20	23	19	22	17	22	16	22	15	22	12	-
173		17	18	16	18	15	18	14	17	13	17	13	17	12	17	10	-
174		14	15	14	15	13	15	12	15	11	14	10	14	10	14	8	-
175		15	15	14	15	13	15	12	15	12	15	11	15	10	15	8	-
176		14	15	13	15	13	15	12	14	11	14	10	14	10	14	8	-
177		12	13	12	13	11	13	10	13	10	13	9	12	8	12	7	-
178		12	12	11	12	11	12	10	12	9	12	9	12	8	12	7	-
180		29	30	28	30	26	30	24	30	23	29	21	29	20	29	16	-
182		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
183		29	30	28	30	26	30	24	30	23	29	21	29	20	29	16	-
197		31	33	30	32	28	32	26	32	25	32	23	32	21	31	17	-
198		34	35	32	35	30	34	28	34	26	34	25	34	23	34	19	-
199		28	29	27	29	25	29	23	28	22	28	20	28	19	28	16	-
201		25	26	24	26	23	26	21	26	20	25	18	25	17	25	14	-
206		40	41	38	41	36	41	33	40	31	40	29	40	27	40	22	-
207		32	34	31	33	29	33	27	33	25	33	24	32	22	32	18	-
208		35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
209		39	41	37	40	35	40	33	40	31	40	29	39	26	39	22	-
210		32	33	31	33	29	33	27	33	25	32	23	32	22	32	18	-
211		32	33	30	33	28	33	27	32	25	32	23	32	21	32	18	-

Site ID	Within AQMA ?	Future Years Projections – Rounded to nearest whole number in ug/m^3 Left cell (white) = LAQM.TG(09) method Right cell (shaded) = Revised method dated April 2012															
		2014		2015		2016		2017		2018		2019		2020		2025	
212		24	25	23	25	22	25	21	25	19	25	18	25	17	24	14	-
213		32	33	30	33	29	33	27	32	25	32	23	32	21	32	18	-
214		26	27	24	26	23	26	21	26	20	26	19	26	17	26	14	-
215		22	23	21	23	20	23	19	23	18	23	16	23	15	22	13	-
216		25	26	24	26	23	26	21	26	20	25	18	25	17	25	14	-
238		28	30	27	29	26	29	24	29	22	29	21	29	19	28	16	-
239		29	30	27	30	26	29	24	29	23	29	21	29	19	29	16	-
240		31	33	30	32	28	32	26	32	25	32	23	32	21	31	17	-
241		30	31	29	31	27	31	25	31	24	31	22	30	20	30	17	-
242		40	41	38	41	35	41	33	40	31	40	29	40	27	40	22	-
243		34	36	33	35	31	35	29	35	27	35	25	34	23	34	19	-
244	Y	38	40	36	40	34	39	32	39	30	39	28	39	26	38	21	-
245	Y	38	40	36	39	34	39	32	39	30	39	28	38	26	38	21	-
246		25	26	24	26	23	26	21	26	20	26	19	26	17	25	14	-
247	Y	31	33	30	32	28	32	26	32	25	32	23	32	21	31	17	-
248		26	28	25	27	24	27	22	27	21	27	19	27	18	26	15	-
249	Y	30	32	29	31	27	31	26	31	24	31	22	31	21	30	17	-
250		26	27	25	27	23	27	22	27	21	27	19	26	18	26	15	-
251	Y	32	34	31	33	29	33	27	33	25	33	24	33	22	32	18	-
252	Y	28	29	27	29	25	29	24	29	22	28	20	28	19	28	16	-
253		23	24	22	23	20	23	19	23	18	23	17	23	15	23	13	-
254		23	24	22	24	21	24	20	24	18	24	17	24	16	23	13	-
255		23	24	22	24	21	24	20	24	18	24	17	23	16	23	13	-
256		36	37	34	37	32	37	30	36	28	36	26	36	24	36	20	-
258		25	26	24	26	22	26	21	25	20	25	18	25	17	25	14	-
265		26	27	25	27	24	27	22	27	21	27	19	27	18	26	15	-
267		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
268		25	26	24	26	22	26	21	25	20	25	18	25	17	25	14	-
271		27	28	26	28	24	28	23	27	21	27	20	27	18	27	15	-
272		29	30	28	30	26	30	25	30	23	30	21	29	20	29	16	-
275	Y	23	24	22	24	21	24	20	24	18	24	17	24	16	23	13	-
276	Y	33	34	31	34	29	33	27	33	26	33	24	33	22	33	18	-
277	Y	33	34	31	34	29	34	27	33	26	33	24	33	22	33	18	-
278	Y	34	36	33	35	31	35	29	35	27	35	25	34	23	34	19	-
279	Y	45	47	43	47	41	47	38	46	36	46	33	46	31	45	25	-
280	Y	38	39	36	39	34	39	32	39	30	38	28	38	25	38	21	-
281	Y	35	36	33	36	31	36	29	36	27	35	25	35	24	35	19	-
282	Y	31	32	29	32	28	32	26	31	24	31	22	31	21	31	17	-
283		28	29	27	29	25	29	23	28	22	28	20	28	19	28	16	-
284		31	32	30	32	28	32	26	32	24	31	23	31	21	31	17	-
285		33	34	31	34	29	34	27	33	26	33	24	33	22	33	18	-
286		30	32	29	31	27	31	26	31	24	31	22	31	20	30	17	-
287	Y	30	32	29	31	27	31	26	31	24	31	22	31	21	30	17	-
288	Y	31	32	29	32	28	32	26	31	24	31	23	31	21	31	17	-
289	Y	33	34	31	34	29	33	27	33	26	33	24	33	22	33	18	-
290	Y	28	29	26	29	25	28	23	28	22	28	20	28	19	28	15	-
291		42	43	40	43	37	43	35	43	33	42	30	42	28	42	23	-
292		16	17	16	17	15	17	14	17	13	17	12	17	11	16	9	-
293		21	22	20	22	19	22	18	21	16	21	15	21	14	21	12	-
294		24	25	23	25	22	25	20	25	19	24	18	24	16	24	13	-
295		28	30	27	29	25	29	24	29	22	29	21	29	19	28	16	-
296		33	35	32	35	30	34	28	34	26	34	24	34	23	33	19	-
297		18	19	17	18	16	18	15	18	14	18	13	18	12	18	10	-
298		20	21	19	21	18	21	17	21	16	21	15	20	14	20	11	-
299		18	19	17	18	16	18	15	18	14	18	13	18	12	18	10	-
298		20	21	19	21	18	21	17	21	16	21	15	20	14	20	11	-

Site ID	Within AQMA ?	Future Years Projections – Rounded to nearest whole number in ug/m^3 Left cell (white) = LAQM.TG(09) method Right cell (shaded) = Revised method dated April 2012															
		2014		2015		2016		2017		2018		2019		2020		2025	
299		18	19	17	18	16	18	15	18	14	18	13	18	12	18	10	-
300		19	20	18	20	17	19	16	19	15	19	14	19	13	19	11	-
301		21	22	20	22	19	22	18	22	17	21	16	21	14	21	12	-
303		21	22	20	22	19	22	18	22	17	21	15	21	14	21	12	-
304		20	20	19	20	17	20	16	20	15	20	14	20	13	19	11	-
305		19	20	18	20	17	20	16	20	15	19	14	19	13	19	11	-
306		20	21	19	21	18	20	17	20	16	20	15	20	13	20	11	-
307		21	22	20	22	19	21	18	21	16	21	15	21	14	21	12	-
308		19	20	18	20	17	20	16	20	15	20	14	20	13	19	11	-
309		20	21	19	21	18	21	17	20	16	20	15	20	13	20	11	-
310		19	19	18	19	17	19	16	19	15	19	14	19	13	19	10	-
311		20	21	19	21	18	21	17	20	16	20	15	20	14	20	11	-
312		20	21	19	21	18	21	17	21	16	20	15	20	14	20	11	-
313		20	20	19	20	17	20	16	20	15	20	14	20	13	20	11	-
314		19	20	18	20	17	20	16	20	15	20	14	19	13	19	11	-
315		19	20	18	20	17	20	16	20	15	19	14	19	13	19	11	-
316		20	21	19	21	18	21	17	20	16	20	15	20	13	20	11	-
317		20	20	19	20	17	20	16	20	15	20	14	20	13	20	11	-
318		18	18	17	18	16	18	15	18	14	18	13	18	12	18	10	-
319		18	19	17	19	16	19	15	19	14	18	13	18	12	18	10	-
320		18	19	17	18	16	18	15	18	14	18	13	18	12	18	10	-
321		19	19	18	19	17	19	16	19	15	19	14	19	13	19	10	-
322		17	18	16	18	15	18	14	17	13	17	12	17	12	17	10	-
323		31	32	29	32	28	32	26	31	24	31	22	31	21	31	17	-

Table 11 – Future Years projections (2014-2020) NO_2 Annual Mean Concentrations

Using both methods to project forwards to 2020 it is clear that whilst the LAQM.TG(09) method indicates full compliance with the annual mean objective being seen during 2018, using the revised April 2012 method, paints a totally different picture, as in 2020, widespread exceedences remain, together with indications that additional numerous sites would still exhibit the potential to exceed the annual mean objective. It is thought that the April 2012 method may well paint a more realistic picture.

Given the above, it is reasonable to assume that widespread exceedences of the nitrogen dioxide annual mean objective will continue to be seen even during 2020.

2.2.4 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[23]. As mentioned previously above, the Morfa Groundhog was decommissioned during early 2011 – historical data is purely included here for information. However, significant issues arrose 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 remains operational at the Morriston Groundhog site until its replacement with a Bam1020 can be funded. However, it has to be said that recently there have been far fewer data quality concerns and data capture concerns with the Morriston FDMS system.

The FDMS unit provides hourly integration data and has 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 unit at Morriston are: Volatile Mass, Non Volatile Mass, External Dew Point, Sample Dew Point, Filter loading, Pressure, Status, External Ambient Air temperature. The control unit refers to these parameters in different terminology. The PM_{10} mass concentration is obtained via post processing of the volatile and non volatile mass parameters by creating a calculated channel within the database to subtract volatile mass from the non volatile mass.

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

[17] 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

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 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 FDMS units and BAM 1020 PM_{10} units have an integration period of 1-hour. Hourly ratified Particulate Matter PM_{10} data for 2013 has been downloaded from the Air Quality Archive at http://uk-air.defra.gov.uk/data/data_selector for the Swansea AURN and via the Welsh Air Quality Forum ratified datasets at http://www.welshairquality.co.uk/data_and_statistics.php for the Morriston Groundhog site. Since the Welsh Assembly Government awarded the contract to run the Welsh Air Quality Forum to AEA Energy and Environment in April 2004, all FDMS equipment on site is fully audited yearly by AEA Energy and Environment. As part of the service and maintenance contract with Enviro Technology Services Plc, each FDMS dryer unit was replaced annually until 2010 but due to budget restraints this has now ceased. Dryer units are now only replaced as and when they fail.

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.[24]

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

[24] *LAQM.TG(09) Annexe 1- Monitoring A1.216 page A1-48*

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 table 12 for information. Similarly, the date of provision of the BAM1020 units at the Swansea AURN is also 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, until now, this had proved impossible to undertake due to the unreliability of the instruments originally deployed on site. As mentioned in chapters 2.1.8 to 2.1.12 above, MetOne EBams have now been deployed at five sites during late 2012. Data for 2013 are now reported here for the first time. It is important to again highlight, that the EBam has not demonstrated equivalency with the EU reference gravimetric method. However, as the intention is only to provide a basic screening assessment, their use is judged to be appropriate.

Site ID (see table 2 above)	Location	Within AQMA	Data Capture 2009 %	Data Capture 2010 %	Data Capture 2011 %	Data Capture 2012 %	Data Capture 2013 %	Annual mean concentrations (µg/m³)				
								2009	2010	2011	2012	2013
1 *	Swansea AURN	Y	97.53	98.63	**62.19**	97.54	96.71	17.19	15.79	14.70	17.79	19.03
2 **	Morfa Groundhog	Y	**54.25**	**65.48**	**-**	-	-	30.41	20.06	-	-	-
3 ***	Morriston Groundhog	N	90.68	**78.36**	**81.64**	90.38	96.99	22.53	18.67	17.96	13.86	15.30
7 ✷	Fforestfach Cross	Y	-	**-**	**-**	-	96.71	-	-	-	-	18.03
8 ✷	Uplands Crescent	N	-	**-**	**-**	-	83.84	-	-	-	-	18.26
9 ✷	Sketty Cross	Y	-	**-**	**-**	-	55.89	-	-	-	-	19.74
10 ✷	Westway Quadrant Bus Station	N	-	**-**	**-**	-	94.79	-	-	-	-	18.91
11 ✷	SA1 Junction Port Tennant	N	-	**-**	**-**	-	95.89	-	-	-	-	17.65

Table 12 Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

** FDMS unit installed 26th September 2006. FDMS units removed 16th November 2011. Met One BAM 1020 unit installed 28th November 2011*

*** FDMS unit installed 28th November 2006. Site decommissioned May 2011*

**** FDMS unit installed 27th October 2006*

✷MetOne EBam

Site ID	Location	Within AQMA	Data Capture 2009 %	Data Capture 2010 %	Data Capture 2011 %	Data Capture 2012 %	Data Capture 2013 %	Number of Exceedences of 24-hour mean (50 µg/m³)				
								2009	2010	2011	2012	2013
1	Swansea AURN	**Y**	97.53	98.63	**62.19**	**97.54**	96.71	4	0	5 **(29.8)**	4	2
2	Morfa Groundhog	**Y**	**54.25**	**65.48**	**-**	**-**	-	14 **(45.1)**	1 **(30.5)**	**-**	**-**	**-**
3	Morriston Groundhog	**N**	90.68	**78.36**	**81.64**	**90.38**	96.99	6	1 **(29.6)**	**8** **(30.3)**	0	0
7	Fforestfach Cross	**Y**	**-**	-	**-**	**-**	96.71	**-**	-	**-**	**-**	2
8	Uplands Crescent	**N**	**-**	-	**-**	**-**	83.84	**-**	-	**-**	**-**	2 ***(28.50)***
9	Sketty Cross	**Y**	**-**	-	**-**	**-**	55.89	**-**	-	**-**	**-**	4 **(34.07)**
10	Westway Quadrant Bus Station	**N**	**-**	-	**-**	**-**	94.79	**-**	-	**-**	**-**	*4*
11	SA1 Junction Port Tennant	**N**	**-**	-	**-**	**-**	95.89	**-**	-	**-**	**-**	*4*

Table 13 Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

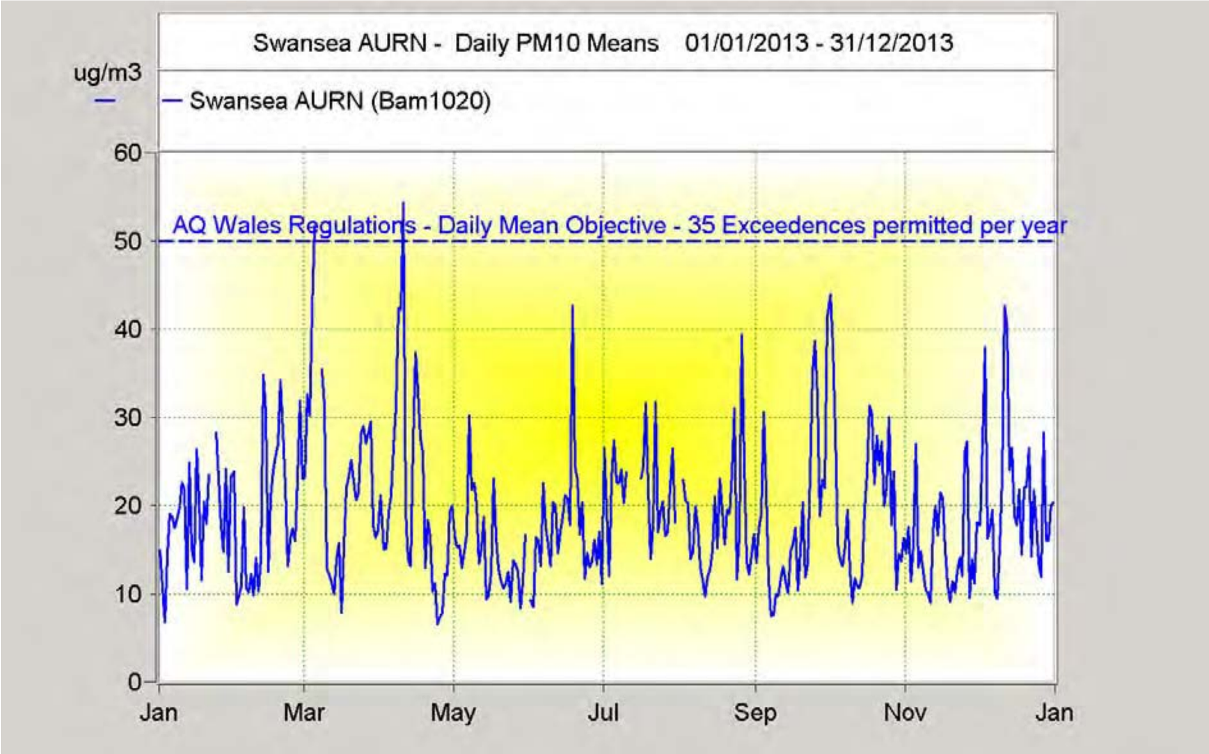
The 90th percentile's of the daily means of measurements made during 2009-2013 are presented in bold within brackets in table 13 where appropriate, as the data capture rates fall below the required 90%[25] due to the problematic FDMS installations at the Swansea AURN and Morriston Groundhog sites. There have been numerous problems since the installation of the Thermo Inc FDMS PM_{10} analysers at all 3 sites during late 2006, resulting in significant periods of data loss. These issues have been both costly and time consuming to rectify. Problems have ranged from the inability to gain a stable frequency response within the tuner board, corruption of the software within the control unit, status error codes due to ice within the chiller unit, to complete sensor unit failures. These issues have extended over the whole period of operation but as the introduction of FDMS units has increased within the UK National AURN Network, additional problems have been identified with their routine operation. Extensive problems existed with the operation of the FDMS units within the Swansea Network as can be seem from the data capture rates above in tables 12 and 13. The volatile data from the Morfa FDMS unit was queried during 2009 and again during 2010 due to very erratic measurements being seen. These data were consistently greater than at the other two FDMS PM_{10} stations within Swansea and therefore the

[25] LAQM TG(09) Annexe A1 – A1.157 page A1-34

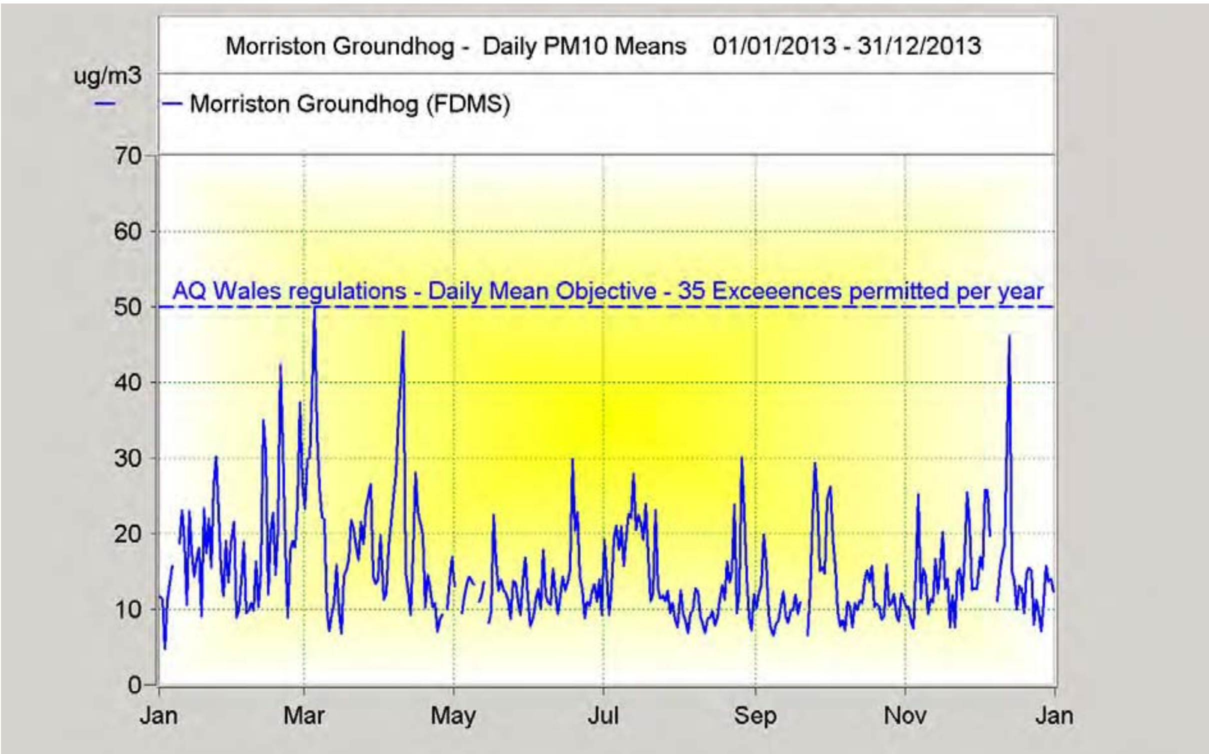
calculated mass concentration being seen was consistently on average 20ug/m^3 above that seen at either the Swansea AURN or Morriston units. This effect can be seen within the annual means reported within table 13 above. No fault could be traced by the service engineers during numerous visits to the site. It was not until the Welsh Air Quality Forum QA/QC audit during March 2010 identified a leak, that the problem was then identified and resolved. This single incident led to data being rejected from the 11th August 2009 to 7th April 2010. Problems continued with the reliability of the FDMS units throughout 2011 with yet more data being rejected resulting in significant data loss – during 2011 the Swansea AURN units (both $PM_{2.5}$ and PM_{10}) saw significant data loss which ultimately drove the decision to replace the units during November 2011 with MetOne BAM1020 units. It remains the intention to replace the FDMS unit at the Morriston Groundhog site once budgets permit.

The loss of data with the MetOne EBam located at Uplands Crescent was due to an external pump failure at the Uplands crescent site and an external temperature/humidity sensor that failed at the Sketty Cross site which compromised the data.

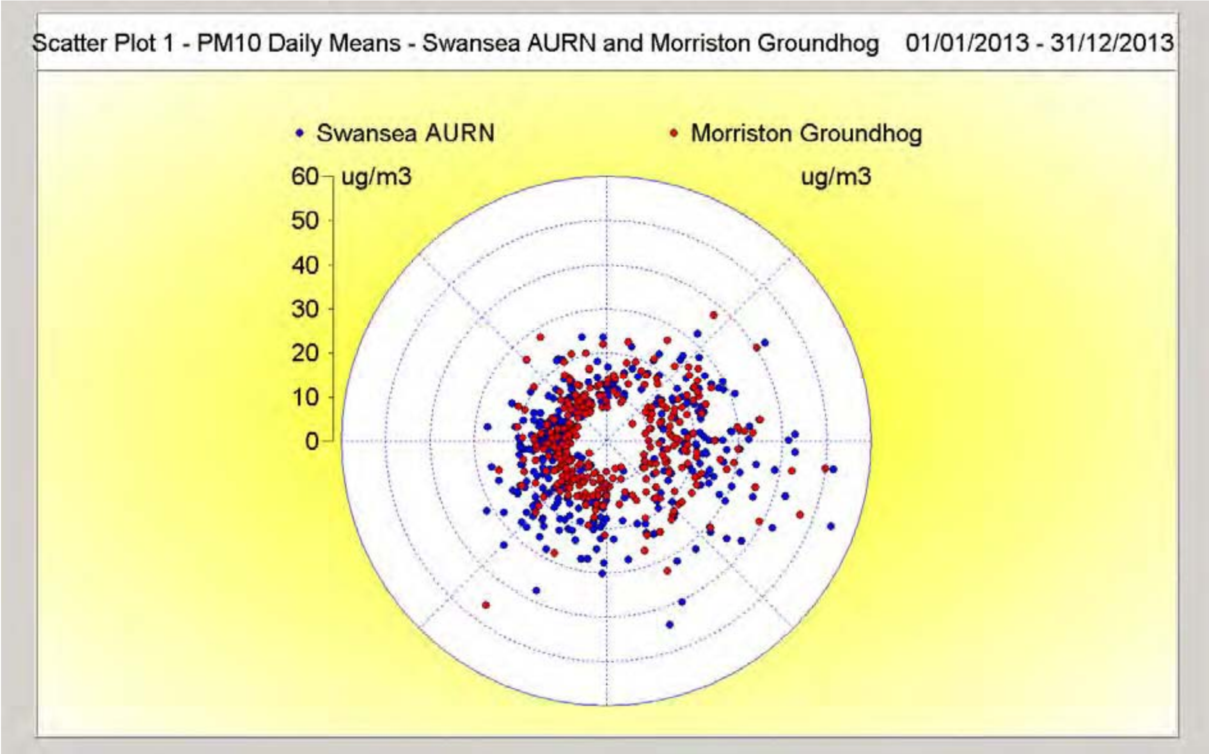
Graphs 6 -12 below indicate the monitoring undertaken during 2013 with scatter plot 1 summarising the period of measurement for the Swansea AURN and Morriston Groundhog sites.



Graph 6 – Swansea AURN 24-hour PM_{10} concentrations 2013

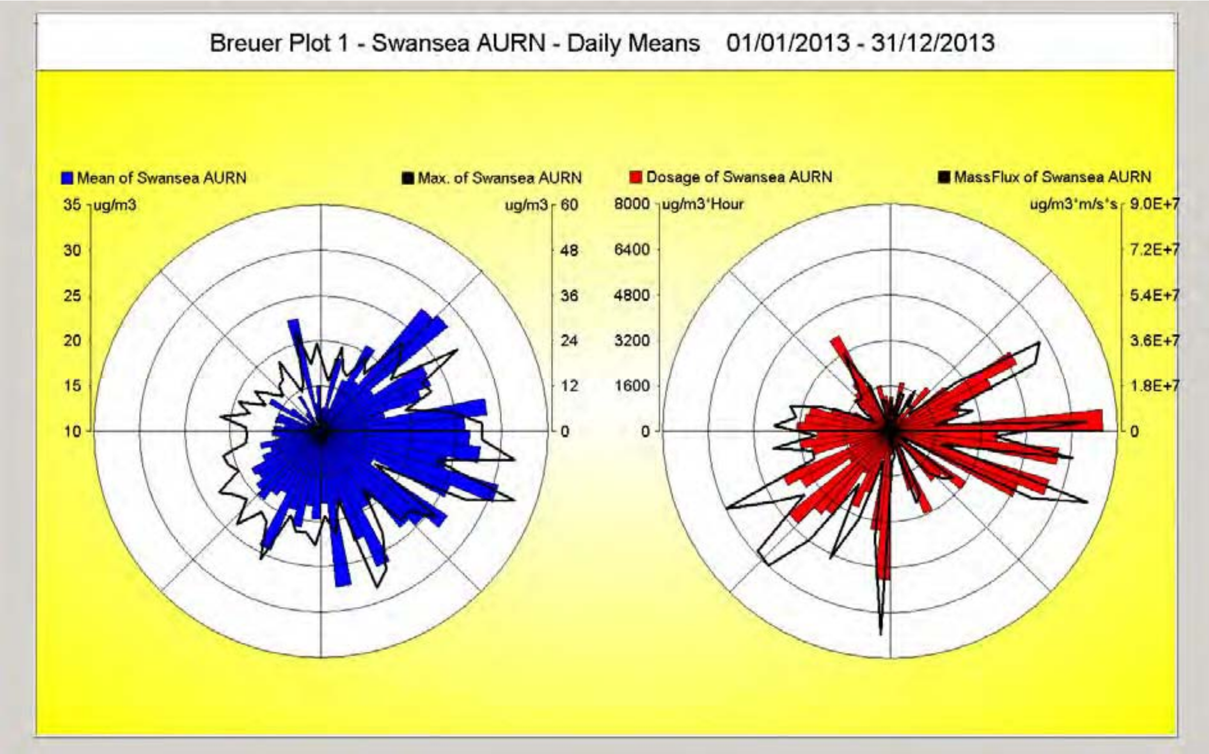


Graph 7 – Morriston Groundhog 24-hour PM_{10} concentrations 2013



Scatter Plot 1 – PM_{10} Daily Means 2013

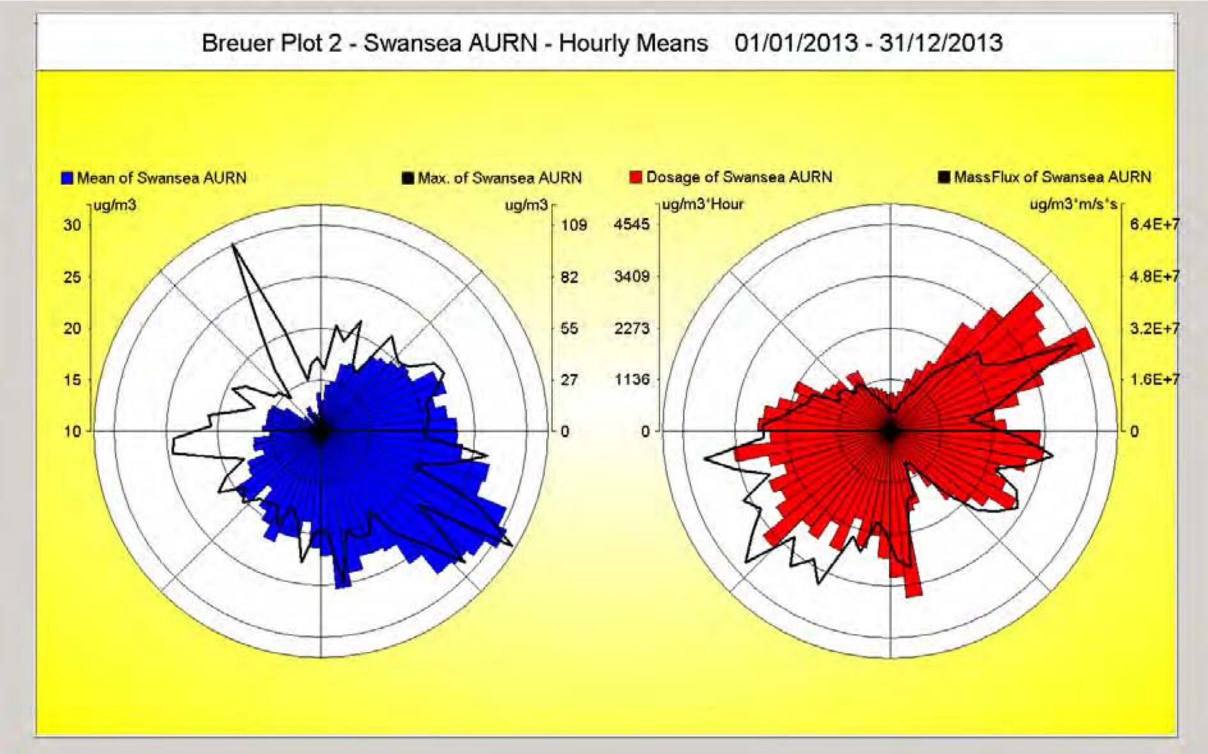
As has been seen during previous there remains a trend during 2013 albeit less pronounced than during previous years for elevated concentrations to emanate from a south-easterly direction. Daily maximum concentration are seen as emanating from the south-east quadrant but the daily means are far more universal with no visible dominant direction. The Tata steelworks is located in a south-easterly direction across Swansea Bay at Port Talbot.



Breuer Plot 1 – Swansea AURN – PM_{10} Daily Means 2013

Dosage is taken to be the accumulated time multiplied with the average value of PM_{10}. 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 [PM_{10}] are not used to calculate the result). The result is presented in the multiplied units of the wind speed and the parameter (PM_{10}). 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.

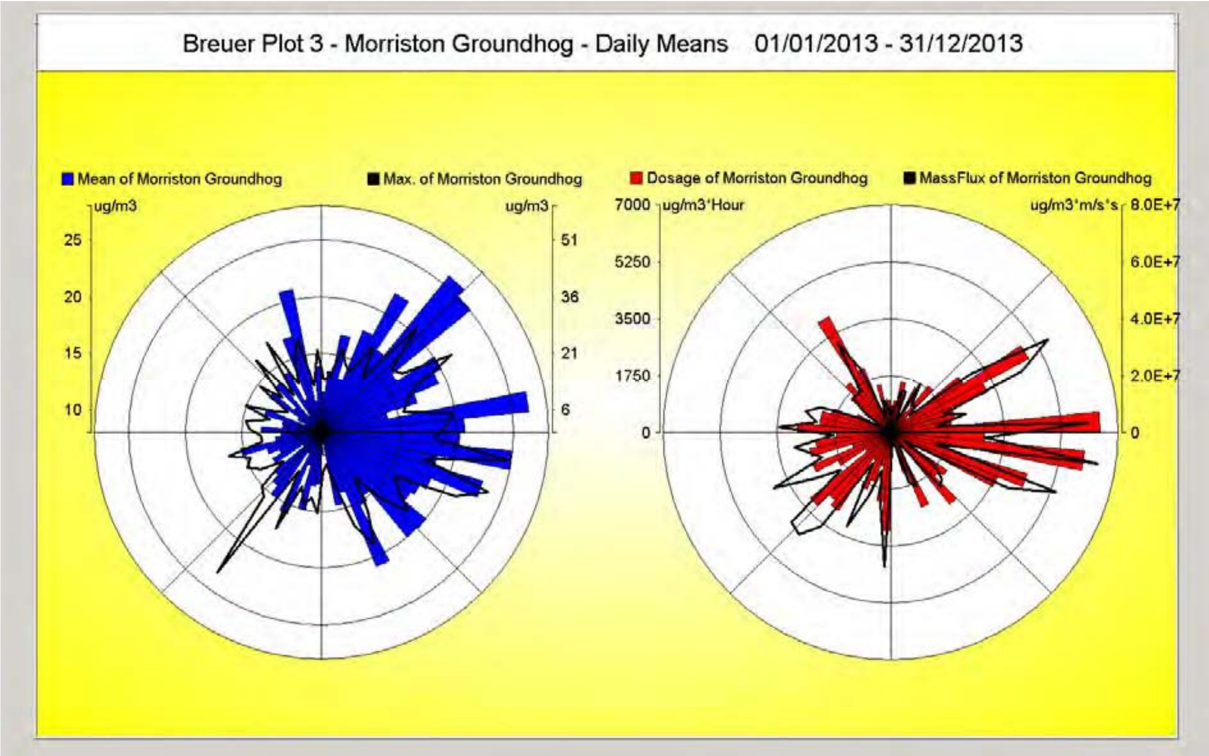
Breuer Plot 2 below presents the hourly mean concentrations at the Swansea AURN



Breuer Plot 2 - Swansea AURN – PM_{10} Hourly Means 2013

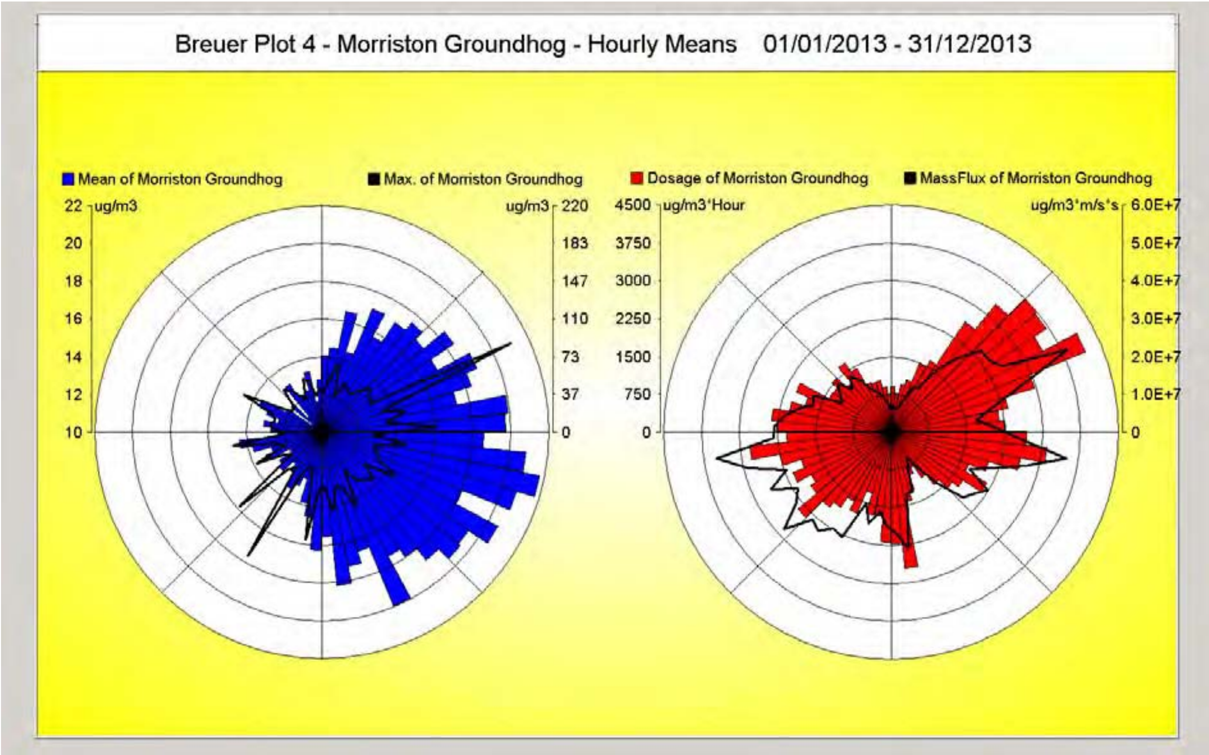
As has been reported in previous years, Breuer Plot 2 once again clearly indicates that mean hourly concentrations are dominated by sources to the south-east. However, maximum hourly concentrations are far more diverse being mainly from a north-west direction. It is thought that these maximum hourly concentrations along with dosage and mass flux probably reflect more local sources/influences during 2013 as has been seen during previous years.

Breuer Plots 3 and 4 below represent an identical analysis undertaken with data from the Morriston Groundhog for 2013.



Breuer Plot 3 – PM_{10} Daily Means – Morriston Groundhog 2013

Breuer Plot 3 again hints of daily mean concentrations emanating from the south-east but this signal is muted compared to previous years with maximum daily mean concentrations being dominated from a north-east direction with, in comparison, an almost total lack of concentrations from westerly locations. Daily mean PM_{10} data for 2013 appears to reflect the possible influence of industrial locations located to the north-east and possible further up the lower Swansea Valley.

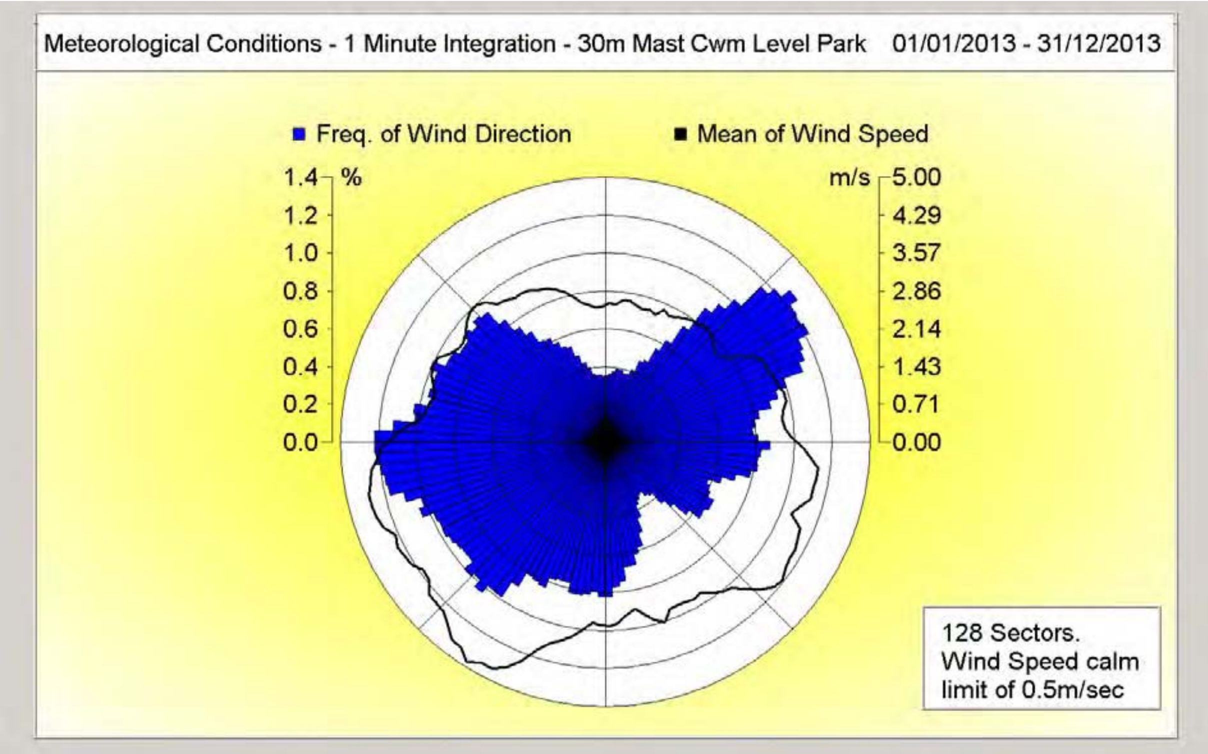


Breuer Plot 4 – PM_{10} Hourly Means – Morriston Groundhog 2013

Breuer plot 4 however reemphasises the widely held belief based on previous monitoring that the south east sector is remains a significant source of PM_{10} concentrations seen within Swansea. Dosage reflects the influence during 2013 of sources from the north-east.

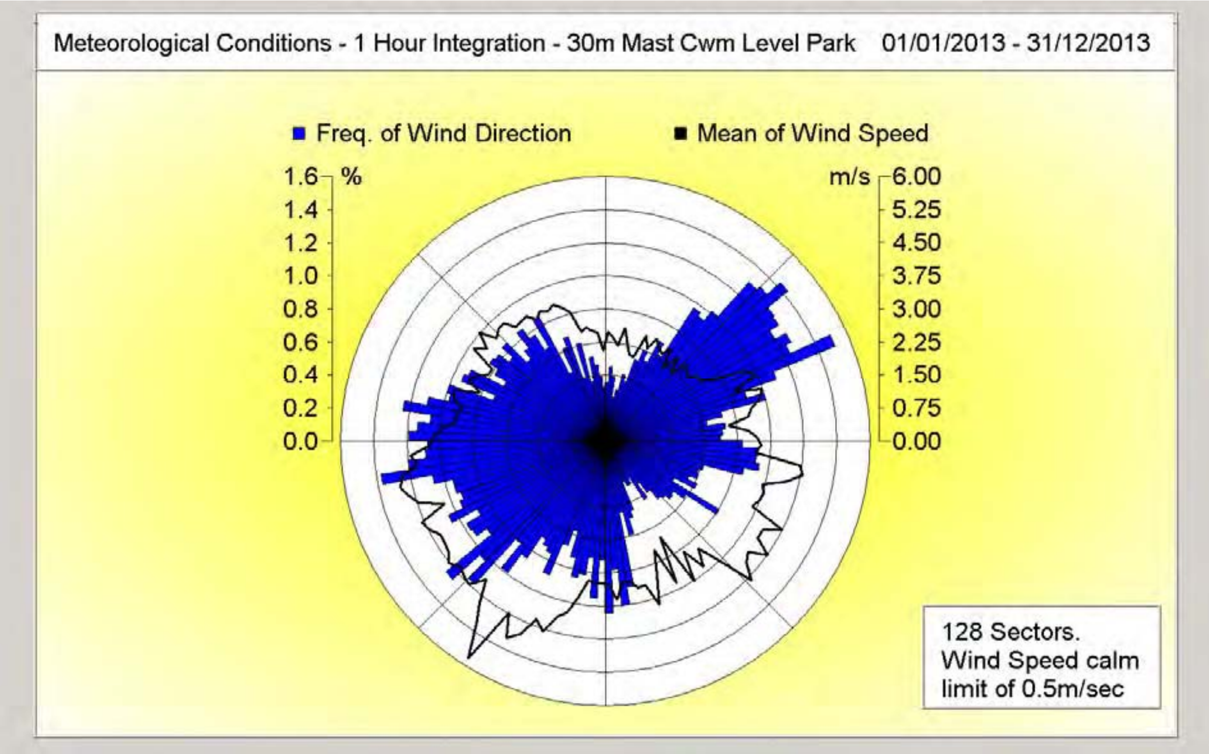
Breuer Plots 5 and 6 below indicate meteorological conditions observed at the 30m Meteorological Mast at Cwm Level Park during 2013. Data is presented at 1 minute integration within Breuer Plot 5 and at 1 hour integration within Breuer Plot 6. This site is within the lower Swansea Valley and is highly representative of conditions throughout Swansea

.



Breuer Plot 5 – Meteorological Conditions – 1 Minute Integration – 30m Meteorological Mast Cwm Level Park 2013

From Breuer Plots 5 above and Breuer Plot 6 below, it can be seen that 2013 can be considered meteorology as a typical or “normal” year with the wind direction being from a predominantly south-westerly / westerly direction. However, there is, once again, during winter months, significant periods of north-easterly winds. These periods of north-easterly winds have become prevalent during recent years are fairly indicative of the harsher winter conditions seen within the UK over the last couple of years.



Breuer Plot 6 – Meteorological Conditions – 1 Hour Integration – 30m Meteorological Mast Cwm Level Park 2013

Meteorological conditions represented within Breuer Plots 5 and 6 help explain the dosage and mass flux plots within Breuer Plots 2 and 4 above.

Charts 8 – 12 below represent the indicative monitoring undertaken at the five EBam locations. For comparativeness sake, the Swansea AURN Bam1020 EU reference equivalent monitoring is plotted against each site.

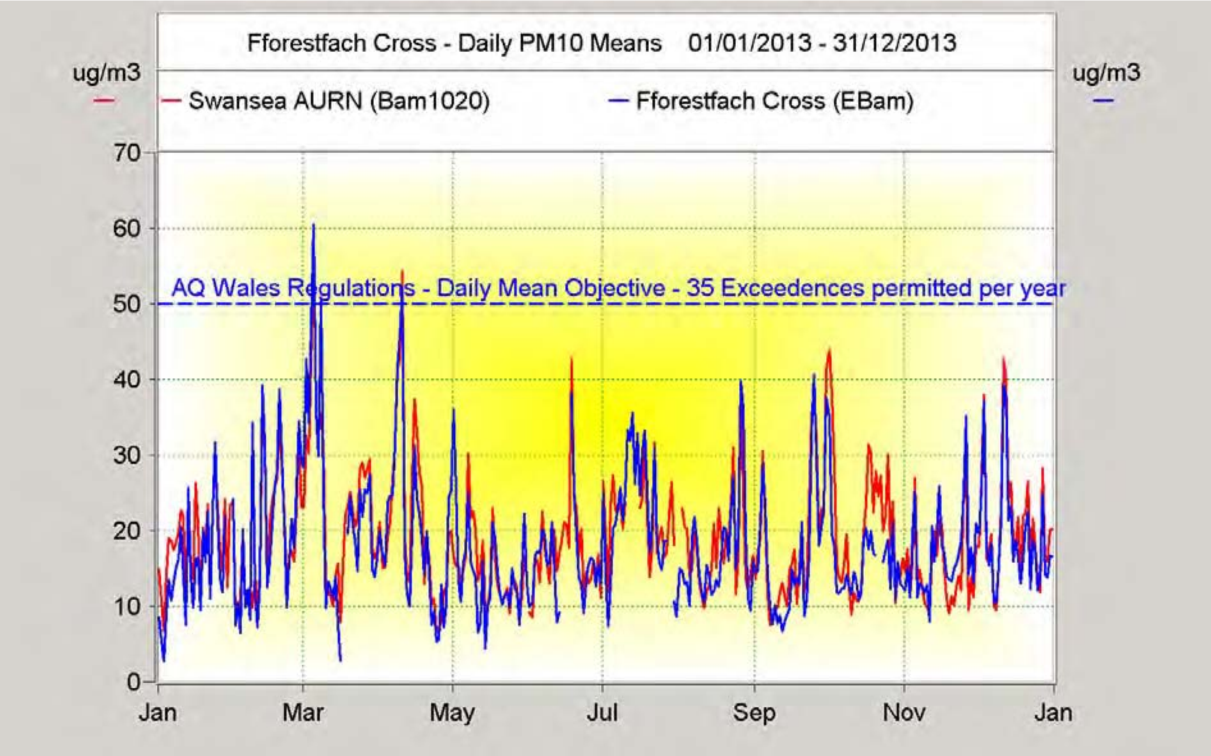


Chart 8 - Fforestfach Cross EBam 24-hour PM_{10} concentrations 2013

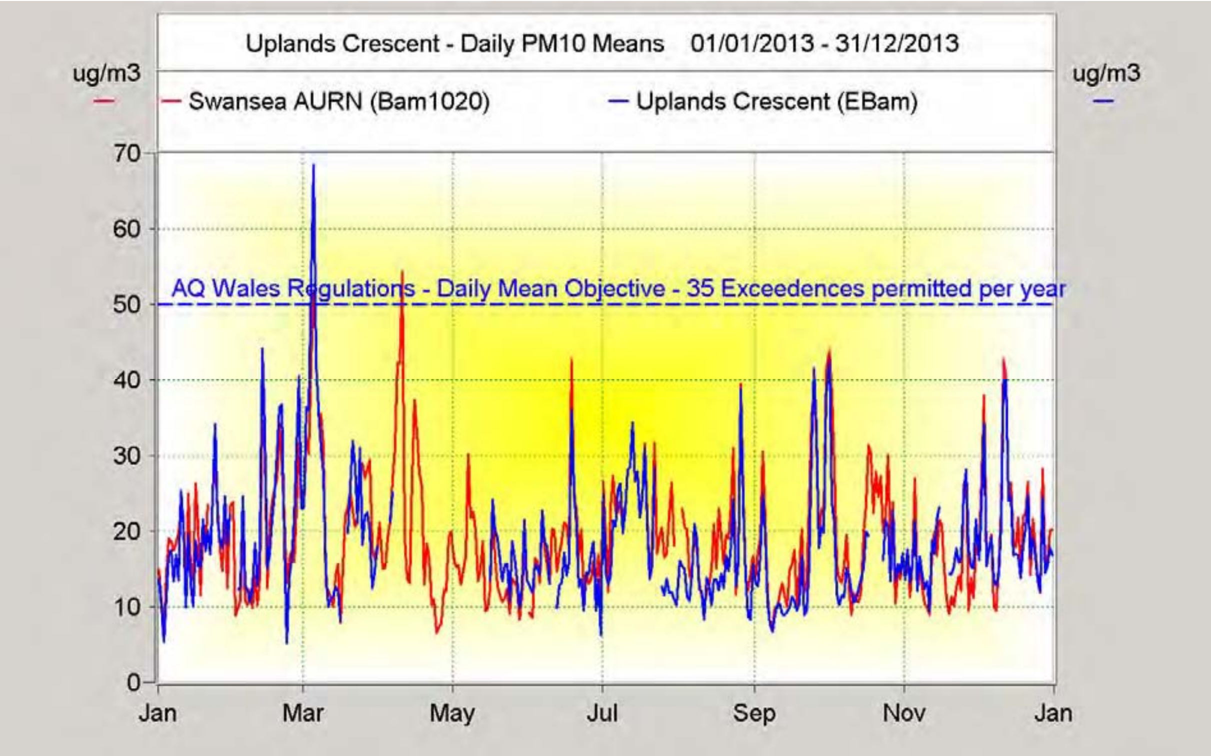


Chart 9 – Uplands Crescent EBam 24-hour PM_{10} concentrations 2013

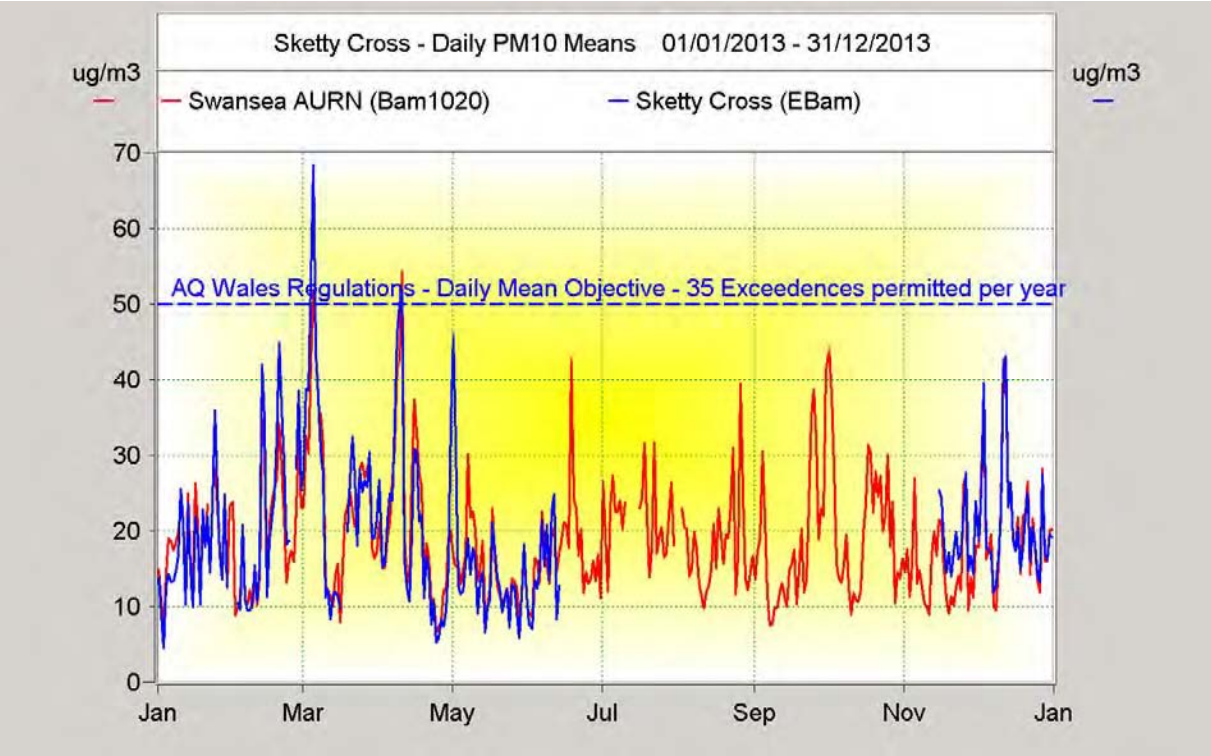


Chart 10 – Sketty Cross EBam 24-hour PM_{10} concentrations 2013

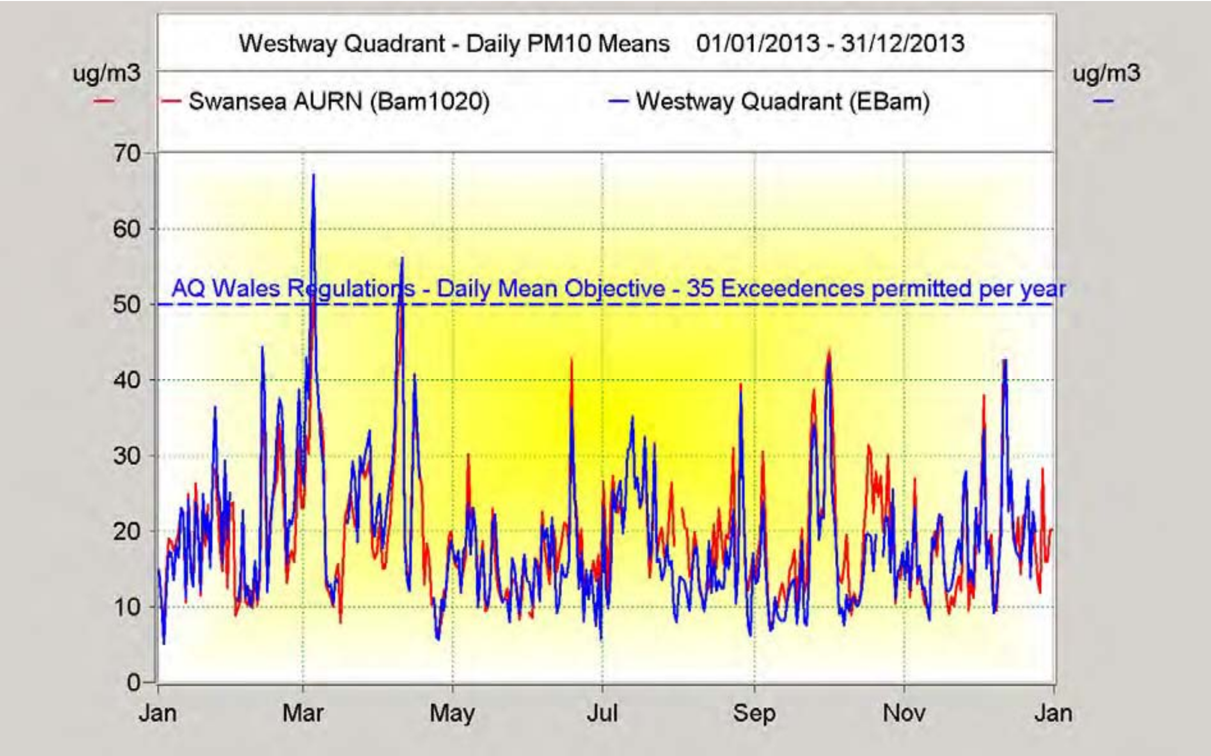


Chart 11 – Westway Quadrant Bus Station EBam 24-hour PM_{10} concentrations 2013

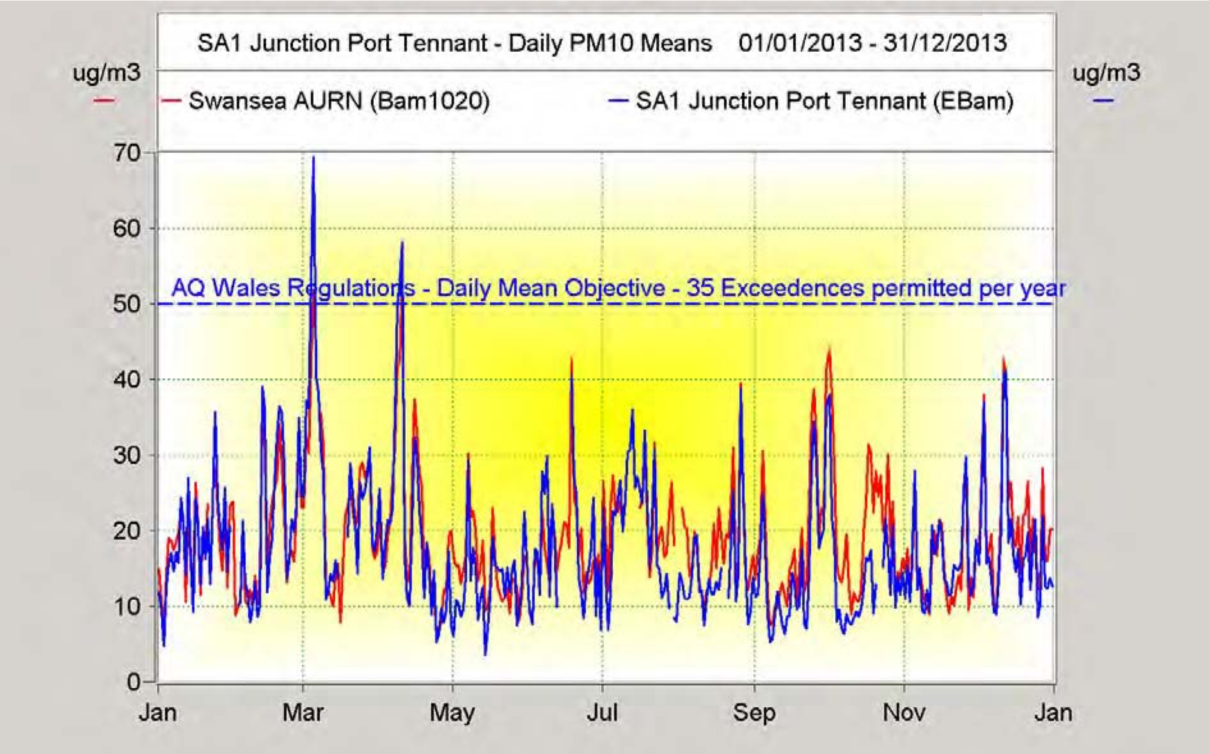
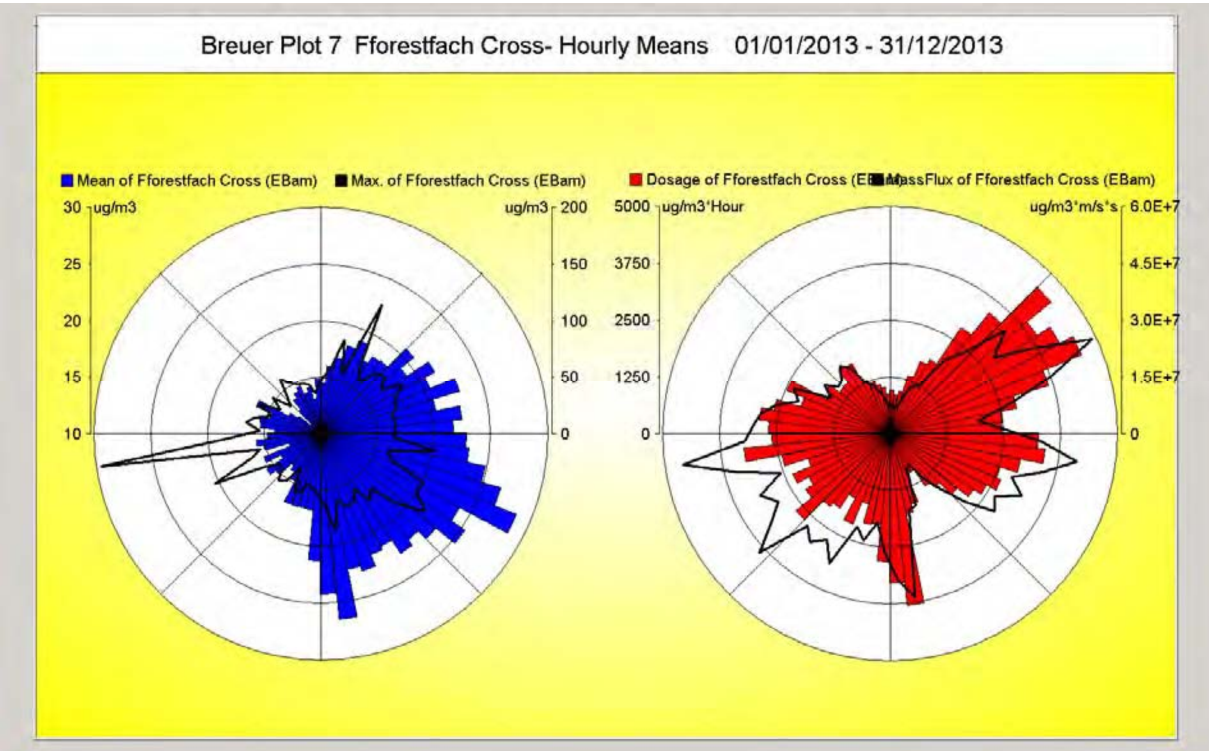
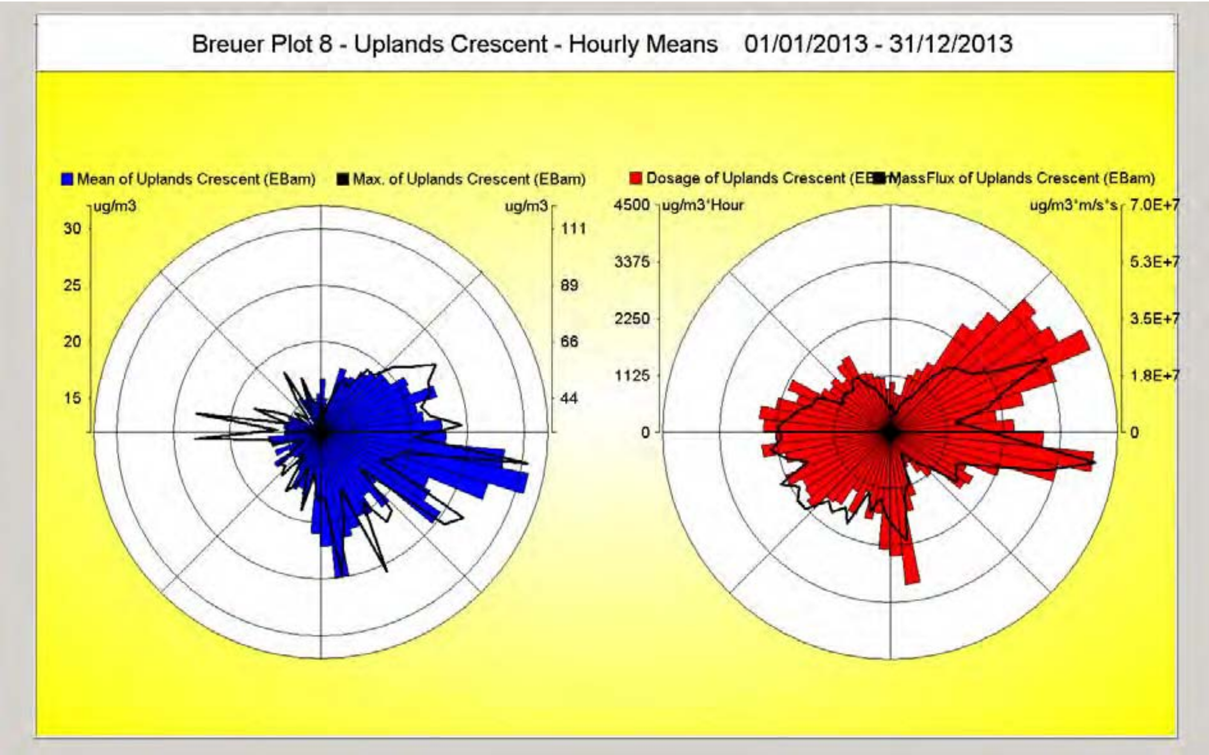


Chart 12 – SA1 Junction Port Tennant EBam 24-hour PM_{10} concentrations 2013

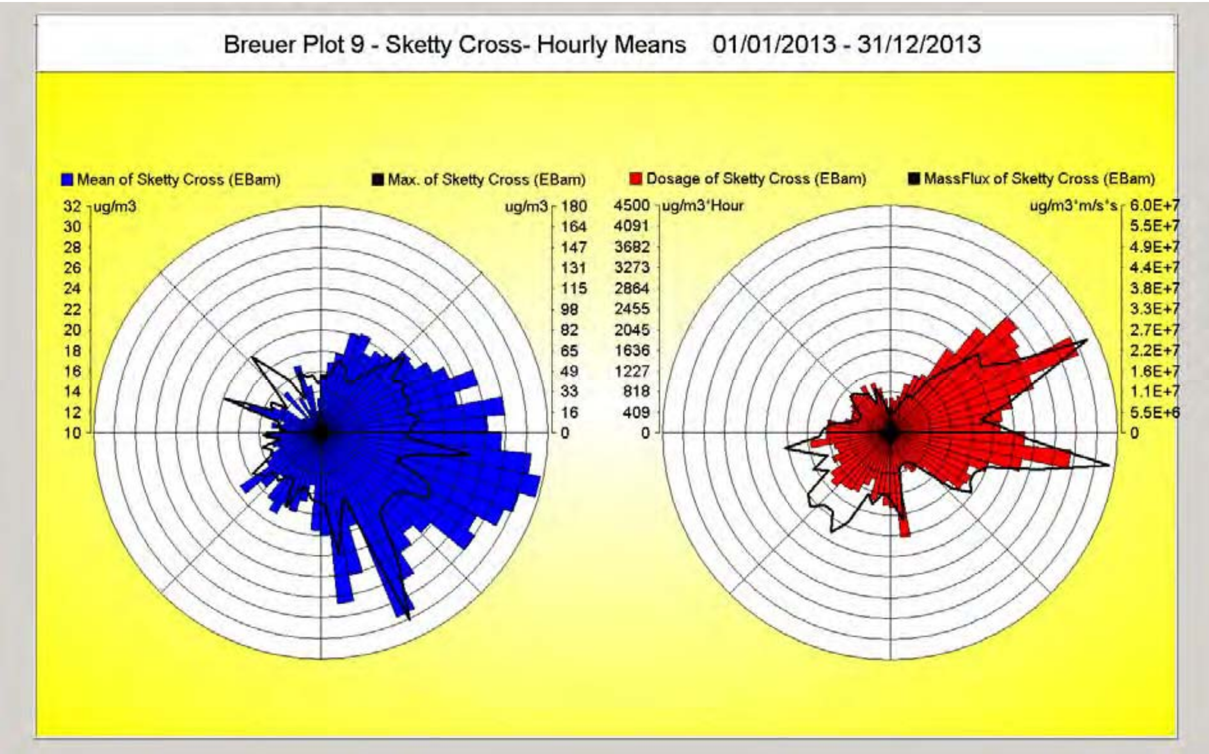
For completeness, hourly Breuer Plots from the hourly means returned from the EBam monitoring during 2013 are presented below as Breuer Plots 7-11.



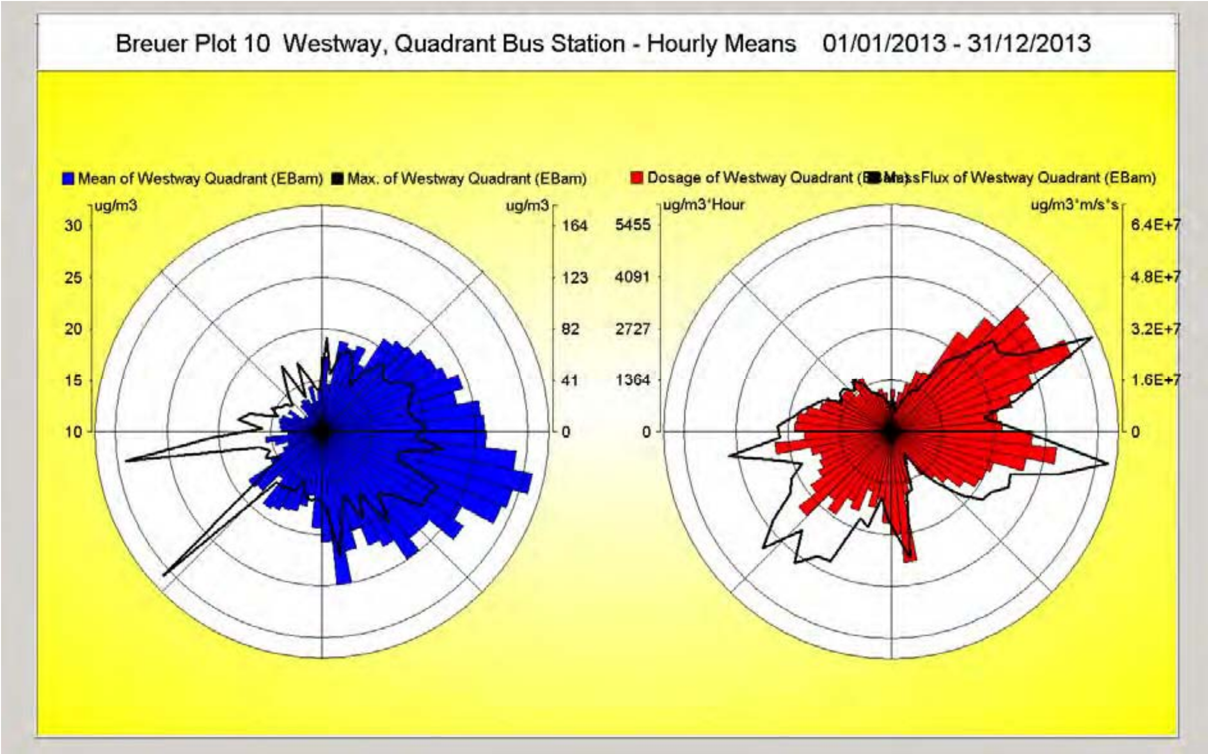
Breuer Plot 7 – PM_{10} Hourly Means – Fforestfach Cross EBam 2013



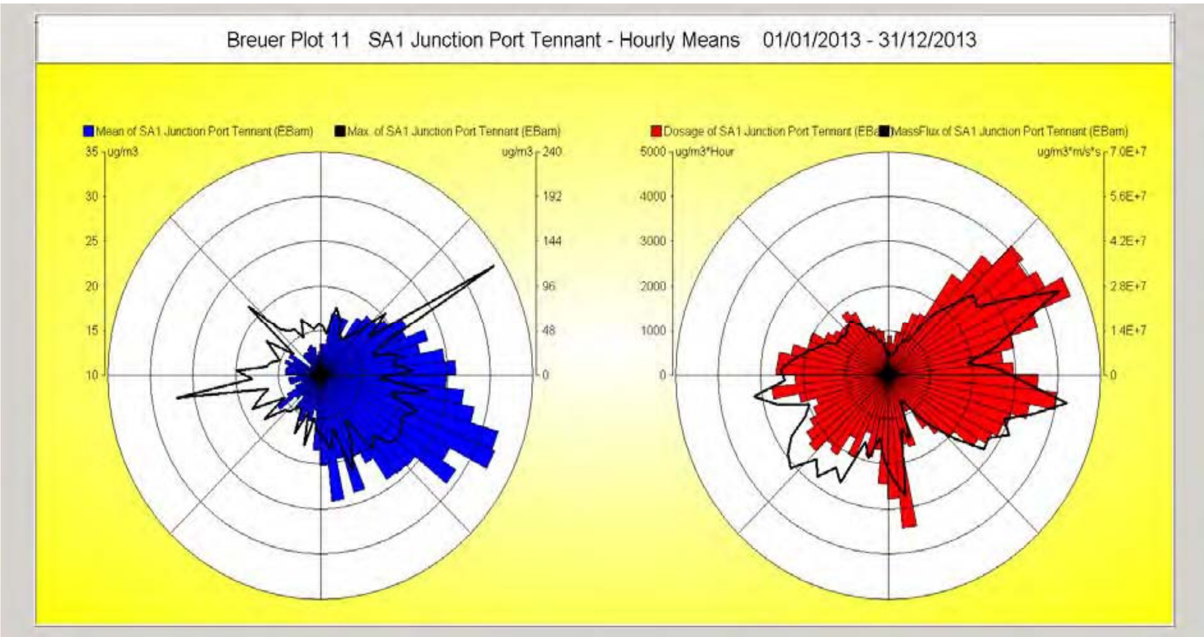
Breuer Plot 8 – PM_{10} Hourly Means Uplands Crescent EBam 2013



Breuer Plot 9 – PM_{10} Hourly Means Sketty Cross EBam 2013



Breuer Plot 10 – PM_{10} Hourly Means Westway Quadrant Bus Stations EBam 2013



Breuer Plot 11 – PM_{10} Hourly Means SA1 Junction Port Tennant EBam 2013

There is a striking similarity to the hourly Breuer Plots produced for the Swansea AURN (Breuer Plot 2) and Morriston Groundhog (Breuer Plot 4) to Breuer Plots 7-11 above. This would seem to point to the fact that all EBam locations, despite being located around busy junctions and/or busy, congested streets, that the dominant easterly source remains constant with local conditions having little or no effect on concentrations recorded. It will be interesting to see if this trend continues.

As can be seen from tables 12 and 13 above, **no exceedences of the annual mean objective** were seen at any of the monitoring stations. Similarly, **no breach of the 35 permitted exceedences of the 24 hour objective** was seen, **nor, where data capture was below 90% did the 90th percentile** (given in brackets after the number of exceedences) **exceed 50ug/m^3**

LAQM.TG(09) provides a method to project measured annual mean roadside PM_{10} concentrations to future years[26]. Using this method, the following future year projections for 2015 and 2020 are presented below within table 13. In order to reach the final calculation, the following steps were taken: All steps were undertaken using the latest download data files for 2013, 2015 and 2020 from http://laqm.defra.gov.uk/maps/maps2010.html

Steps 1-4	Measured 2013 Conc.	2013 Background Conc.	2013 Local Road Contribution	Road Cont 2015	Road Cont 2020
Swansea AURN	19.03	13.85	5.18	0.948343	0.826101
Morriston	15.3	13.91	1.39	0.835781	0.717022

Step 5	Year Adj. Factor 2015	Year Adj. Factor 2020
Swansea AURN	0.893998612	0.77876164
Morriston	0.88300499	0.75753577

Step 6	Year Adj. Factor 2015	Year Adj. Factor 2020
Swansea AURN	4.630912812	4.033985283
Morriston	1.227376936	1.052974721

[26] LAQM.TG(09) box 2.2 page 2-5

Site ID	Location	Within AQMA?	Measured Annual Mean 2013	Future Years Projections	
				2015	2020
1	Swansea AURN	Y	19.03	18.15	17.05
3	Morriston Groundhog	N	15.30	14.76	14.07

Table 14 PM_{10} Annual Mean projections

From table 14 it can be seen that from the 2013 annual mean measured concentrations used to derive the 2015 and 2020 projections that the projected trend at both sites continues downwards despite fluctuating annual mean measured concentrations – see table 12.

These latest projections for both 2015 and 2020 are for PM_{10} concentrations to remain considerably below the annual mean objective.

The City & County of Swansea facilitated a research study by a group comprising: School of Earth and Ocean Sciences Cardiff University, School of Biosciences Cardiff University, and the Centre for Health and Environment Research, Department of Primary Care and Public Health, Neuadd Meirionydd into ultrafine and nanoparticles using a Dekati™ Electrical Low Pressure Impactor within a street canyon environment. The site chosen for measurements was the Hafod Post Office, Neath Road, Hafod, Swansea. This site is located within the Hafod Air Quality (NO_2) Management Area. **Full details of the study are reproduced with the permission of the group, within Annexe 6. The study confirmed the existence of an early morning diurnal pattern within the ultrafine fraction which appears to match the diurnal NO_2 pattern highlighted above within section 2.2.**

2.2.5 Sulphur Dioxide

There were major alterations to the authority's network of SO_2 analysers during 2010. These changes have been reported within the reports previously submitted but are repeated within this report for clarity. Due to budget restrictions and with the knowledge that SO_2 concentrations have remained low for several years with no exceedence of any of the objectives, the decision was made to switch off the Advanced Pollution Instrumentation (API) real-time SO_2 analysers at the Swansea AURN, Morfa and Morriston Groundhog stations.

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[27]. 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[28]

The data capture rates are presented within table 15 and, where applicable, the percentile value corresponding to the objective exceedence value is given should the data capture rate fall below 90%[29]

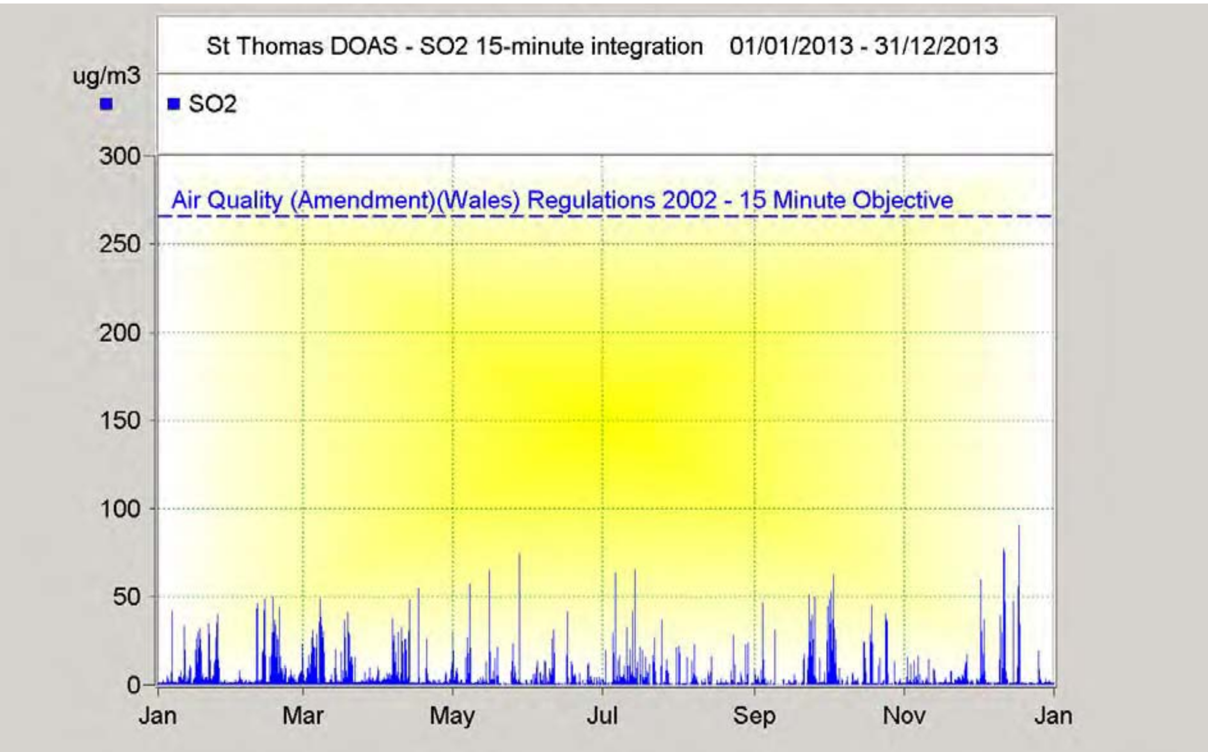
Graphs 13-15 are presented below, representing time series measurements made during 2013 with the accompanying Breuer plot 12 providing an insight into the more likely source direction.

[27] LAQM.TG(09) Appendix A1 - Reporting of Monitoring data – Calculation of Exceedence Statistics A1.216 page A1-47
[28] LAQM.TG(09) Appendix A1 - Reporting of Monitoring data – Calculation of Exceedence Statistics A1.216 page A1-48
[29] LAQM TG(09) Annexe A1 – A1.157 page A1-34

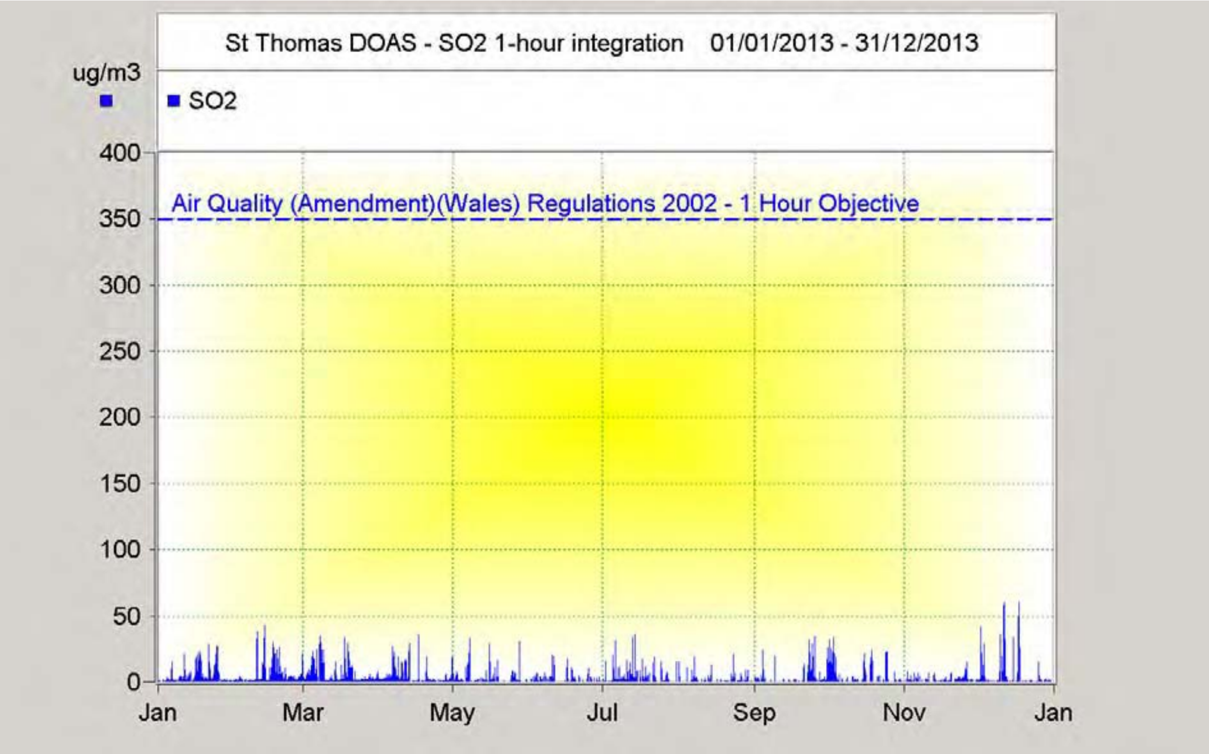
St.Thomas DOAS 2013	Max 15-Min Mean µg/m^3 (266µg/m^3)	Max 1-hour Mean µg/m^3 (350µg/m^3)	Max 24-Hour Mean µg/m^3 (125µg/m^3)
Data Capture %	59.49%	61.07%	45.21%
Concentration	90.45	59.99	20.73
Exceedences	0	0	0
Date of Max	17th December 2013	17th December 2013	11th December 2013
Time of Max	15:45	15:00	
2013 Percentiles	15 Minute	1 Hour	24-Hour
99.9th Percentile	55.73	-	-
99.7th Percentile	-	36.36	-
99th Percentile	-	-	13.43

Table 15- SO_2 Concentrations 2013 St.Thomas DOAS

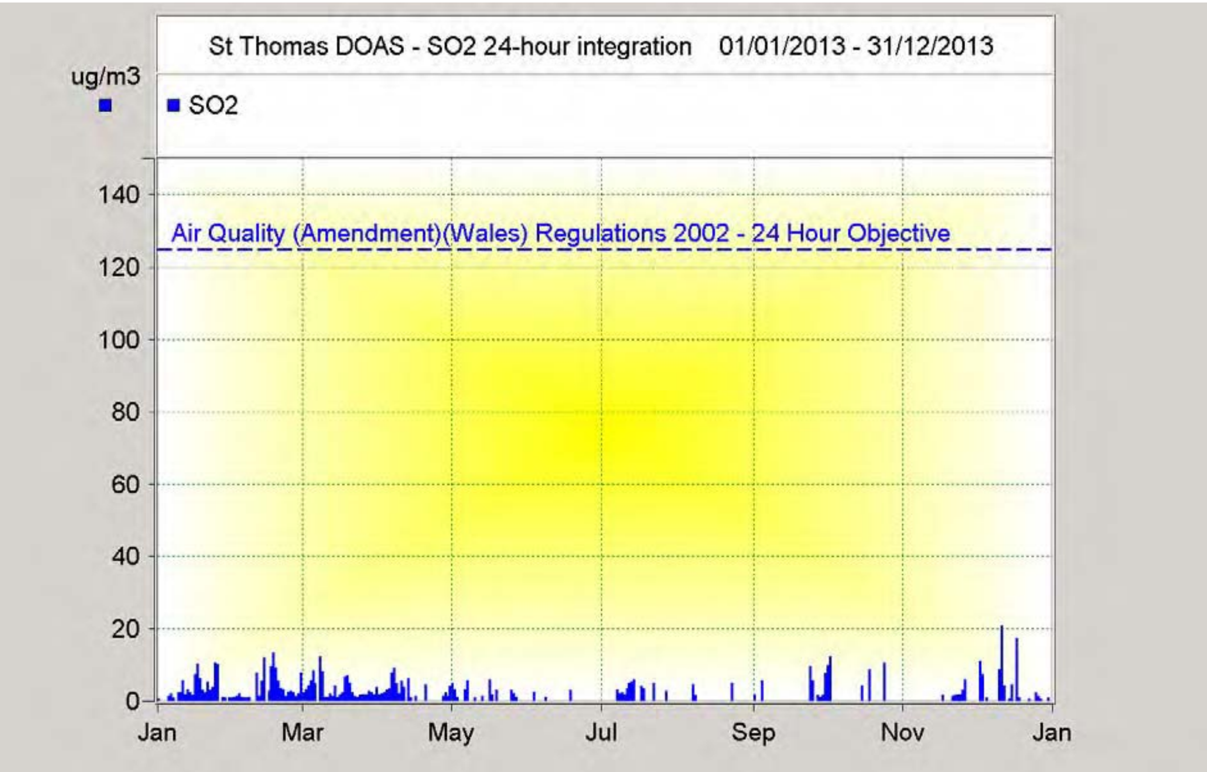
Looking at the data capture rates for 2013 within table 15 above, it could mistakenly be taken that there were operational issues with the equipment at the site. However, this impression would be incorrect. The reason for the quoted data capture rate is due to the QA/QC formulae used (see section 2.1.7 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.



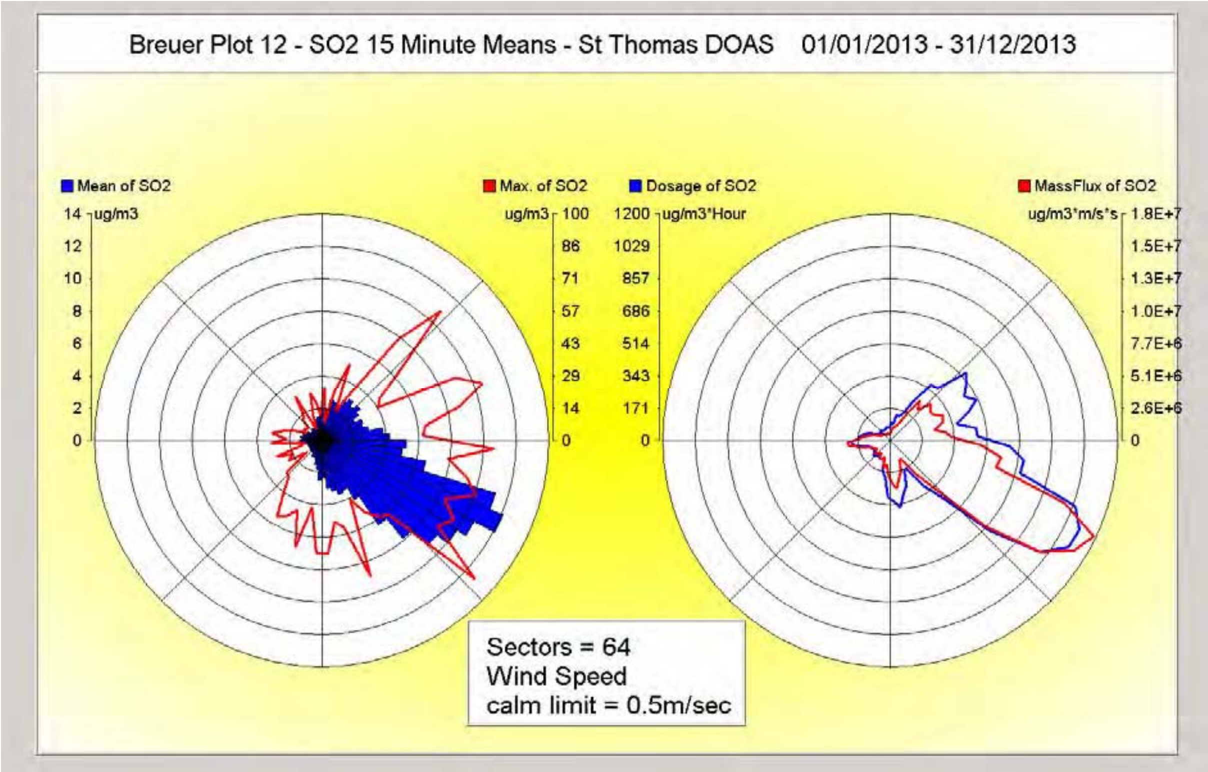
Graph 13 – 15 minute SO_2 means – St Thomas DOAS 2013



Graph 14 – 1-Hour SO_2 means – St Thomas DOAS 2013



Graph 15 – 24-Hour SO_2 means – St Thomas DOAS 2013



Breuer Plot 12– 15 minute SO_2concentrations St.Thomas DOAS 2013

From Breuer Plot 12 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. Again during 2013 there would appear to be an additional source as yet unidentified contributing to the maximum concentrations from the north-east. This source was also reported within the Progress Report 2013. 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 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 2013 data this remains the case and is reinforced by examination of the dosage and Mass Flux plots within Breuer plot 12. 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.

2.2.6 Benzene

Benzene is measured in real-time at two roadside sites in Swansea with Opsis DOAS instruments. Sections 2.1.6 and 2.1.7 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 2009-2013 are provided below within table 16.

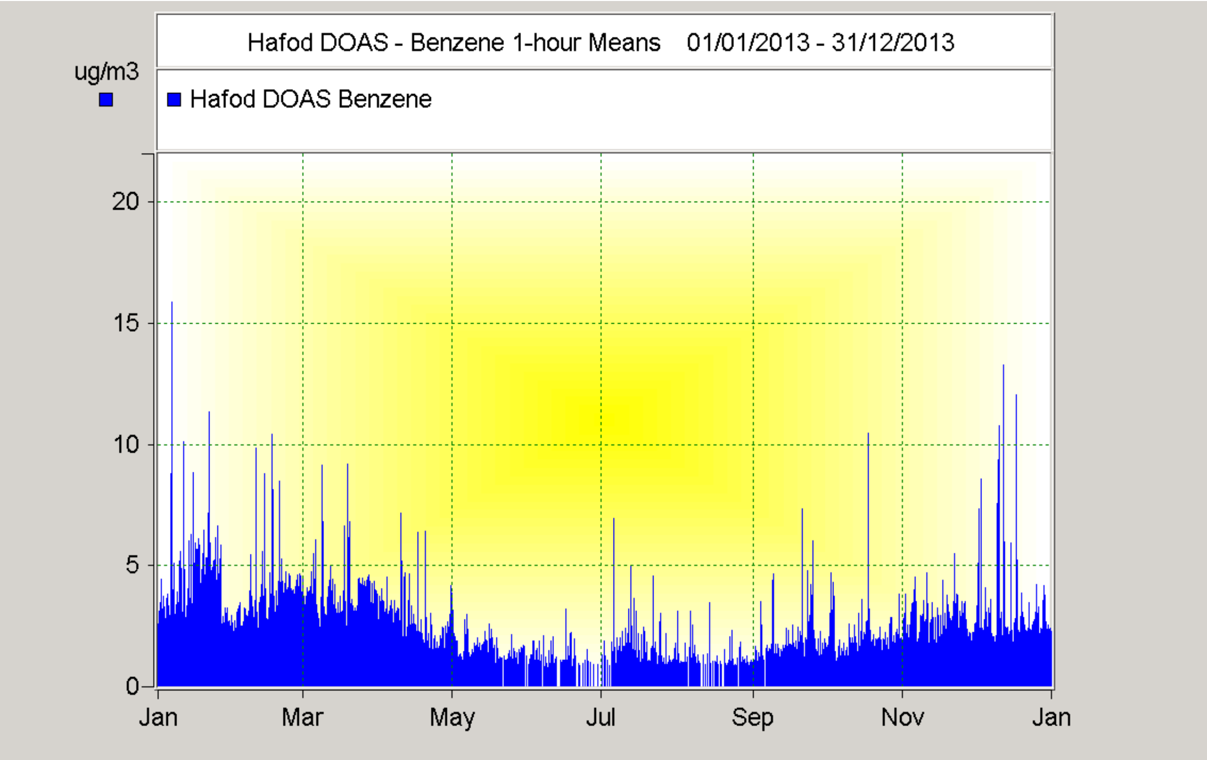
Site ID	Location	Within AQMA	Data Capt. 2009 %	Data Capt. 2010 %	Data Capt. 2011 %	Data Capt. 2012 %	Data Capt. 2013 %	Annual mean concentrations (μg/m^3)				
								2009	2010	2011	2012	2013
5	Hafod DOAS	Y	98%	**76%**	**75%**	**74%**	**73%**	1.88	3.69	3.10	2.66	2.23
6	St.Thomas DOAS	N	**88%**	**80%**	**81%**	**76%**	**73%**	1.81	3.58	3.09	2.55	2.30

Table 16 Benzene annual means 2009-2013

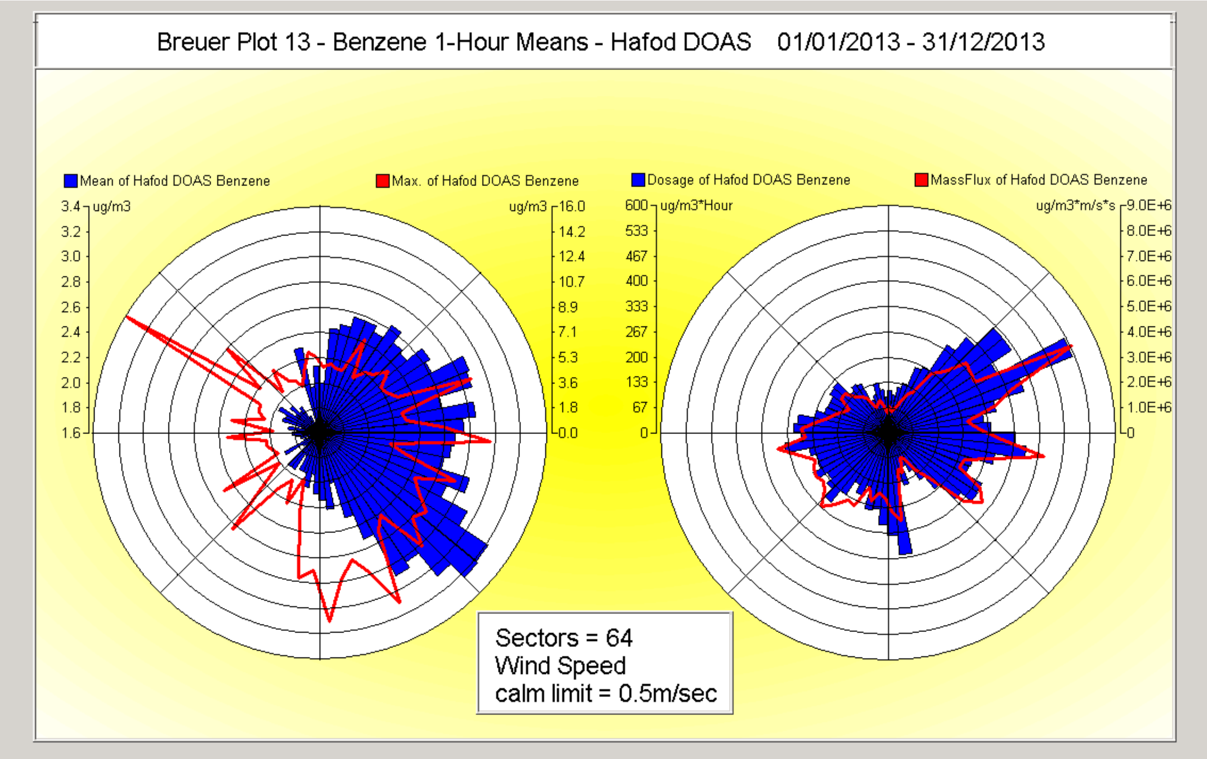
Significant data has been lost at these sites in previous years due to operational issues and also building renovation works in the case of the Hafod site. Analysis of the data for 2013 has once again produced data capture rates below the recommended 90%. However, this can partly be explained by the validation rules outlined within sections 2.1.6 – 2.1.7 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 2013 are much reduced from hourly spikes seen in recent years. Breuer Plots 13 and 14 provide additional information as to the source direction of measured concentrations.

Both sites show a reduction in annual mean concentrations over those reported between 2010-2012. Concentrations continue to remain below the annual mean objective level of 5µg/m^3. It is thought that the annual mean concentrations returned for 2010 were influenced by the atypical meteorological conditions experienced during 2010, particularly during the early winter months of late 2010. 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 2013 that could account for the numerous hourly spikes.

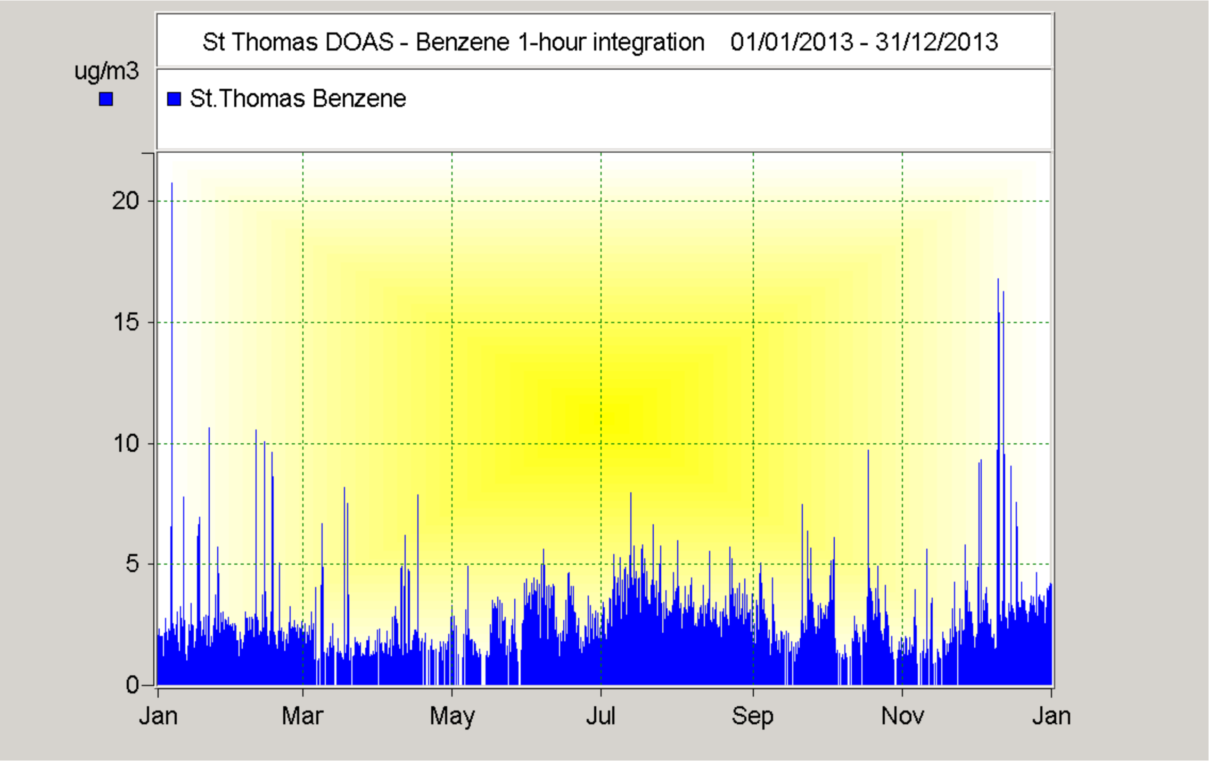


Graph 16 – Hourly Benzene concentrations Hafod DOAS 2013

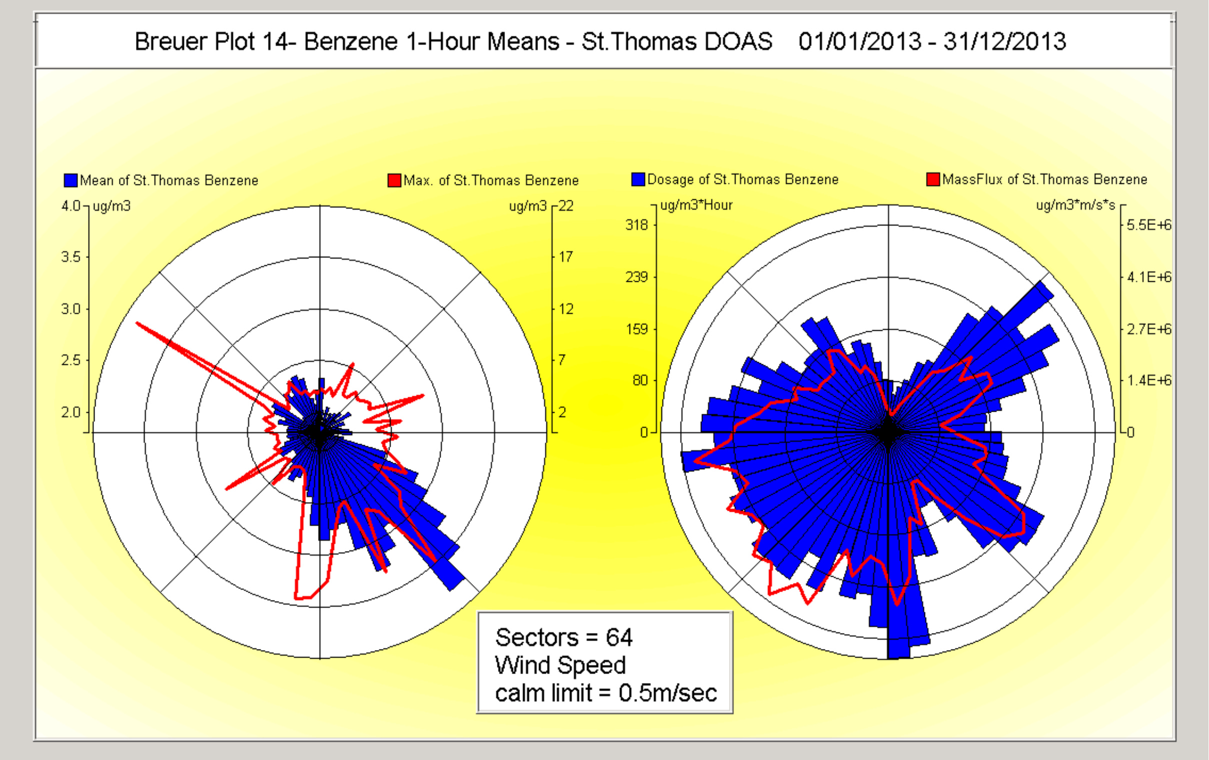


Breuer Plot 13 – Hafod DOAS Benzene Hourly Concentrations 2013

Breuer Plot 13 above indicates multiple directions of sources for benzene concentrations during 2013 with the majority indicated as emanating from an easterly direction (both north and south). The more dominant source is from the south east and this is more probably associated with emissions from the heavy industry to the east of Swansea Bay. Also shown is the source to the south/south east which is thought to be from industry within Swansea Docks which influence the maximum hourly concentrations seen. Interestingly, a source to the north east, as yet unidentified contributes significantly to the dosage received at the Hafod DOAS.



Graph 17 – Hourly Benzene concentrations St.Thomas DOAS 2013



Breuer Plot 14 – St.Thomas DOAS Benzene Hourly Concentrations 2013

Breuer Plot 14 above from St Thomas indicates definitively the primary source of mean and maximum hourly concentrations to be from source(s) to the south-east which is thought to be the heavy industry located to the east of Swansea Bay. Surprisingly, the source thought to be located to be from within Swansea Dock does not manifest itself clearly within Breuer Plot 14. The only indications of the existence of the source(s) are evident within the maximum hourly concentration seen to the south.

From table 16 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.

2.3 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 also continues to be measured at the Morriston Groundhog and the Hafod and St Thomas DOAS sites. Lastly, $PM_{2.5}$ is 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.

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 2.1.10. 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).

2.3.1 Ozone

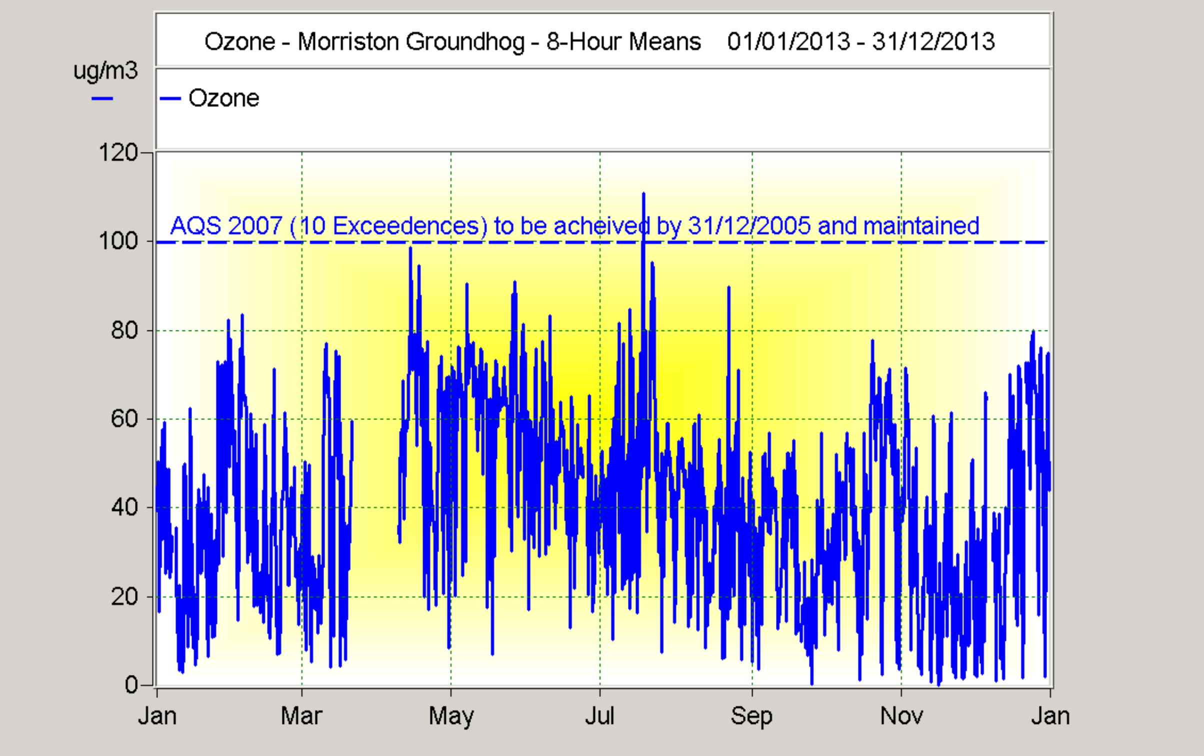
Whilst the objective for ozone has not been set in regulation as yet as it is seen as a national rather than local authority problem, details have been included here of the measurements made during 2012. The objective for ozone is for the 8-hour means not to exceed 100µg/m^3 on more than 10 occasions with a compliance date of 31st December 2005.

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

Ratified datasets have been downloaded from http://www.welshairquality.co.uk/data_and_statistics.php in relation to the ozone monitoring undertaken at the Morriston Groundhog and Cwm Level Park sites. Data ratification procedures undertaken at the Hafod and St Thomas DOAS sites are described in more detail within sections 2.1.6 and 2.1.7

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 17 - 20 detail the monitoring undertaken during 2013 along with previous years results.

Morriston Groundhog

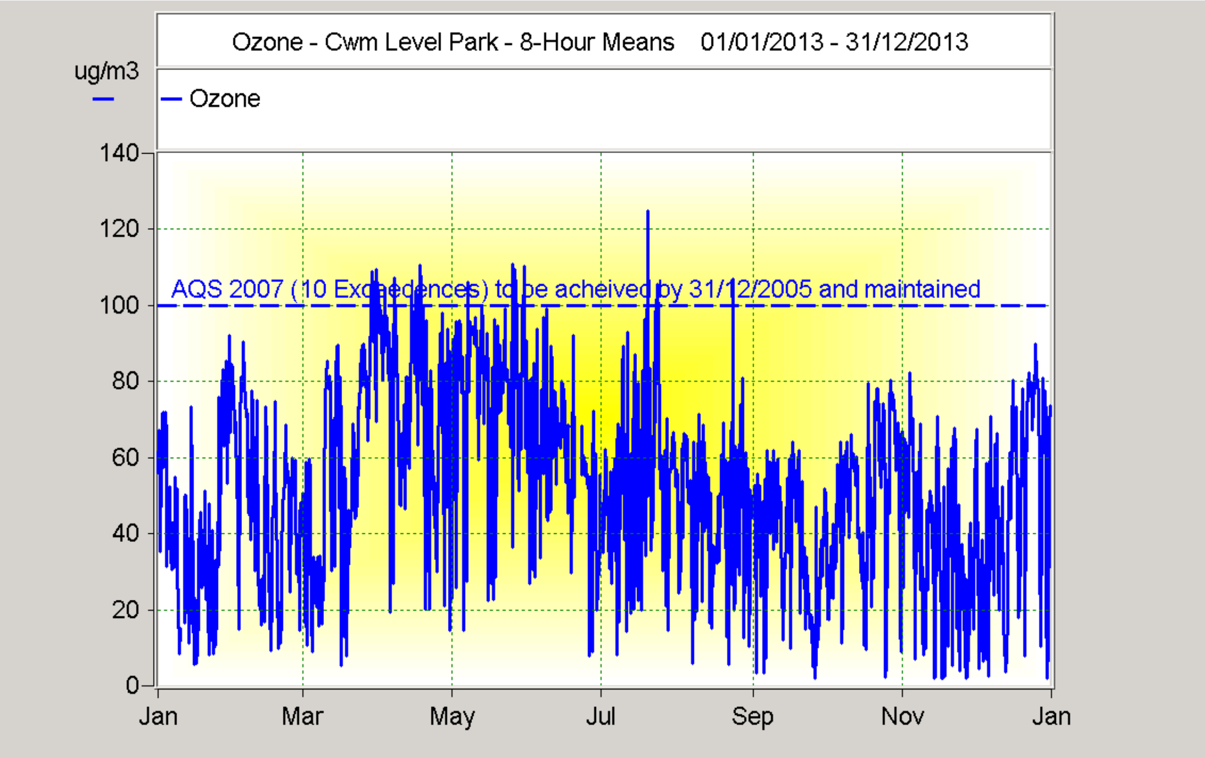


Graph 18 – Morriston Groundhog – 8-Hour Ozone means 2013

Morriston Groundhog	Max 8-hour Mean ($\mu g/m^3$)	Data capture	Exceedences 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

Table 17 – Morriston groundhog Ozone 8-Hour means 2002-2013

Cwm Level Park

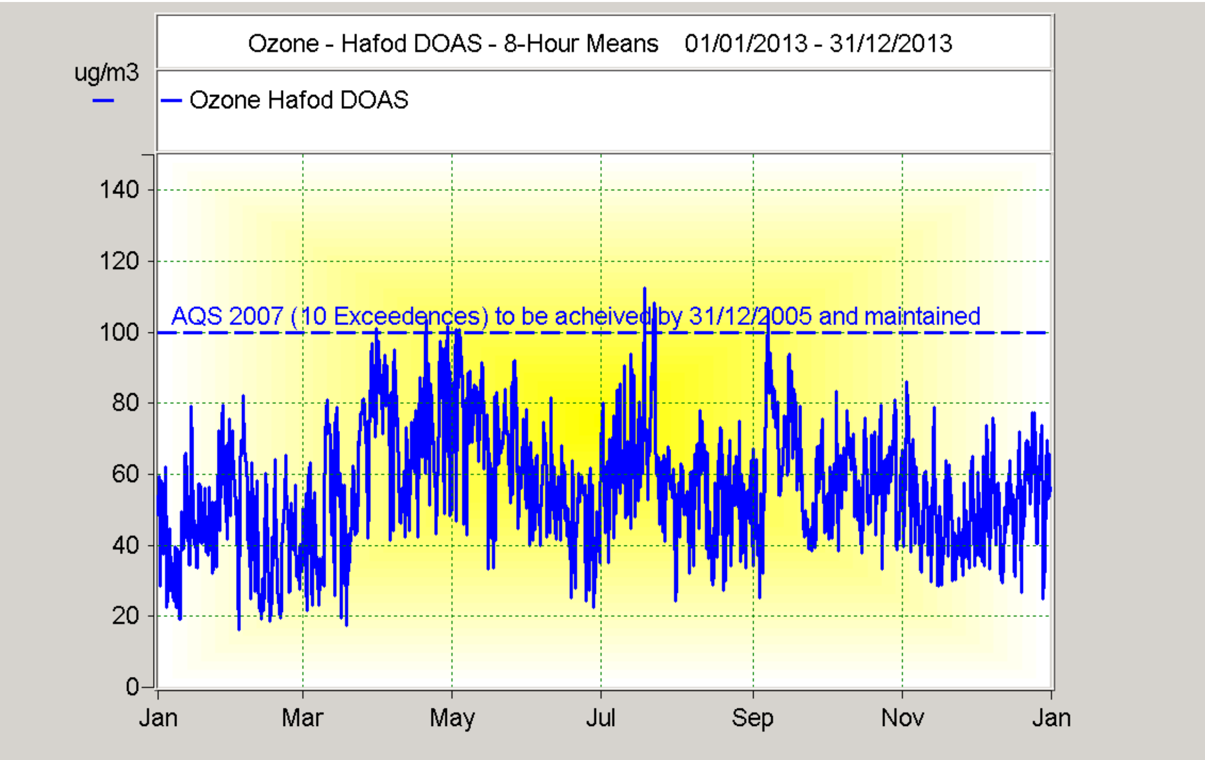


Graph 19 – Cwm Level Park – 8-Hour Ozone means 2013

Cwm Level Park	Max 8-hour Mean ($\mu g/m^3$)	Data capture	Exceedences of 8-hour objective $100\mu g/m^3$ (10 permitted)
2009	100.75	92.6%	1
2010	106.5	98.26%	1
2011	112.0	98.63	5
2012	130.25	96.17%	5
2013	124.75	98.54%	23

Table 18 – Cwm Level Park - Ozone 8-Hour means 2002-2013

Hafod DOAS

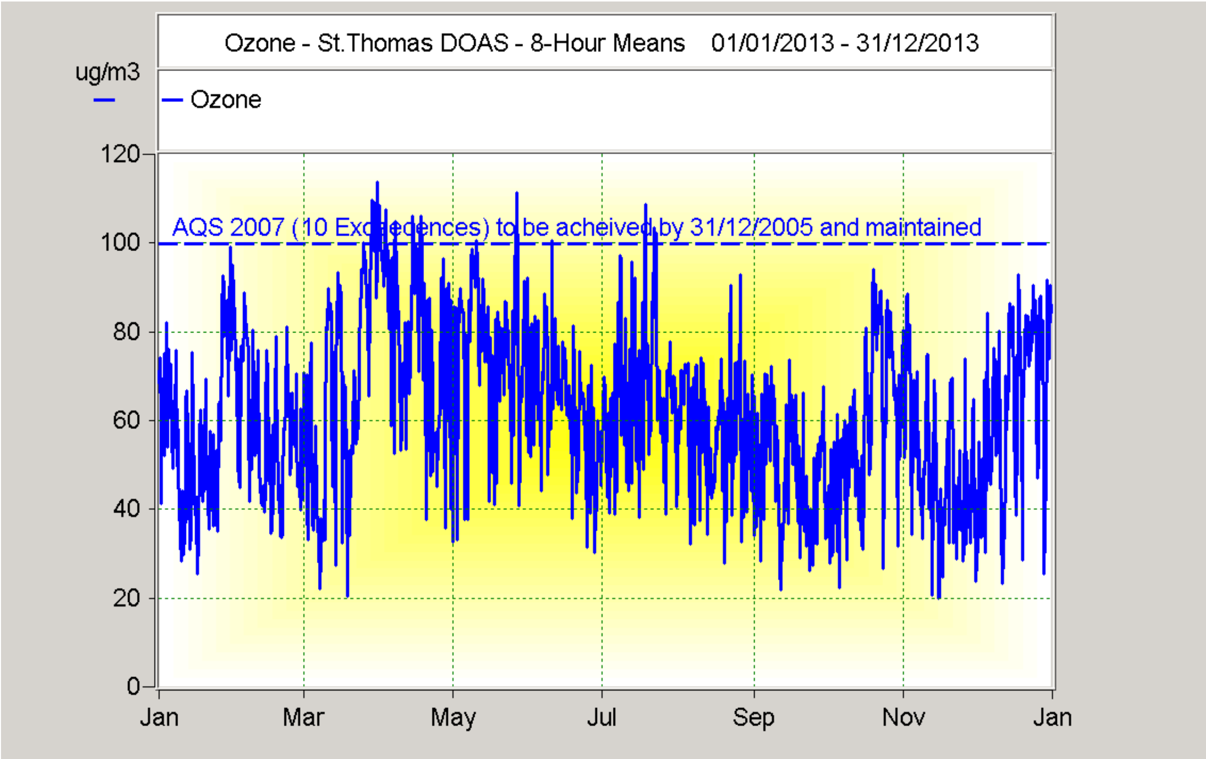


Graph 20 – Hafod DOAS – 8-Hour Ozone means 2013

Hafod DOAS	Max 8-hour Mean (μg/m^3)	Data capture %	Exceedences 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

Table 19 – Hafod DOAS - Ozone 8-Hour means 2006-2013

St.Thomas DOAS



Graph 21 – St Thomas DOAS – 8-Hour Ozone means 2013

St Thomas DOAS	Max 8-hour Mean (µg/m^3)	Data capture	Exceedences of 8-hour objective 100µg/m^3 (10 permitted)
2006	150.6	94.9%	47
2007	106.4	98.7%	10
2008	127.9	99.9%	91
2009	118.93	99.4%	48
2010	120.45	99.36%	37
2011	108.90	99.54%	9
2012	116.42	98.63%	4
2013	113.76	99.7%	22

Table 20 – St.Thomas DOAS - Ozone 8-Hour means 2006-2013

It should be restated here that the DOAS technique produces a spatial measurement between the transmitter and receiver units of 250m at the Hafod DOAS site and 280m at the St.Thomas site. Whilst being located alongside roads with AADT's of 15336 and 20376 respectively during 2013 its clear that the St Thomas DOAS, being located in a more open aspect is subject to more photochemistry along Pentreguineau Road.

Cwm Level Park is an background site and has been subject to higher concentrations than the other API analayser at the Morriston Groundhog due to photochemistry during 2013.

Compliance is being seen at both the Morriston Groundhog site and Hafod DOAS although at Cwm Level Park, and the St Thomas DOAS results from 2013 indicate an exceedence of the 10 permitted instances where the 8-hour means exceed 100ug/m^3

2.3.2 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[30]. 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 stably by the installed air conditioning system.

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

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

be present[31]. LAQM.TG(09) provides no direct guidance on $PM_{2.5}$,except for paragraphs 3.50 – 3.53.

There have 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, 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.[32] [33]

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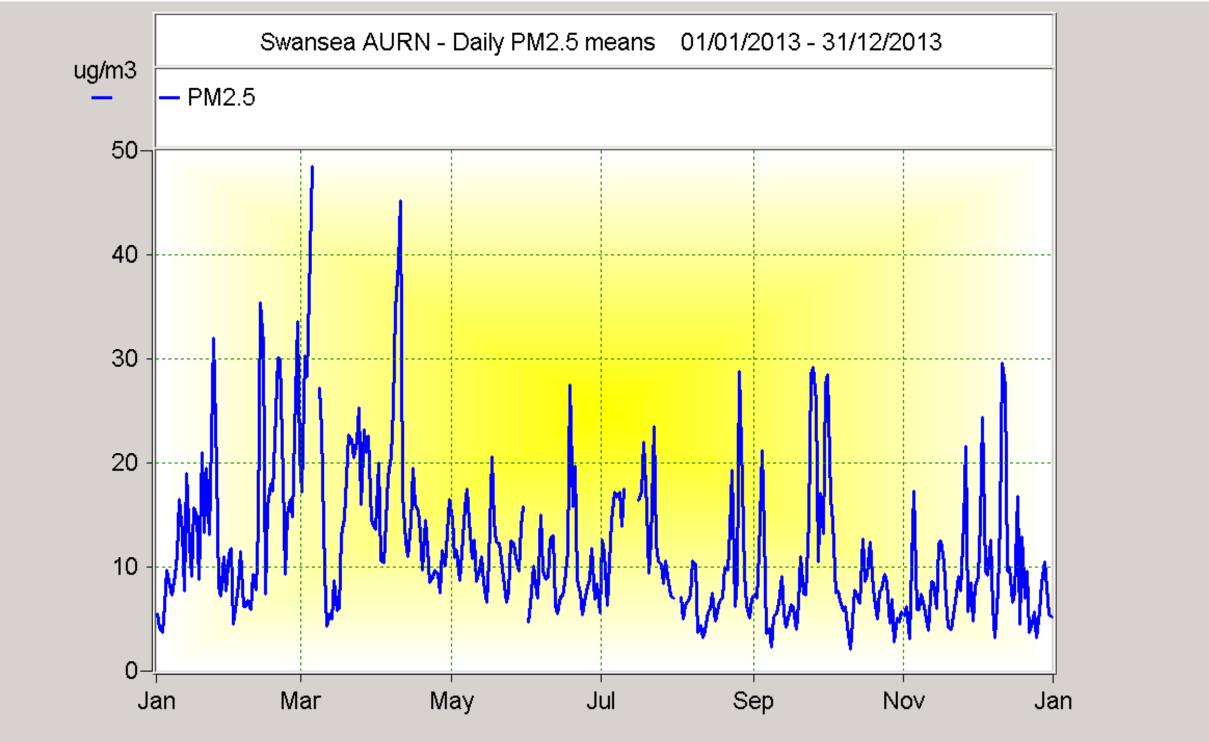
31 LAQM.TG(09) Calculation of Exceedence Statistics A1.216 page A1-48
32 http://www.metone.com/documents/Met_One_Letter_5.pdf
33 http://uk-air.defra.gov.uk/reports/cat05/0606130952_UKPMEquivalence.pdf

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 2013. Table 21 summarises $PM_{2.5}$ data between 2007 and 2013.

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.



Graph 22 – Daily $PM_{2.5}$ means – Swansea AURN 2013

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

Table 21 – Swansea AURN $PM_{2.5}$ daily means 2007-2013

Max 1-hour 2011 occurred on 5th November 2011

** ***Max 1-hour 2012 occurred on 5th November 2012***

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 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.

The City & County of Swansea facilitated a research study by a group comprising: School of Earth and Ocean Sciences Cardiff University, School of Biosciences

Cardiff University, and the Centre for Health and Environment Research, Department of Primary Care and Public Health, Neuadd Meirionydd into ultrafine and nanoparticles using a Dekati™ Electrical Low Pressure Impactor within a street canyon environment. The site chosen for measurements was the Hafod Post Office, Neath Road, Hafod, Swansea. This site is located within the Swansea Air Quality (NO_2) Management Area 2010.

Full details of the study are reproduced with the permission of the group, within Annexe 6.

2.3.3 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 2.1.10 above which outlines the overall monitoring program and sites chosen.

Several years of monitoring data are available and can be viewed within previous LAQM Progress Report reporting cycles undertaken online at http://www.swansea.gov.uk/index.cfm?articleid=9929

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 bezo(a)pyrene and, for ease of reference these are repeated below as table 22.

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

Table 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. Changes in the way that the parameter suit from the UK Network sites is reported to the authority now mean that only the annual averages can be presented for the Swansea Coedgwilym and Swansea Morriston sites for 2013.

Table 23 below presents the available monthly means for 2013 from the **Glais Primary School ❷** site. All results are expressed in ng/m^{-3}. **Please note that the monthly results for January – March 2013 with the flow corrected "annual" mean are presented for information only. Data capture during 2013 was 19% so no significance can be placed upon these data.**

Glais Primary School 2013											
2013	**As**	**Cd**	**Cr**	**Cu**	**Fe**	**Mn**	**Ni**	**Pb**	**Pt**	**V**	**Zn**	**Hg**
Jan	0.28	0.15	2.08	3.03	74	1.1	2.0	52.6	0.004	0.90	21.0	0.007
Feb	0.65	0.19	0.53	4.74	129	3.0	4.7	9.5	<0.001	0.60	21.3	0.014
Mar	0.90	0.22	0.32	4.19	202	5.3	4.6	11.2	0.002	0.93	25.4	0.017
***Ann Av.**	**0.60**	**0.19**	**1.00**	**3.79**	**138.4**	**3.39**	**4.15**	**14.1**	**0.00**	**0.52**	**0.79**	**19.79**

Table 23– Heavy Metals monitoring 2013 Glais Primary School

** Site ceased monitoring in April 2013. data capture 19%*

Table 24 below presents the monthly monitoring undertaken at the **YGG Gellionnen** ❹ (Welsh Primary School) for 2013 with the flow corrected annual means for each parameter.

YGG Gellionnen 2013												
2013	**As**	**Cd**	**Cr**	**Cu**	**Fe**	**Mn**	**Ni**	**Pb**	**Pt**	**V**	**Zn**	**Hg**
Jan	0.40	0.12	0.92	3.48	102	1.8	2.9	8.3	0.001	0.93	12.1	0.011
Feb	0.35	0.17	<0.01	2.16	108	2.5	3.3	5.6	0.001	0.65	16.8	0.017
Mar	0.75	0.25	0.01	3.86	226	5.4	7.1	9.6	0.041	1.27	22.4	0.224
April	-	-	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-	-	-
June	0.34	0.17	0.19	2.71	127	3.0	5.9	5.4	0.004	0.79	11.5	0.011
July	0.53	0.33	0.59	5.19	387	8.3	8.3	11.8	0.001	1.40	29.0	0.004
Aug	0.34	0.17	1.61	3.05	124	2.6	5.2	6.3	0.0005	0.98	13.2	0.004
Sept	0.46	0.25	1.06	3.27	143	3.9	4.3	6.4	<0.001	0.88	17.1	<0.001
Oct	0.36	0.39	3.59	3.24	128	2.4	8.4	7.5	<0.001	0.74	22.8	<0.001
Nov	0.80	0.21	4.90	5.14	116	2.2	9.3	11.7	<0.001	0.39	17.4	<0.001
Dec	0.73	0.26	14.95	4.10	263	5.2	16.5	8.4	0.0009	0.70	24.5	0.020
Ann Av.	**0.52**	**0.24**	**3.77**	**3.79**	**178.2**	**3.84**	**7.53**	**8.15**	**0.01**	**1.39**	**0.90**	**18.97**

Table 24– Heavy Metals monitoring 2013 YGG Gellionnen

Nickel annual mean data for **the Coed-Gwilym Cemetery site** ❸ and the **Morriston Groundhog** ❺ site during 2013 is presented below within table 25 which details the nickel annual mean results from all four monitoring stations during 2002 - 2013. 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

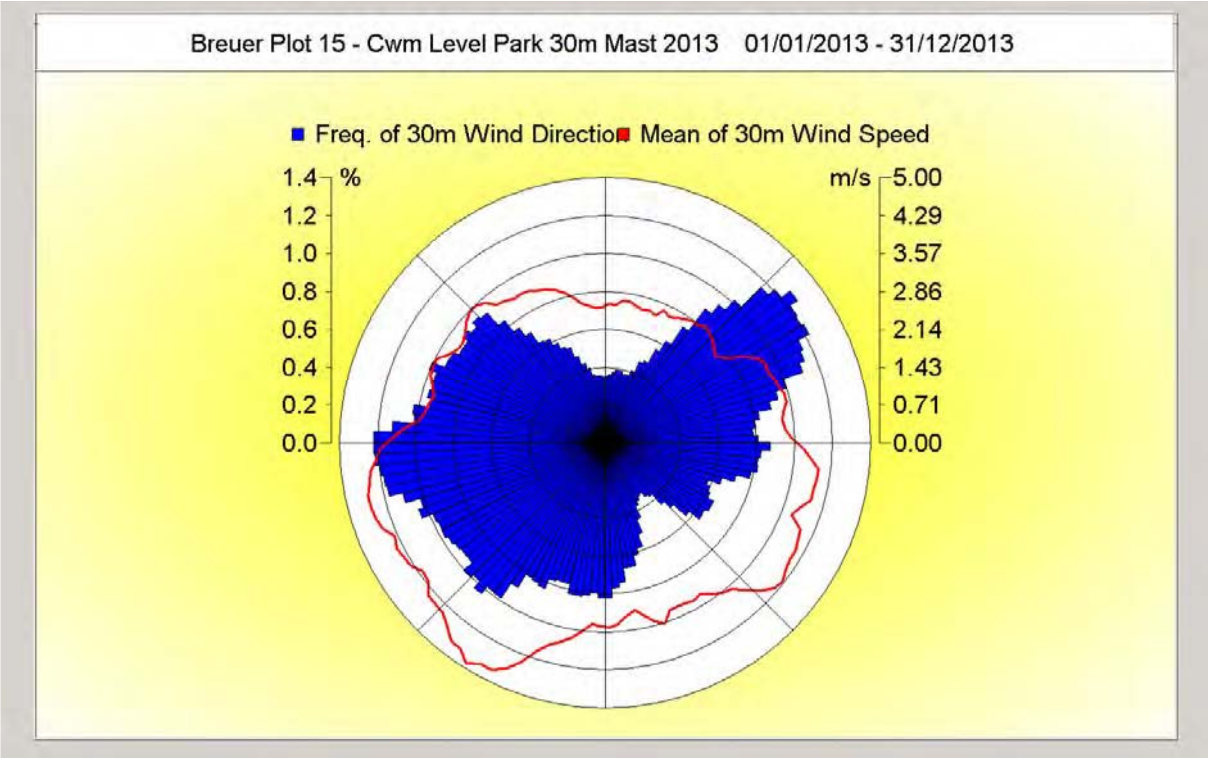
Table 25 – Swansea Nickel Annual Means 2002 – 2013

** 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 site can be seen from the data, albeit slightly tempered by the knowledge of a downturn in production due to the economic conditions that have been witnessed globally. The latest monitoring data from 2013 would indicate that the highest annual mean from the four sites within the City & County of Swansea, sits at 38.9% of the target value with an overall continued downward trend in concentrations continuing to be evident. The situation is significantly different within Pontardawe with one monitoring site close to one of the the identified sources being at 186.1% of the target value during 2013 (annual mean of 37.22 ng/m^{-3})

Breuer Plot 15 below shows the meteorological conditions recorded during 2013 at Cwm Level Park in the lower Swansea Valley.



Breuer Plot 15 – Cwm Level Park 30m Mast 2013

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 tables 23-25 it is clear that nickel compliance has been achieved at all monitoring sites (both UK Network sites and the City & County of Swansea funded sites) since 2008

Annual mean data between 2008 and 2013 for arsenic (As) and cadmium (Cd) is presented below within table 26**.** 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

Table 26 – Annual Mean Arsenic and Cadmium data 2008-2013

*** Data capture 19%**

From table 26 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 2013 for lead is presented within table 27 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

Table 27 – Annual Mean Lead data 2008-2013

*** Data capture 19%**

From the data available within table 27, 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

2013. Results of all compounds measured from 2007 to December 2012 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. 2012 and the pollutant of interest from the drop down list – each pollutant is displayed individually. However, it would appear that the data for 2013 is not available at the above site as yet. 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.

2.4 Summary of Compliance with AQS Objectives

The City & County of Swansea has measured concentrations of nitrogen dioxide during 2013 above the annual mean objective at relevant locations outside of the existing **Swansea Air Quality Management Area 2010.**

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 Progress Report from the authority as they view the Progress Report as a useful information source that provides the latest up to date overview of air quality matters without having to additionally refer to the latest USA. Given this view, the details presented have been updated from those submitted within the USA 2012. 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

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

within the then Hafod Air Quality Management Area and discounted[35] from further consideration.

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 28 were identified. These roads were not previously thought likely to present problems with the nitrogen dioxide annual mean objective but have been 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	Pontardulais
St Teilo Crescent	Pontardulais
Water Street	Pontardulais
Carnglas Road	Tycoch

Table 28 – Identified narrow Streets with AADT > 5000

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

The authorities' monthly exposure of passive nitrogen dioxide diffusion tubes was increased from 134 sites to 274 sites during November 2009 to assess locations within the above table. This work has now been undertaken and the results of monitoring are presented within tables 3 and 7 of section 2.3 above. 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 due to financial restrictions, further monitoring ceased at those sites during May 2011 that had exhibited bias corrected annual means concentrations consistently below 30ug/m^3.

However, there are some notable exceptions, mainly Newton Road in Mumbles. The situation at Newton road is outlined within section 2.3 where further monitoring has been undertaken during 2011-2013. This monitoring is likely to continue into the foreseeable future. The results of this further monitoring have confirmed the exceedence of the annual mean nitrogen dioxide objective first observed during 2010. **The authority's intentions with regard to Newton Road are outlined within section 10 – Conclusions and Proposed Actions**.

It is likely however that monitoring at sites 162-175 within the Pontardulais area will cease 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.

Monitoring commenced during 2012 at additional sites within the Gorseinon area. A request was received from the Traffic Management Group Leader to assess the impact of a traffic calming scheme designed to reduce and remove queuing traffic along High Street, Gorseinon and direct traffic down adjacent narrow residential streets. This work ceased during early 2014 as data is presented within table 7 above (sites 297-323) has indicated post traffic calming, that all locations remain below the nitrogen dioxide annual mean objective.

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 initiates to attract people to live within the city centre. The monitoring details are included within section 2.3 above and the results contained within table 7. The sites within the city centre are sites 112 - 134.

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 exceedences 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 2011 - 2013, whilst concentrations remain above the annual mean objective at these sites, there has been no indication that exceedence of the 1-hour objective was likely to have been observed. 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 suitable 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. The situations are described within section 2.3 above.

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

[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

once commercial area. One such development (Urban Village) was completed during 2013. A brief outline is provided within section 2.3 above whilst discussing the NO_2 passive tube diffusion results. 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 authority's intentions with regard to the High Street area are outlined within section 10 – Conclusions and Proposed Actions.

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

The authority now operate 54 GPRS traffic counters (5 of which were within the authorities Park & Ride sites but these will now be redeployed following the introduction of a new gated entry system into/out of the park and ride sites) that have been configured to produce a vehicle classification split into the EUR 6 basic categories as detailed below within table 47. Their location can be seen within Annexe 7. 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 2013 with just the addition of two or three sites (see above regarding deployment of spare Park & Ride counters).

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 29 – EUR6 Classification scheme

Data from the ATC network has been analysed for the years 2004 – 2013 for the basic three categories from the EUR6 classification employed that are required to produce the composition of flow within LAQM.TG(09) box 5.3 Section A3 page 5-12.

These details are provided separately for EUR6 classification categories 4-6 below within tables 29-32. Table 33 summarises the total HDV flows.

Class 4 L/M/HGV	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Site 1	5.2	4	5.1	4.8	4.1	3.5	3.6	3.8	**4.1**	4.4
Site 2	6	5.9	6.4	6.1	6.6	6.1	6.2	6.4	**6.2**	6.3
Site 3	4.1	3.2	4.3	4.5	7.4	16.2	4.7	4.8	**5.0**	5.2
Site 4	4	3.9	4.4	4.4	4.4	4.4	4.5	4.7	**4.7**	4.9
Site 5	5.6	5.3	5.6	5.8	5.9	5.4	5.6	5.5	5.8	5.5
Site 6	6.1	6.3	6.9	7.4	7.4	7.2	7.5	7.4	7.4	7.5
Site 7	3.9	3.8	4.2	4.5	4.8	4.6	4.7	4.8	4.9	5.2
Site 8	29.4	30	29.9	29.8	30.3	29.8	29.9	30.6	30	30.3
Site 9	6.4	6.2	6.4	6.6	6.2	5.8	6	6.2	6.2	6.5
Site 10	5	4.8	4.8	4.8	4.6	4.3	4.3	4.4	4.4	4.5
Site 11	5.8	5.8	6	6.5	6.9	6.3	6.9	6.5	6.9	6.9
Site 12	5.2	4.7	5.1	4.9	4.8	4.6	4.7	4.6	4.6	4.9
Site 13	4.9	4.5	4.7	4.6	4.5	4.3	4.6	4.5	4.3	4.5
Site 14	5.2	5.2	5.6	5.7	5.9	5.4	5.6	5.6	5.7	5.8
Site 15	5.4	13.5	8.4	14.4	6.1	6.1	6	6.2	6.1	6
Site 16	5.7	4.7	4.6	4.8	4.8	4.6	4.6	4.7	4.7	4.8
Site 17	2.2	2	4.3	4.1	5.3	5.1	5.3	5.4	5.4	5.5
Site 18	5	11	6.7	6.4	6.3	6.5	6.5	6.5	6.5	6.7
Site 19	5.6	5.4	5.6	5.7	5.7	5.4	5.6	5.7	5.6	5.7
Site 20	6	5.7	4.9	4.6	4.3	3.9	4.2	4.3	4.2	4
Site 21	6.1	5.8	6.4	6.5	6.7	6.5	6.5	6.7	6.8	6.8
Site 22	6.1	6.2	6.9	7	6.9	6.7	6.1	5.8	5.3	5.2
Site 23	4.7	4.5	4.8	5	4.9	4.5	4.6	4.7	4.8	4.9
Site 24	-	5.5	5.7	5.7	5.5	5.5	5.9	6.1	6	6.1
Site 25	-	4.1	4.5	6.2	6.0	5.6	5.9	6.0	5.8	6.1
Site 26	4.8	5.1	5.5	5.7	5.6	5.4	5.6	5.9	5.9	6.1
Site 27	4.3	4.5	5.1	5.5	5.7	15.6	4.5	4.6	4.4	4.5
Site 28	4.2	4.3	4.8	4.9	4.9	4.6	4.4	4.6	4.6	4.8
Site 29	4.7	4.4	4.7	4.9	4.7	4.7	4.8	5	4.8	4.8
Site 30	-	12.6	6.6	4.1	4.2	3.9	4.2	4.1	4.2	4.4
Site 31	4.1	4.1	4.4	4.6	4.7	4.7	4.8	5.1	5.1	4.7
Site 32	-	16.8	8.2	3.8	3.8	3.9	3.9	3.9	4.1	4.3
Site 33	4.1	3.9	4.2	4.4	4.4	4.5	4.6	4.5	4.6	4.6
Site 34	-	13.2	6.8	4.3	4.4	4.4	4.2	4.1	4.1	4
Site 35	-	37.5	13.9	5.3	5.7	4.8	5	5.1	5.2	5.4
Site 36	-	-	-	-	-	-	-		-	-
Site 37	-	3.8	3.4	3.8	3.9	3.5	3.6	3.8	3.5	3.6
Site 38	-	5.9	6.4	6.5	6.3	5.8	8.6	18.8	7	6
Site 39	-	4.5	4.7	4.6	5.2	4.9	5.2	5	4.8	4.7
Site 40	3	3.1	3.5	3.8	3.9	4.0	3.8	3.9	3.9	4
Site 41	-	2.9	2.9	2.7	3.4	3.0	3.1	3.2	3.1	3.1
Site 42	-	10.9	6.9	5.2	5.1	5.0	4.8	4.9	5	5.1
Site 43	-	4.8	5.1	5.6	5.6	5.3	5.5	5.8	6	6.1
Site 44	-	-	-	6.1	6.1	5.8	6.0	6.1	6.0	6.2
Site 50	-	-	-	-	-	-	-	-	-	3.7
Site 51	-	-	-	-	-	-	-	-	-	4.2
Site 52	-	-	-	-	-	-	-	-	-	4.5
Site 53	-	-	-	-	-	-	-	-	-	4.7
Site 54	-	-	-	-	-	-	-	-	-	6.2
Site 55	-	-	-	-	-	-	-	-	-	7.0

Table 29 – EUR6 Classification scheme 2004-2013 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 some time 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

The authority installed an additional four ATC counters during May 2012 at :

- Site 50 Gower Road, Upper Killay
- Site 51 Mumbles Road, Brynmill (A483)
- Site 52 West Street Gorseinon
- Site 53 Victoria Road, Gowerton

During May 2013 a further two ATC sites were established at:

- Site 54 Newton Road, Mumbles
- Site 55 Peniel Green Road, Llansamlet (A48)

Data for 2013 is presented for sites 54 and 55 but these data should be treated with caution until a full calendar year of data is available.

Class 5 Artic HGV + Trailer	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Site 1	0.3	0	0.2	0	0	0.2	0.2	0.2	0.2	0.2
Site 2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Site 3	0	0	0.0	0.0	0.0	0.2	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
Site 5	0	0	0.3	0.3	0.3	0.3	0.3	0.0	0.3	0.3
Site 6	0.6	0.6	0.8	0.8	0.8	0.7	0.4	0.6	0.5	0.5
Site 7	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Site 8	2.9	2.9	1.9	1.1	1.8	2.1	2.3	2.4	2.2	1.5
Site 9	0.5	0.5	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 10	0.4	0.4	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
Site 12	0.3	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Site 13	0.5	0.4	0.4	0.4	0.2	0.2	0.2	0.4	0.2	0.2
Site 14	0.2	0.2	0.3	0.3	0.1	0.2	0.3	0.3	0.2	0.2
Site 15	0	0.3	0.1	0.3	0.1	0.2	0.5	0.4	0.4	0.5
Site 16	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 17	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 18	0.3	0.8	0.2	0.4	0.2	0.5	0.6	0.6	0.5	0.5
Site 19	0.3	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Site 20	0.8	0.8	0.7	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Site 21	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 22	0.7	0.6	0.4	0.4	0.4	0.2	0.4	0.3	0.2	0.2
Site 23	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.1
Site 24	-	0	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Site 25	-	1.1	0.5	0.4	0.3	0.3	0.4	0.4	0.4	0.4
Site 26	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Site 27	0.2	0.3	0.3	0.2	0.4	0.3	0.4	0.2	0.2	0.2
Site 28	0	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4
Site 29	0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Site 30	-	0.3	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.2
Site 31	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Site 32	-	0	0.1	0	0	0.0	0	0	0.2	0.2
Site 33	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 34	-	0.6	0.3	0.2	0.1	0.1	0.8	0.1	0.1	0.1
Site 35	-	1.2	0.7	0.2	0.4	0.2	0.2	0.4	0.4	0.4
Site 36	-	-	-	-	-	-	-	-	-	
Site 37	-	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.3	0.4
Site 38	-	0	0.3	0	0.3	0.3	0.3	0.5	0.3	0.3
Site 39	-	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Site 40	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	0.2	0.3
Site 42	-	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Site 43	-	1.1	0.9	0.9	1	0.8	1	0.9	1	1
Site 44	-	-	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Site 50	-	-	-	-	-	-	-	-	-	0.0
Site 51	-	-	-	-	-	-	-	-	-	0.4
Site 52	-	-	-	-	-	-	-	-	-	0.2
Site 53	-	-	-	-	-	-	-	-	-	0.1
Site 54	-	-	-	-	-	-	-	-	-	0.0
Site 55	-	-	-	-	-	-	-	-	-	1.2

Table 30 – EUR6 Classification scheme 2004-2013 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.

The authority installed an additional four ATC counters during May 2012 at :

- Site 50 Gower Road, Upper Killay
- Site 51 Mumbles Road, Brynmill (A483)
- Site 52 West Street Gorseinon
- Site 53 Victoria Road, Gowerton

During May 2013 a further two ATC sites were established at:

- Site 54 Newton Road, Mumbles
- Site 55 Peniel Green Road, Llansamlet (A48)

Data for 2013 is presented for sites 54 and 55 but these data should be treated with caution until a full calendar year of data is available.

Class 6 Bus	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Site 1	0.3	0.3	1.2	1.6	1.4	1	0.8	0.6	0.4	0.2
Site 2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.2	0.2
Site 3	0.2	0.2	0.5	0.5	0.6	0.6	0.6	0.6	0.2	0.2
Site 4	0	0.3	0.5	0.7	0.7	0.7	0.7	0.5	0.2	0.0
Site 5	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Site 6	1.4	1.3	1.8	1.9	1.7	1.0	0.6	0.3	0.2	0.2
Site 7	0.5	0.4	0.6	0.8	1	0.7	1.4	0.6	0.5	0.4
Site 8	1.5	1.4	0	1.1	0	0.0	0	0	0	0
Site 9	0.5	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2
Site 10	0.4	0.3	0.7	0.9	0.5	0.2	0.2	0.2	0.4	0.5
Site 11	0.8	0.8	2.7	2.9	3.4	2.9	2.9	2.9	2.9	3.4
Site 12	0.3	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
Site 13	0.6	0.4	0.2	0.2	0.4	0.4	0.2	0.2	0.2	0.2
Site 14	1.5	1.3	2	2.2	1.9	1.3	1	0.9	0.8	0.6
Site 15	0.9	1	1.1	1.2	1.1	0.9	0.6	0.5	0.5	0.5
Site 16	0.7	0.2	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.3
Site 17	0.3	0.2	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2
Site 18	1	1.6	2.1	2.1	1.7	1.3	1.3	1	0.9	0.9
Site 19	1.2	1.2	2.5	3.3	3.6	3.3	3.1	2.9	3	3
Site 20	1.1	1.1	1	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Site 21	0.2	0.3	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2
Site 22	3.6	3.2	6.7	8.4	8.7	7.4	6.5	5.6	5.3	5.9
Site 23	0.5	0.4	0.7	0.9	0.9	0.8	0.8	0.8	0.9	1.1
Site 24	-	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.8
Site 25	-	0.7	0.5	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Site 26	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4
Site 27	0.5	0.4	0.5	0.6	0.6	0.6	0.4	0.4	0.3	0.4
Site 28	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Site 29	0	0.3	1.3	1.7	1.7	1.7	1.6	1.4	1.2	1.8
Site 30	-	0.8	0.8	0.8	0.8	0.8	0.6	0.7	0.7	0.7
Site 31	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.3	0.3
Site 32	-	1.3	1.3	1.4	1.4	1.2	1.2	1	1	1
Site 33	0.2	0.5	1.1	1.5	1.3	1.3	1.3	1	1.1	0.9
Site 34	-	1.5	1.5	1.7	1.7	1.6	0.9	0.3	0.3	0.3
Site 35	-	2	1.6	1.5	1.4	1.2	1	0.9	1	1
Site 36	-	-	-	-	-	-	-	-	-	
Site 37	-	0.9	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.8
Site 38	-	0.7	1.6	2.1	1.8	1.0	1.2	1.8	0.8	0.8
Site 39	-	0.2	0.4	0.7	0.8	0.8	0.9	0.7	0.8	0.9
Site 40	0	0.3	0.7	0.7	0.7	0.7	0.8	0.5	0.5	0.5
Site 41	-	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4
Site 42	-	0.8	1	1.1	1.1	1.1	1	0.8	0.8	0.9
Site 43	-	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
Site 44	-	-	-	0.9	0.9	0.9	1.0	0.9	0.9	0.9
Site 50	-	-	-	-	-	-	-	-	-	0.4
Site 51	-	-	-	-	-	-	-	-	-	0.7
Site 52	-	-	-	-	-	-	-	-	-	1.1
Site 53	-	-	-	-	-	-	-	-	-	0.3
Site 54	-	-	-	-	-	-	-	-	-	0.7
Site 55	-	-	-	-	-	-	-	-	-	0.4

Table 31 – EUR6 Classification scheme 2004-2013 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

The authority installed an additional four ATC counters during May 2012 at :

- Site 50 Gower Road, Upper Killay
- Site 51 Mumbles Road, Brynmill (A483)
- Site 52 West Street Gorseinon
- Site 53 Victoria Road, Gowerton

During May 2013 a further two ATC sites were established at:

- Site 54 Newton Road, Mumbles
- Site 55 Peniel Green Road, Llansamlet (A48)

Data for 2013 is presented for sites 54 and 55 but these data should be treated with caution until a full calendar year of data is available.

HDV as % of Traffic Flow	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Site 1	5.8	4.3	6.5	6.4	5.5	4.7	4.6	4.6	4.7	4.8
Site 2	6.4	6.3	6.6	6.3	6.9	6.4	6.6	6.7	6.4	6.7
Site 3	4.3	3.4	4.8	5	8	17	5.3	5.4	5.2	5.4
Site 4	4	4.2	4.9	5.1	5.1	5.1	5.2	5.2	4.9	4.9
Site 5	5.6	5.3	5.9	6.1	6.2	5.7	5.9	5.5	6.1	5.8
Site 6	8.1	8.2	9.5	10.1	9.9	8.9	8.5	8.3	8.1	8.2
Site 7	4.6	4.3	4.9	5.4	5.9	5.4	6.2	5.5	5.5	5.7
Site 8	33.8	34.3	31.8	32	32.1	31.9	32.2	33	32.2	31.8
Site 9	7.4	7	7.4	7.4	7	6.6	6.8	7	6.8	7.1
Site 10	5.8	5.5	5.7	5.9	5.3	4.7	4.7	4.8	5	5.2
Site 11	6.6	6.6	8.7	9.4	10.3	9.2	9.8	9.4	9.8	10.3
Site 12	5.8	5.5	5.4	5.2	5	4.8	4.9	4.8	4.8	5.3
Site 13	6	5.3	5.3	5.2	5.1	4.9	5	5.1	4.7	4.9
Site 14	6.9	6.7	7.9	8.2	7.9	6.9	6.9	6.8	6.7	6.6
Site 15	6.3	14.8	9.6	15.9	7.3	7.2	7.1	7.1	7	7
Site 16	6.7	5.1	5.1	5.3	5.4	5.1	5	5.1	5.1	5.3
Site 17	2.6	2.4	4.9	4.7	5.9	5.6	5.7	5.8	5.8	5.9
Site 18	6.3	13.4	9	8.9	8.2	8.3	8.4	8.1	7.9	8.1
Site 19	7.1	7	8.3	9.2	9.4	8.9	8.9	8.8	8.8	8.9
Site 20	7.9	7.6	6.6	6	5.7	5.2	5.5	5.6	5.5	5.3
Site 21	6.7	6.4	7.1	7.2	7.2	7	7	7.2	7.2	7.2
Site 22	10.4	10	14	15.8	16	14.3	13	11.7	10.8	11.3
Site 23	5.5	5.1	5.7	6.1	6	5.4	5.6	5.7	5.8	6.1
Site 24	-	6.1	6.6	6.6	6.4	6.6	7	7.2	7.2	7.2
Site 25	-	5.9	5.5	7.4	7.1	6.7	7.2	7.3	7.1	7.4
Site 26	5.8	5.9	6.2	6.5	6.4	6	6.3	6.6	6.6	6.7
Site 27	5	5.2	5.9	6.3	6.7	6.5	5.3	5.2	4.9	5.1
Site 28	4.6	4.9	5.5	5.6	5.6	5.4	5.2	5.4	5.4	5.6
Site 29	4.7	5	6.2	6.8	6.6	6.6	6.6	6.6	6.2	6.9
Site 30	-	13.7	7.6	5	5.1	4.8	5	4.9	5.1	5.3
Site 31	4.7	4.6	5.1	5.3	5.4	5.4	5.5	5.8	5.6	5.2
Site 32	-	18.1	9.6	5.2	5.2	5.1	5.1	4.9	5.3	5.5
Site 33	4.5	4.6	5.5	6.1	5.9	6	6.1	5.7	5.9	5.7
Site 34	-	15.3	8.6	6.2	6.2	6.1	5.9	4.5	4.5	4.4
Site 35	-	40.7	16.2	7	7.5	6.2	6.2	6.4	6.6	6.8
Site 36	-	-	-	-	-	-	-			
Site 37	-	5.1	4.6	5	5.2	4.8	4.8	5.2	4.4	4.8
Site 38	-	6.6	8.3	8.6	8.4	7.1	10.1	21.1	8.1	7.1
Site 39	-	4.9	5.4	5.6	6.3	6	6.4	6	5.8	5.8
Site 40	3	3.4	4.2	4.5	4.6	4.7	4.6	4.4	4.4	4.5
Site 41	-	3.3	3.3	3.1	3.8	3.5	3.7	3.8	3.7	3.8
Site 42	-	12.1	8.1	6.5	6.4	6.3	6	5.9	6	6.2
Site 43	-	6.3	6.4	6.9	7	6.5	6.9	7	7.3	7.4
Site 44	-	-	-	7.4	7.4	7.1	7.4	7.4	7.3	7.5
Site 50	-	-	-	-	-	-	-	-	-	4.1
Site 51	-	-	-	-	-	-	-	-	-	5.3
Site 52	-	-	-	-	-	-	-	-	-	5.8
Site 53	-	-	-	-	-	-	-	-	-	5.1
Site 54	-	-	-	-	-	-	-	-	-	6.9
Site 55	-	-	-	-	-	-	-	-	-	8.6

Table 32– HDV composition from EUR6 Classification scheme 2004-2013

The authority installed an additional four ATC counters during May 2012 at :

- Site 50 Gower Road, Upper Killay
- Site 51 Mumbles Road, Brynmill (A483)
- Site 52 West Street Gorseinon
- Site 53 Victoria Road, Gowerton

During May 2013 a further two ATC sites were established at:

- Site 54 Newton Road, Mumbles
- Site 55 Peniel Green Road, Llansamlet (A48)

Data for 2013 is presented for sites 54 and 55 but these data should be treated with caution until a full calendar year of data is available

LAQM.TG(09) box 5.3 Section A3 page 5-12 defines roads with an unusually high proportion of HDV as ones with a HDV content greater than 20%. From table 32 it can be seen that only site 8 at Morfa Road consistently meets this definition. As explained above, there is at present no relevant exposure at this location as Morfa Road leads into an industrial estate that also houses the main transport depot for the authority.

However, this situation has change significantly within the last 6-12 months. Residential development at the former Unit Superheaters site commenced during mid 2011 mainly with single storey “town housing/link houses” to the southern/eastern edge of the site. A number of these properties are now occupied. During 2012 and into 2013, the developer constructed blocks of flats within the middle section of the site. Development has now focused on the remaining areas of the site that border both New Cut Road and Morfa Road directly behind the authorities’ main transport depot. It is not known whether the authority’s transportation depot will have been sold off prior to occupation of these dwellings. If not, the HDV content existing along Morfa Road will remain, become significant and therefore guidance within LAQM.TG(09) box 5.3 will become relevant. As part of a Section 106 agreement entered into with the developer a real-time chemiluminescent analyser is to be installed along the façade of proposed student flats fronting Morfa Road/New Cut Road. As time progresses, details from this new monitoring location will be incorporated within the authorities reporting.

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 is due to be 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.

The high HDV composition at site 38 during 2011 may be as a result of gas main replacement works along the outbound carriageway of Carmarthen Road causing traffic to divert to avoid delays and congestion. Data for 2012 and 2013 indicate that flows have returned to what can be considered as “normal”. No significance has been placed on the 2011 data as an indication of likely future flows.

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 within tables 29-32 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 requires the identification of all “busy” junctions. A busy junction is defined within LAQM.TG(09) as one with more than 10,000 vehicles per day. An additional requirement is 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). 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 2.3 above.

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} [38] (similar in operation to the MetOne PM_{10} Bam1020) but not referenced for equivalency to the EU gravimetric method. As outlined within sections 2.1.8 – 2.1.12 five EBam PM_{10} units have been installed at :-

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

Monitoring results for 2013 are presented within table 12 with charts 8-12 and Breuer Plots 7-11 providing additional information.

[38] 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 3.1.3 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 2006-2013 and these data are presented below within tables 33- 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 33 - 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.

The authority installed an additional four ATC counters during May 2012 at :

- Site 50 Gower Road, Upper Killay
- Site 51 Mumbles Road, Brynmill (A483)
- Site 52 West Street Gorseinon
- Site 53 Victoria Road, Gowerton

During May 2013 a further two ATC sites were established at:

- Site 54 Newton Road, Mumbles
- Site 55 Peniel Green Road, Llansamlet (A48)

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2006	Percentage Vehicle Classes							AADT	AWDT
	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6		
Site 1	0.8	0.8	91.5	0.4	5.1	0.2	1.2	**12072**	**12792**
Site 2	0.0	0.7	92.4	0.3	6.4	0.0	0.2	**14160**	**15288**
Site 3	0.0	0.4	94.6	0.2	4.3	0.0	0.5	**13272**	**14016**
Site 4	0.0	0.5	94.4	0.2	4.4	0.0	0.5	**10392**	**10848**
Site 5	0.0	0.9	92.9	0.3	5.6	0.3	0.0	**7728**	**8376**
Site 6	0.0	1.3	88.7	0.5	6.9	0.8	1.8	**14616**	**15240**
Site 7	0.0	0.7	94.2	0.2	4.2	0.1	0.6	**21576**	**22680**
Site 8	0.0	3.7	63.6	0.9	29.9	1.9	0	**2568**	**3264**
Site 9	0.0	0.6	91.7	0.4	6.4	0.6	0.4	**12984**	**13488**
Site 10	0.0	0.6	93.5	0.3	4.8	0.2	0.7	**21672**	**22992**
Site 11	0.0	0.5	89.6	1.1	6	0	2.7	**4368**	**4560**
Site 12	0.0	0.6	93.8	0.1	5.1	0.2	0.1	**19440**	**21144**
Site 13	0.0	0.5	93.9	0.4	4.7	0.4	0.2	**13320**	**15168**
Site 14	0.0	0.9	90.5	0.6	5.6	0.3	2	**15408**	**16128**
Site 15	0.0	0.5	89.6	0.2	8.4	0.1	1.1	**22032**	**23520**
Site 16	0.0	0.6	94.1	0.3	4.6	0.2	0.3	**27120**	**28968**
Site 17	0.0	1.2	93.6	0.3	4.3	0.2	0.4	**27336**	**28824**
Site 18	0.0	1.4	89.5	0.2	6.7	0.2	2.1	**15744**	**16608**
Site 19	0.0	0.6	90.6	0.5	5.6	0.2	2.5	**23232**	**24144**
Site 20	0.0	0.9	92.1	0.4	4.9	0.7	1	**32904**	**34488**
Site 21	0.0	0.6	92	0.3	6.4	0.2	0.5	**30528**	**32592**
Site 22	0.0	0.7	84	1.3	6.9	0.4	6.7	**10752**	**10896**
Site 23	0.0	0.4	93.4	0.4	4.8	0.2	0.7	**22656**	**24072**
Site 24	0.0	2.2	90.8	0.2	5.7	0.2	0.7	**9672**	**10272**
Site 25	0.0	2.3	91.9	0.3	4.5	0.5	0.5	**23160**	**24720**
Site 26	0.0	0.5	92.9	0.3	5.5	0.3	0.4	**22440**	**23664**
Site 27	0.1	0.5	93	0.4	5.1	0.3	0.5	**17496**	**18528**
Site 28	0.0	0.7	93.5	0.4	4.8	0.2	0.5	**13584**	**14352**
Site 29	0.0	0.9	92.3	0.6	4.7	0.2	1.3	**11208**	**11856**
Site 30	0.0	1	91.2	0.2	6.6	0.2	0.8	**21480**	**22728**
Site 31	0.0	0.9	93.6	0.4	4.4	0.3	0.4	**16416**	**16944**
Site 32	0.0	0.4	89.8	0.1	8.2	0.1	1.3	**16464**	**17352**
Site 33	0.0	0.7	93.4	0.4	4.2	0.2	1.1	**21864**	**22848**
Site 34	0.0	0.7	90.6	0.1	6.8	0.3	1.5	**17088**	**18048**
Site 35	0.0	4.2	78.9	0.7	13.9	0.7	1.6	**13656**	**14088**
Site 36	-	-	-	-	-	-	-	**-**	**-**
Site 37	5.4	2.7	86.9	0.4	3.4	0.4	0.8	**44088**	**45816**
Site 38	0.0	0.8	90.4	0.5	6.4	0.3	1.6	**8976**	**9576**
Site 39	0.0	1.9	92.4	0.3	4.7	0.3	0.4	**23664**	**24936**
Site 40	0.0	0.7	94.9	0.2	3.5	0	0.7	**10248**	**11040**
Site 41	0.0	2	94.5	0.3	2.9	0.2	0.2	**30768**	**32424**
Site 42	0.0	0.7	91.1	0.2	6.9	0.2	1	**14592**	**15624**
Site 43	0.0	1.4	91.7	0.5	5.1	0.9	0.4	**31248**	**33696**

Table 33 – GPRS ATC Classification split 2006

2007	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	0.6	92.8	0.2	4.8	0	1.6	**11976**	**12696**
Site 2	0.0	0.7	92.9	0.2	6.1	0.0	0.2	**13824**	**14904**
Site 3	0.0	0.4	94.4	0.2	4.5	0.0	0.5	**13272**	**14016**
Site 4	0.0	0.5	94.4	0.0	4.4	0.0	0.7	**10368**	**10848**
Site 5	0.0	0.9	92.6	0.3	5.8	0.3	0.0	**7800**	**8472**
Site 6	0.0	1.3	88.3	0.3	7.4	0.8	1.9	**14952**	**15576**
Site 7	0.0	0.7	93.8	0.1	4.5	0.1	0.8	**20424**	**21504**
Site 8	0.0	3.2	63.8	1.1	29.8	1.1	1.1	**2280**	**2880**
Site 9	0.0	0.5	92	0.2	6.6	0.4	0.4	**13536**	**13944**
Site 10	0.3	0.6	92.9	0.2	4.8	0.2	0.9	**21432**	**22584**
Site 11	0.0	0.6	89.4	0.6	6.5	0	2.9	**4056**	**4248**
Site 12	0.0	0.7	93.9	0.1	4.9	0.2	0.1	**19896**	**21504**
Site 13	0.0	0.6	93.6	0.4	4.6	0.4	0.2	**13080**	**14856**
Site 14	0.0	1.1	90.3	0.3	5.7	0.3	2.2	**15072**	**15672**
Site 15	0.0	0.5	83.3	0.3	14.4	0.3	1.2	**22368**	**23976**
Site 16	0.0	0.7	93.8	0.2	4.8	0.2	0.3	**27600**	**29304**
Site 17	0.0	1.3	93.7	0.3	4.1	0.2	0.4	**27360**	**28728**
Site 18	0.0	1.6	89.3	0.1	6.4	0.4	2.1	**16200**	**17112**
Site 19	0.0	0.7	89.9	0.1	5.7	0.2	3.3	**22704**	**23472**
Site 20	0.0	1.1	92.6	0.3	4.6	0.5	0.9	**32976**	**34896**
Site 21	0.0	0.8	91.8	0.2	6.5	0.2	0.5	**30984**	**33000**
Site 22	0.0	0.7	83.3	0.2	7	0.4	8.4	**10896**	**11040**
Site 23	0.0	0.5	93.1	0.2	5	0.2	0.9	**22344**	**23568**
Site 24	0.0	2.2	90.8	0.2	5.7	0.2	0.7	**9696**	**10296**
Site 25	0.0	1.0	91.4	0.2	6.2	0.4	0.8	**12000**	**12600**
Site 26	0.0	0.5	92.6	0.3	5.7	0.3	0.5	**22584**	**23808**
Site 27	0.0	0.9	92.6	0.2	5.5	0.2	0.6	**22320**	**23760**
Site 28	0.0	0.9	93.3	0.2	4.9	0.2	0.5	**13656**	**14424**
Site 29	0.0	0.8	92.2	0.2	4.9	0.2	1.7	**11328**	**12000**
Site 30	0.0	1	93.9	0.2	4.1	0.1	0.8	**22344**	**23712**
Site 31	0.0	1	93.3	0.3	4.6	0.3	0.4	**16056**	**16584**
Site 32	0.0	0.5	94.3	0.2	3.8	0	1.4	**15984**	**16896**
Site 33	0.0	0.7	93.1	0.1	4.4	0.2	1.5	**21312**	**22272**
Site 34	0.0	0.8	92.9	0.2	4.3	0.2	1.7	**15144**	**16032**
Site 35	0.0	3.6	89.2	0.2	5.3	0.2	1.5	**12696**	**13152**
Site 36	-	-	-	-	-	-	-	**-**	
Site 37	0.0	2.6	92	0.5	3.8	0.5	0.7	**47592**	**49728**
Site 38	0.0	0.8	90.6	0	6.5	0	2.1	**9240**	**9864**
Site 39	6.0	2.1	86.1	0.2	4.6	0.3	0.7	**23280**	**24384**
Site 40	0.0	0.7	94.8	0	3.8	0	0.7	**10200**	**10968**
Site 41	0.0	2.3	94.5	0.2	2.7	0.2	0.2	**30720**	**32280**
Site 42	0.0	0.8	92.6	0.2	5.2	0.2	1.1	**14904**	**15936**
Site 43	0.0	1.5	91.2	0.5	5.6	0.9	0.4	**30648**	**32976**
Site 44	0.0	0.9	91.4	0.2	6.1	0.4	0.9	**10944**	**11544**

Table 34 – GPRS ATC Classification split 2007

2008	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	0.9	93.4	0.2	4.1	0	1.4	**10584**	**11232**
Site 2	0.0	0.7	92.2	0.2	6.6	0.0	0.3	**14472**	**15648**
Site 3	0.0	0.4	91.4	0.2	7.4	0.0	0.6	**12048**	**12720**
Site 4	0.0	0.5	94.4	0.0	4.4	0.0	0.7	**9936**	**10392**
Site 5	0.0	0.9	92.5	0.3	5.9	0.3	0.0	**7656**	**8304**
Site 6	0.0	1.2	88.6	0.3	7.4	0.8	1.7	**15528**	**16392**
Site 7	0.0	0.8	93.2	0.1	4.8	0.1	1	**20064**	**21264**
Site 8	0.0	4.6	62.4	0.9	30.3	1.8	0	**2616**	**3336**
Site 9	0.0	0.6	92.4	0.2	6.2	0.4	0.4	**12864**	**13272**
Site 10	0.0	0.3	93.7	0.7	4.6	0.2	0.5	**21312**	**22560**
Site 11	0.0	0.6	89.1	0	6.9	0	3.4	**4176**	**4344**
Site 12	0.0	0.6	94.2	0.1	4.8	0.1	0.1	**19440**	**21000**
Site 13	0.0	0.6	94.2	0.2	4.5	0.2	0.4	**12864**	**14616**
Site 14	0.0	0.9	90.9	0.3	5.9	0.1	1.9	**16368**	**17328**
Site 15	0.0	0.6	91.9	0.2	6.1	0.1	1.1	**22512**	**24192**
Site 16	0.0	0.7	93.8	0.2	4.8	0.2	0.4	**26976**	**28872**
Site 17	0.0	0.7	93.3	0.2	5.3	0.2	0.4	**27048**	**28680**
Site 18	0.0	0.4	91.2	0.3	6.3	0.2	1.7	**15744**	**16728**
Site 19	0.0	0.8	89.7	0.1	5.7	0.1	3.6	**18216**	**18840**
Site 20	0.0	1.1	92.9	0.3	4.3	0.5	0.9	**31560**	**33144**
Site 21	0.0	0.8	91.8	0.2	6.7	0.2	0.3	**30744**	**32976**
Site 22	0.0	0.7	83	0.2	6.9	0.4	8.7	**10728**	**10824**
Site 23	0.0	0.5	93.3	0.2	4.9	0.2	0.9	**22200**	**23544**
Site 24	0.0	4	89.3	0.2	5.5	0.2	0.7	**9672**	**10344**
Site 25	0.0	0.8	91.8	0.2	6.0	0.3	0.8	**14352**	**15192**
Site 26	0.0	0.5	92.8	0.2	5.6	0.3	0.5	**22440**	**23904**
Site 27	0.0	0.7	92.4	0.2	5.7	0.4	0.6	**19920**	**21288**
Site 28	0.0	0.7	93.3	0.4	4.9	0.2	0.5	**13248**	**14088**
Site 29	0.0	0.9	92.3	0.2	4.7	0.2	1.7	**11160**	**11832**
Site 30	0.0	1	93.8	0.2	4.2	0.1	0.8	**21936**	**23376**
Site 31	0.0	1.1	93.3	0.3	4.7	0.2	0.5	**15360**	**15888**
Site 32	0.0	0.5	94.2	0.2	3.8	0	1.4	**15792**	**16704**
Site 33	0.0	0.7	93.3	0.1	4.4	0.2	1.3	**21408**	**22488**
Site 34	0.0	0.7	92.9	0.1	4.4	0.1	1.7	**16824**	**17928**
Site 35	0.0	3.3	89.1	0.2	5.7	0.4	1.4	**12288**	**12744**
Site 36	-	-	-	-	-	-	-	**-**	**-**
Site 37	0.0	1.7	92.5	0.6	3.9	0.5	0.8	**45960**	**47712**
Site 38	0.0	0.8	90.3	0.5	6.3	0.3	1.8	**9144**	**9792**
Site 39	0.0	1.7	91.8	0.2	5.2	0.3	0.8	**23208**	**24360**
Site 40	0.0	0.7	94.7	0	3.9	0	0.7	**9936**	**10680**
Site 41	0.0	1	95	0.2	3.4	0.2	0.2	**29856**	**31512**
Site 42	0.0	0.8	92.6	0.2	5.1	0.2	1.1	**14976**	**16056**
Site 43	0.8	1.5	90.2	0.5	5.6	1	0.4	**29784**	**32232**
Site 44	0.0	0.9	91.5	0.2	6.1	0.4	0.9	**13344**	**14184**

Table 35 – GPRS ATC Classification split 2008

2009	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	1	94.1	0.2	3.5	0.2	1	**11808**	**12552**
Site 2	0.0	0.7	92.5	0.2	6.1	0.0	0.3	**14448**	**15624**
Site 3	0.0	0.4	82.5	0.2	16.2	0.2	0.6	**12888**	**13656**
Site 4	0.0	0.5	94.4	0.0	4.4	0.0	0.7	**9864**	**10368**
Site 5	0.0	1	93	0.3	5.4	0.3	0.0	**7152**	**7680**
Site 6	0.0	1.3	89.6	0.2	7.2	0.7	1.0	**14232**	**14880**
Site 7	0.0	0.7	93.6	0.1	4.6	0.1	0.7	**19248**	**20376**
Site 8	0.0	5.3	61.7	1.1	29.8	2.1	0.0	**2256**	**2880**
Site 9	0.0	0.6	92.8	0.2	5.8	0.4	0.4	**12912**	**13368**
Site 10	0.0	0.6	93.9	0.8	4.3	0.2	0.2	**21624**	**22968**
Site 11	0.0	0.6	90.2	0.0	6.3	0.0	2.9	**4200**	**4368**
Site 12	0.0	0.7	94.3	0.1	4.6	0.1	0.1	**19776**	**21456**
Site 13	0.0	0.6	94.4	0.2	4.3	0.2	0.4	**12792**	**14568**
Site 14	0.0	1	91.8	0.3	5.4	0.2	1.3	**14952**	**15696**
Site 15	0.0	0.8	91.8	0.1	6.1	0.2	0.9	**20544**	**21864**
Site 16	0.0	0.8	93.9	0.2	4.6	0.2	0.3	**25656**	**27264**
Site 17	0.0	0.8	93.4	0.2	5.1	0.2	0.3	**26640**	**28104**
Site 18	0.0	1.8	89.8	0.2	6.5	0.5	1.3	**14760**	**15528**
Site 19	0.0	0.8	90.3	0.1	5.4	0.2	3.3	**21936**	**22776**
Site 20	0.0	1.1	93.3	0.3	3.9	0.4	0.9	**31680**	**33216**
Site 21	0.0	0.9	92	0.3	6.5	0.2	0.3	**27768**	**29616**
Site 22	0.0	0.7	84.7	0.2	6.7	0.2	7.4	**10320**	**10416**
Site 23	0.0	0.6	93.8	0.2	4.5	0.1	0.8	**22320**	**23808**
Site 24	0.0	2.3	91.2	0.0	5.5	0.3	0.8	**9600**	**10248**
Site 25	0.0	0.8	92.2	0.2	5.6	0.3	0.8	**14232**	**15096**
Site 26	0.0	0.4	93.3	0.2	5.4	0.2	0.4	**21768**	**23136**
Site 27	0.0	0.3	82.2	1.0	15.6	0.3	0.6	**22464**	**24000**
Site 28	0.0	0.4	93.8	0.5	4.6	0.4	0.4	**13608**	**14424**
Site 29	0.0	0.8	92.4	0.2	4.7		1.7	**11280**	**11928**
Site 30	0.0	1	94.1	0.2	3.9	0.1	0.8	**22224**	**23664**
Site 31	0.0	1.1	93.3	0.3	4.7	0.2	0.5	**15840**	**16392**
Site 32	0.0	0.4	94.3	0.1	3.9	0.0	1.2	**16152**	**17088**
Site 33	0.0	0.7	93.2	0.1	4.5	0.2	1.3	**21528**	**22584**
Site 34	0.0	0.7	93	0.1	4.4	0.1	1.6	**16872**	**17952**
Site 35	0.0	3.1	90.7	0.0	4.8	0.2	1.2	**12432**	**12888**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0.0	1.6	92.8	0.9	3.5	0.5	0.8	**47064**	**48888**
Site 38	0.0	0.5	90.8	1.6	5.8	0.3	1.0	**9144**	**9816**
Site 39	0.0	1.3	92.5	0.2	4.9	0.3	0.8	**22944**	**24096**
Site 40	0.0	0.7	94.6	0.0	4.0	0.0	0.7	**9720**	**10464**
Site 41	0.0	0.6	95.6	0.3	3.0	0.2	0.3	**30336**	**31992**
Site 42	0.0	0.8	92.7	0.2	5.0	0.2	1.1	**14832**	**15864**
Site 43	0.0	1.4	91.5	0.5	5.3	0.8	0.4	**29232**	**31488**
Site 44	0.0	0.9	91.9	0.2	5.8	0.4	0.9	**13272**	**14112**

Table 36 – GPRS ATC Classification split 2009

2010	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1	0.0	1	94.1	0.2	3.6	0.2	0.8	**11856**	**12600**
Site 2	0.0	0.7	92.6	0.2	6.2	0.0	0.4	**13536**	**14616**
Site 3	0.0	0.6	94.0	0.2	4.7	0.0	0.6	**12792**	**13608**
Site 4	0.0	0.7	94.0	0.0	4.5	0.0	0.7	**10080**	**10704**
Site 5	0.0	1.0	92.7	0.3	5.6	0.3	0.0	**7224**	**7776**
Site 6	1.0	2.3	87.9	0.2	7.5	0.4	0.6	**11544**	**12264**
Site 7	0.0	0.8	92.8	0.1	4.7	0.1	1.4	**20832**	**22104**
Site 8	0.0	4.6	62.1	1.1	29.9	2.3	0	**2088**	**2664**
Site 9	0.0	0.8	92.3	0.2	6	0.4	0.4	**12768**	**13008**
Site 10	0.0	1.4	93.2	0.7	4.3	0.2	0.2	**20856**	**22224**
Site 11	0.0	0.6	89.6	0	6.9	0	2.9	**4152**	**4344**
Site 12	0.0	0.8	94.1	0.1	4.7	0.1	0.1	**18720**	**20256**
Site 13	0.0	0.6	94.2	0.2	4.6	0.2	0.2	**12096**	**13776**
Site 14	0.0	1	91.8	0.3	5.6	0.3	1	**14640**	**15432**
Site 15	0.0	0.8	92	0.1	6	0.5	0.6	**20784**	**22200**
Site 16	0.0	0.8	94.1	0.2	4.6	0.2	0.2	**25176**	**26760**
Site 17	0.0	0.8	93.4	0.2	5.3	0.2	0.2	**28488**	**30192**
Site 18	0.0	1.6	89.8	0.2	6.5	0.6	1.3	**14784**	**15648**
Site 19	0.0	0.8	90.1	0.1	5.6	0.2	3.1	**20136**	**20952**
Site 20	0.0	1.2	93.1	0.3	4.2	0.4	0.9	**30840**	**32544**
Site 21	0.0	0.8	92	0.2	6.5	0.2	0.3	**28968**	**31128**
Site 22	0.0	0.8	86.2	0	6.1	0.4	6.5	**5928**	**6048**
Site 23	0.0	0.7	93.5	0.2	4.6	0.2	0.8	**21792**	**23208**
Site 24	0.0	1.9	91.1	0	5.9	0.3	0.8	**8880**	**9480**
Site 25	0.0	0.9	91.8	0.2	5.9	0.4	0.9	**13488**	**14304**
Site 26	0.0	0.5	93	0.2	5.6	0.2	0.5	**20976**	**22200**
Site 27	0.0	0.7	93.3	0.7	4.5	0.4	0.4	**19344**	**20568**
Site 28	0.0	0.4	93.8	0.6	4.4	0.4	0.4	**12456**	**13224**
Site 29	0.0	0.9	92.2	0.2	4.8	0.2	1.6	**10488**	**11088**
Site 30	0.0	1	93.9	0.2	4.2	0.2	0.6	**14952**	**16008**
Site 31	0.0	1.1	93.1	0.3	4.8	0.2	0.5	**15336**	**15840**
Site 32	0.0	0.5	94.2	0.2	3.9	0	1.2	**15456**	**16368**
Site 33	0.0	0.8	92.9	0.1	4.6	0.2	1.3	**20280**	**21216**
Site 34	0.0	0.9	92.3	0.8	4.2	0.8	0.9	**15360**	**16344**
Site 35	0.0	2	91.8	0	5	0.2	1	**12024**	**12576**
Site 36	-	-	-	-	-	-	-	-	-
Site 37	0.0	1.6	92.7	0.8	3.6	0.5	0.7	**45648**	**47688**
Site 38	0.0	0.6	87.7	1.5	8.6	0.3	1.2	**7776**	**8352**
Site 39	0.0	1.3	92.1	0.2	5.2	0.3	0.9	**22248**	**23400**
Site 40	0.0	0.8	94.6	0	3.8	0	0.8	**8928**	**9624**
Site 41	0.0	0.6	95.5	0.3	3.1	0.2	0.4	**29136**	**31008**
Site 42	0.0	0.8	93.1	0.2	4.8	0.2	1	**14520**	**15600**
Site 43	0.0	1.3	91.3	0.5	5.5	1	0.4	**27264**	**29544**
Site 44	0.0	1.0	91.5	0.2	6.0	0.4	1.0	**12456**	**13272**

Table 37 – GPRS ATC Classification split 2010

2011	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1		1	94.2	0.2	3.8	0.2	0.6	**12000**	**12768**
Site 2		0.7	92.5	0.2	6.4	0.0	0.3	**14376**	**15456**
Site 3		0.4	94.1	0.2	4.8	0.0	0.6	**12984**	**13800**
Site 4		0.7	94.1	0.0	4.7	0.0	0.5	**9720**	**10272**
Site 5		1.0	93.5	0.0	5.5	0.0	0.0	**7440**	**8016**
Site 6		1.7	89.9	0.2	7.4	0.6	0.3	**15888**	**16824**
Site 7		0.8	93.5	0.1	4.8	0.1	0.6	**20832**	**22320**
Site 8		4.7	62.4	0	30.6	2.4	0	**2040**	**2616**
Site 9		0.7	92.1	0.2	6.2	0.4	0.4	**10848**	**11280**
Site 10		0.4	94	0.7	4.4	0.2	0.2	**19440**	**20688**
Site 11		0.6	90	0	6.5	0	2.9	**4080**	**4272**
Site 12		0.8	94.2	0.1	4.6	0.1	0.1	**18072**	**19560**
Site 13		0.6	94.1	0.2	4.5	0.4	0.2	**12216**	**13896**
Site 14		0.9	92	0.3	5.6	0.3	0.9	**16200**	**17160**
Site 15		0.9	91.9	0.1	6.2	0.4	0.5	**22536**	**24216**
Site 16		0.7	94	0.2	4.7	0.2	0.2	**26208**	**27864**
Site 17		0.7	93.4	0.2	5.4	0.2	0.2	**29472**	**31368**
Site 18		1.6	90.1	0.1	6.5	0.6	1	**16320**	**17400**
Site 19		0.8	90.2	0.1	5.7	0.2	2.9	**21192**	**22128**
Site 20		1.2	92.9	0.3	4.3	0.4	0.9	**30888**	**32664**
Site 21		0.8	91.8	0.2	6.7	0.2	0.3	**30240**	**32592**
Site 22		0.5	87.9	0	5.8	0.3	5.6	**9504**	**9720**
Site 23		0.7	93.5	0.1	4.7	0.2	0.8	**20568**	**21888**
Site 24		2.7	90.1	0	6.1	0.3	0.8	**8976**	**9624**
Site 25		0.9	91.6	0.2	6.0	0.4	0.9	**13128**	**13944**
Site 26		0.5	92.6	0.2	5.9	0.2	0.5	**19800**	**21024**
Site 27		0.4	93.8	0.6	4.6	0.2	0.4	**19392**	**20712**
Site 28		0.4	93.6	0.6	4.6	0.4	0.4	**12360**	**13152**
Site 29		1	92.1	0.2	5	0.2	1.4	**9984**	**10608**
Site 30		0.9	93.9	0.2	4.1	0.1	0.7	**20424**	**21744**
Site 31		1.4	92.6	0.3	5.1	0.2	0.5	**15600**	**16200**
Site 32		0.6	94.3	0.1	3.9	0	1	**16080**	**17040**
Site 33		0.8	93.3	0.1	4.5	0.2	1	**21144**	**22224**
Site 34		0.4	93.8	1.3	4.1	0.1	0.3	**16896**	**18072**
Site 35		1.1	92.3	0.2	5.1	0.4	0.9	**13152**	**13752**
Site 36									
Site 37		2.9	91	1	3.8	0.6	0.8	**45288**	**47328**
Site 38		0.3	77.2	1.3	18.8	0.5	1.8	**9168**	**9864**
Site 39		1.3	92.5	0.2	5	0.3	0.7	**22632**	**23856**
Site 40		0.8	94.7	0	3.9	0	0.5	**9144**	**9840**
Site 41		0.5	95.4	0.3	3.2	0.2	0.4	**27336**	**29016**
Site 42		0.8	93.2	0.2	4.9	0.2	0.8	**15192**	**16344**
Site 43		1.3	91.1	0.5	5.8	0.9	0.3	**28752**	**31296**
Site 44		0.9	91.5	0.2	6.1	0.4	0.9	**12936**	**13800**

Table 38 – GPRS ATC Classification split 2011

2012	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	AADT	AWDT
Site 1		1.2	93.9	0.2	4.1	0.2	0.4	**11712**	**12456**
Site 2		0.7	92.8	0.2	6.2	0.0	0.2	**13944**	**14928**
Site 3		0.4	94.2	0.2	5.0	0.0	0.2	**12888**	**13680**
Site 4		0.7	94.3	0.0	4.7	0.0	0.2	**9672**	**10248**
Site 5		1.3	92.7	0.0	5.8	0.3	0.0	**7512**	**8064**
Site 6		1.6	90.2	0.2	7.4	0.5	0.2	**15480**	**16344**
Site 7		0.8	93.5	0.1	4.9	0.1	0.5	**20424**	**21744**
Site 8		5.6	62.2	0	30	2.2	0	**2184**	**2784**
Site 9		0.6	92.4	0.2	6.2	0.4	0.2	**11928**	**12648**
Site 10		0.4	93.9	0.7	4.4	0.2	0.4	**19824**	**21072**
Site 11		0.6	89.7	0	6.9	0	2.9	**4224**	**4416**
Site 12		0.8	94.2	0.1	4.6	0.1	0.1	**18768**	**20256**
Site 13		0.8	94.4	0.2	4.3	0.2	0.2	**12408**	**14112**
Site 14		1.1	92	0.3	5.7	0.2	0.8	**15864**	**16728**
Site 15		0.9	92	0.1	6.1	0.4	0.5	**22080**	**23616**
Site 16		0.7	94	0.2	4.7	0.2	0.2	**26208**	**27768**
Site 17		0.7	93.3	0.2	5.4	0.2	0.2	**29112**	**30888**
Site 18		1.7	90.3	0.2	6.5	0.5	0.9	**15840**	**16824**
Site 19		0.8	90.2	0.1	5.6	0.2	3	**20832**	**21696**
Site 20		1.1	93.3	0.2	4.2	0.4	0.9	**31704**	**33480**
Site 21		0.8	91.8	0.2	6.8	0.2	0.2	**29640**	**31800**
Site 22		0.7	88.4	0.2	5.3	0.2	5.3	**10512**	**10656**
Site 23		0.6	93.5	0.1	4.8	0.1	0.9	**20736**	**22056**
Site 24		3	89.9	0	6	0.3	0.9	**8040**	**8568**
Site 25		0.9	91.9	0.2	5.8	0.4	0.9	**13320**	**14040**
Site 26		0.6	92.6	0.2	5.9	0.2	0.5	**20784**	**22008**
Site 27		0.3	94	0.7	4.4	0.2	0.3	**20688**	**22104**
Site 28		0.4	93.6	0.6	4.6	0.4	0.4	**12408**	**13176**
Site 29	2.9	0.7	89.8	0.2	4.8	0.2	1.2	**9912**	**10512**
Site 30		0.9	93.7	0.2	4.2	0.2	0.7	**20424**	**21816**
Site 31		1.1	93	0.3	5.1	0.2	0.3	**14712**	**15216**
Site 32		0.6	94	0.2	4.1	0.2	1	**15072**	**15864**
Site 33		0.8	93.2	0.1	4.6	0.2	1.1	**20472**	**21360**
Site 34		0.4	93.9	1.2	4.1	0.1	0.3	**16464**	**17496**
Site 35		1.3	91.9	0.2	5.2	0.4	1	**12480**	**13008**
Site 36									
Site 37		0.8	93.8	1	3.5	0.3	0.6	**29736**	**31176**
Site 38		0.5	90.1	1.3	7	0.3	0.8	**8952**	**9600**
Site 39		1.3	92.7	0.2	4.8	0.2	0.8	**21960**	**22968**
Site 40		0.8	94.8	0	3.9	0	0.5	**9264**	**9888**
Site 41		0.5	95.6	0.3	3.1	0.2	0.4	**28680**	**30480**
Site 42		0.9	92.9	0.2	5	0.2	0.8	**15192**	**16272**
Site 43		1.3	90.9	0.5	6	1	0.3	**28080**	**30456**
Site 44		0.9	91.5	0.2	6.0	0.4	0.9	**12720**	**13488**
*Site 50		1.9	93.8	0.6	3.7	0	0	**3888**	**3840**
*Site 51		0.9	93.8	0.1	4.2	0.4	0.6	**18864**	**20040**
*Site 52		0.7	93.3	0.4	4.5	0	1.1	**6408**	**6768**
*Site 53		0.8	93.5	0.6	4.8	0	0.4	**12072**	**12672**

Table 39 – GPRS ATC Classification split 2012

* AADT Data should be treated with caution as sites installed during May 2012 and do not represent a full year of monitoring

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 40 – GPRS ATC Classification split 2013

* AADT Data should be treated with caution as sites installed during May 2013 and do not represent a full year of monitoring

To assess if the AADT has changed significantly over the period 2006-2012, data is presented below in table 41.

Site	AADT 2007	AADT 2008	AADT 2009	AADT 2010	AADT 2011	AADT 2012	AADT 2013	% Diff 2013 over 2010	% Diff 2013 over 2011	% Diff 2013 over 2011
1	11976	10584	11808	11856	12000	11712	11424	-3.64	-4.80	-2.46
2	13824	14472	14448	13536	14376	13944	14184	4.79	-1.34	1.72
3	13272	12048	12888	12792	12984	12888	13008	1.69	0.18	0.93
4	10368	9936	9864	10080	9720	9672	9840	-2.38	1.23	1.74
5	7800	7656	7152	7224	7440	7512	7416	2.66	-0.32	-1.28
6	14952	15528	14232	11544	15888	15480	15336	32.85	-3.47	-0.93
7	20424	20064	19248	20832	20832	20424	20376	-2.19	-2.19	-0.24
8	2280	2616	2256	2088	2040	2184	1584	-24.14	-22.35	-27.47
9	13536	12864	12912	12768	10848	11928	12552	-1.69	15.71	5.23
10	21432	21312	21624	20856	19440	19824	20376	-2.30	4.81	2.78
11	4056	4176	4200	4152	4080	4224	4200	1.16	2.94	-0.57
12	19896	19440	19776	18720	18072	18768	18072	-3.46	0.00	-3.71
13	13080	12864	12792	12096	12216	12408	12192	0.79	-0.20	-1.74
14	15072	16368	14952	14640	16200	15864	15648	6.89	-3.41	-1.36
15	22368	22512	20544	20784	22536	22080	18096	-12.93	-19.70	-18.04
16	27600	26976	25656	25176	26208	26208	26496	5.24	1.10	1.10
17	27360	27048	26640	28488	29472	29112	29064	2.02	-1.38	-0.16
18	16200	15744	14760	14784	16320	15840	15504	4.87	-5.00	-2.12
19	22704	18216	21936	20136	21192	20832	21048	4.53	-0.68	1.04
20	32976	31560	31680	30840	30888	31704	32232	4.51	4.35	1.67
21	30984	30744	27768	28968	30240	29640	29736	2.65	-1.67	0.32
22	10896	10728	10320	5928	9504	10512	9792	65.18	3.03	-6.85
23	22344	22200	22320	21792	20568	20736	21168	-2.86	2.92	2.08
24	9696	9672	9600	8880	8976	8040	8976	1.08	0.00	11.64
25	12000	14352	14232	13488	13128	13320	13464	-0.18	2.56	1.08
26	22584	22440	21768	20976	19800	20784	22056	5.15	11.39	6.12
27	22320	19920	22464	19344	19392	20688	21456	10.92	10.64	3.71
28	13656	13248	13608	12456	12360	12408	12600	1.16	1.94	1.55
29	11328	11160	11280	10488	9984	9912	9408	-10.30	-5.77	-5.08
30	22344	21936	22224	14952	20424	20424	20256	35.47	-0.82	-0.82
31	16056	15360	15840	15336	15600	14712	14784	-3.60	-5.23	0.49
32	15984	15792	16152	15456	16080	15072	14568	-5.75	-9.40	-3.34
33	21312	21408	21528	20280	21144	20472	20640	1.78	-2.38	0.82
34	15144	16824	16872	15360	16896	16464	16632	8.28	-1.56	1.02
35	12696	12288	12432	12024	13152	12480	12528	4.19	-4.74	0.38
36	-	-	-	-	-	-	-			
37	47592	45960	47064	45648	45288	29736	37824	-17.14	-16.48	27.20
38	9240	9144	9144	7776	9168	8952	8760	12.65	-4.45	-2.14
39	23280	23208	22944	22248	22632	21960	22032	-0.97	-2.65	0.33
40	10200	9936	9720	8928	9144	9264	9744	9.14	6.56	5.18
41	30720	29856	30336	29136	27336	28680	28292	-2.90	3.50	-1.35
42	14904	14976	14832	14520	15192	15192	15168	4.46	-0.16	-0.16
43	30648	29784	29232	27264	28752	28080	28224	3.52	-1.84	0.51
44	10944	13344	13272	12456	12936	12720	12792	2.70	-1.11	0.57
* 50	-	-	-	-	-	3888	6576	-	-	69.14
* 51	-	-	-	-	-	18864	32184	-	-	70.61
* 52	-	-	-	-	-	6408	11112	-	-	73.41
* 53	-	-	-	-	-	12072	20904	-	-	73.16

Table 41 AADT Percentage Growth 2010-2013

** No significance on growth figures should be implied as sites established May 2012*

No significance should be taken from the data presented within table 41 above for sites 6, site 22 or 30 for 2010 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 has been affected by highway alterations as part 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 increase I 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 has retuned to normal during 2013.

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.

Guidance within LAQM.TG(09) box 5.3 Section A6 page 5-18 defines a “large” increase in traffic flow to be one greater than 25%. This level of growth had been seen between 2005 and 2006 at several sites but between 2007- 2013, there is no evidence to determine that such an increase has been seen at any of the GPRS ATC’s.

The details relating to the Swansea Metro project have been reported previously but for completeness, the information is repeated here again. The Swansea Metro project aims to transform public transport in Swansea by introducing the new concept StreetCar vehicle, on a route with signalled priority at key sections between Morriston Hospital and Singleton Hospital, via the City Centre.

It now runs on-street, from Morriston Hospital to Singleton Hospital via the City Centre and Oystermouth Road stopping at many key destinations, including:

- Morriston Hospital,
- Woodfield Street, Morriston
- High Street Station,
- Kingsway,
- the new Quadrant Interchange (see section 3.8 below)
- County Hall,
- University and Singleton hospital**.**

Signalled priority will be provided at key locations, including:

- Martin Street roundabout,
- Cwm Level roundabout,
- Normandy Road roundabout,
- the proposed Landore Express Route
- and in the City Centre, with the detailed design being carried out in-house

In order to enable the Swansea Metro to run, considerable works to the existing road network were required. Some of these works required at Cwm Level and Normandy Road roundabouts lie within the existing Hafod Air Quality Management Area. The road network surrounding these key roundabouts has been altered to provide priority to the Metro service by way of signal controlled access.

The first phase of these works started within the Kingsway area of the city centre during the summer months of 2006. Plans of the works completed as part of phase 1 can be seen below as maps 18 and 19.

Phase 2 of the Metro scheme (see map 20) commenced during July 2007 to extend the provision from the Kingsway down along Westway, linking into the Quadrant Transport Interchange and to the new Civic Centre on Oystermouth Road. Phase 2 was completed during late 2008/early 2009.

Phase 2 has seen major changes to the traffic flow within the city centre area. As yet, no GPRS ATC's have been installed along the affected routes to assess any pattern changes but discussions have already taken place and sites identified to enable suitable monitoring of traffic flows. Unfortunately, due to budgetary constraints no orders have been place with the equipment suppliers as yet. Some of the work being undertaken with regard to the passive diffusion tube survey work is aimed at assessing what, impact this change in traffic flow within the city centre is having with NO_2 levels – in particular to the 1-hour objective in view of several café type environments that exist within the city centre. This work is outlined within section 2.3 above.

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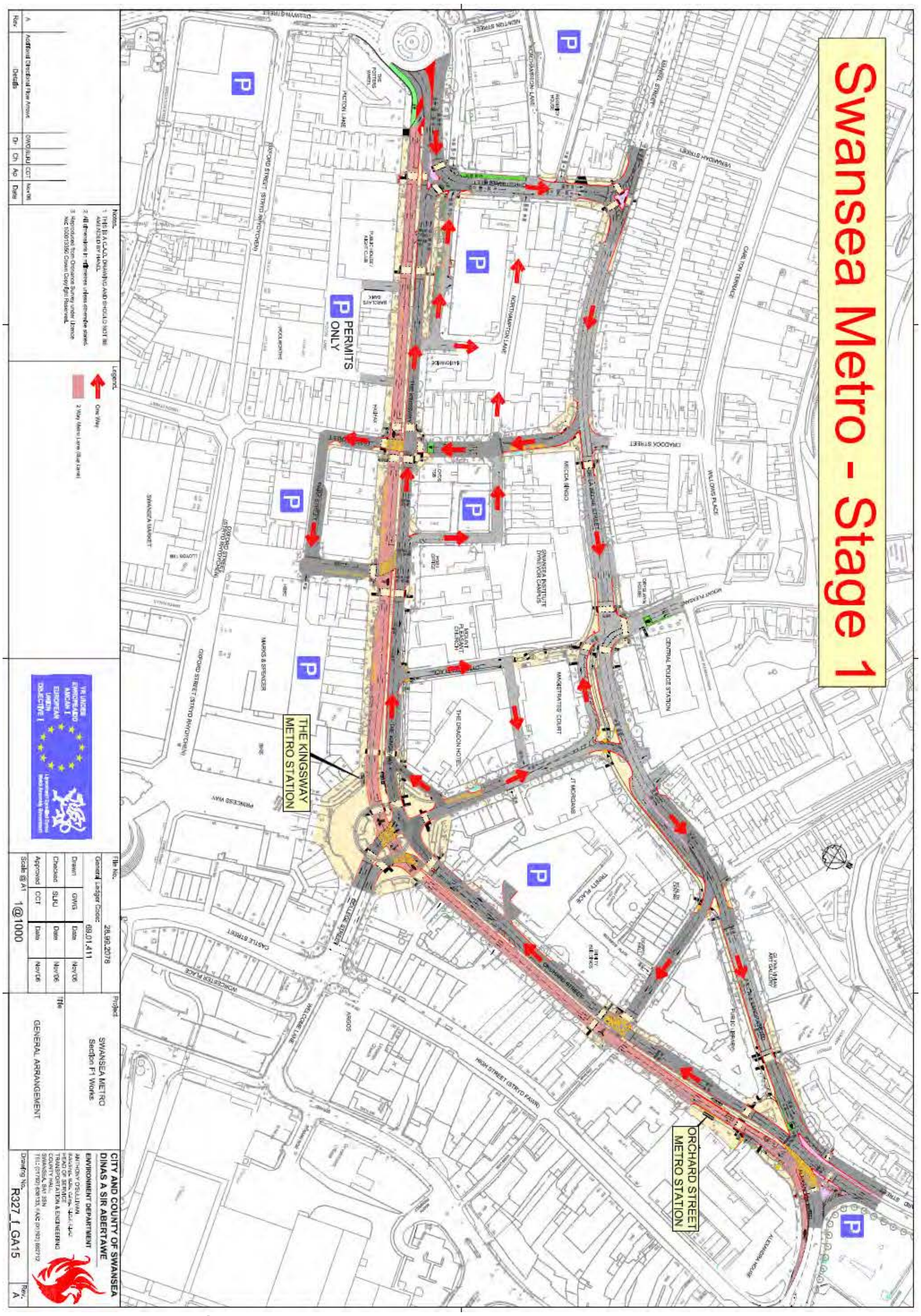
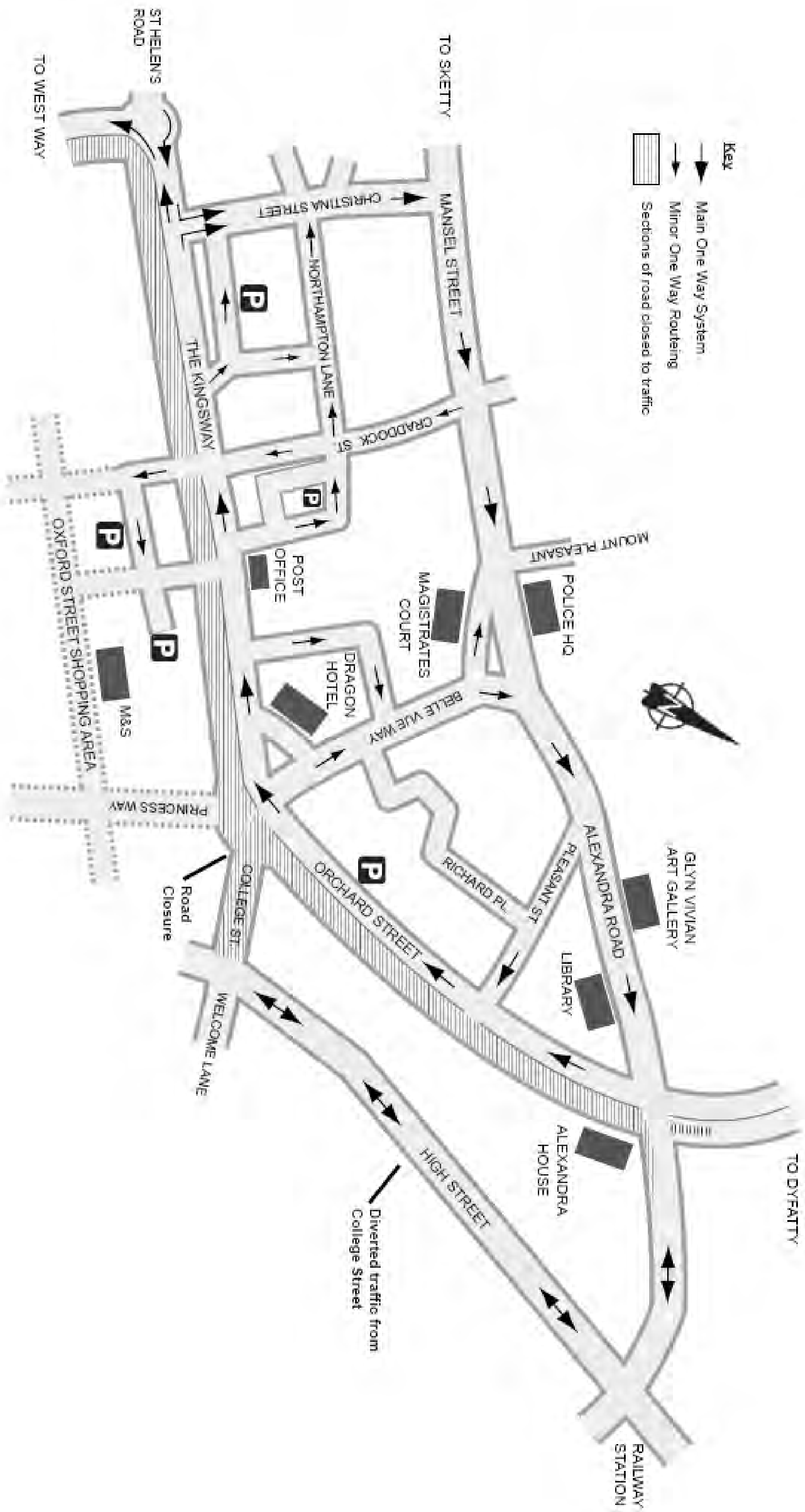
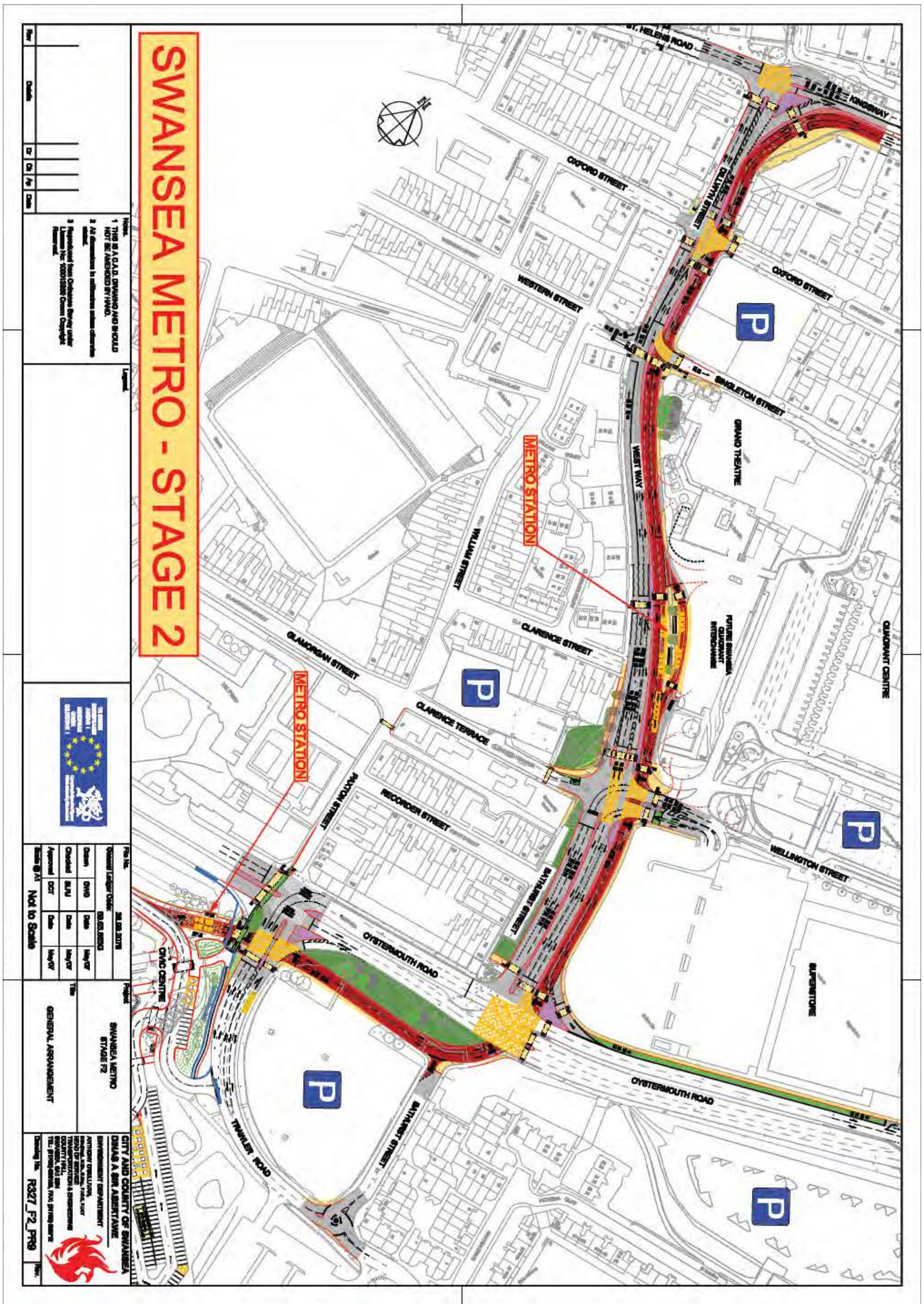


Map 18 – Swansea Metro Phase 1



Map 19 Swansea Metro Phase 1



Map 20 – Phase 2 Swansea Metro Project

Funding is being sought to enable the installation of GPRS ATC's within the city centre area but with the current budgetary restraints being faced by the authority, this is unlikely to be realised.

The Swansea Boulevard Project

As part of the delivery of the City Centre Strategic Framework, Consultants were engaged to produce a Concept, Design and Implementation Study in relation to the European Boulevard which was agreed by Cabinet in December 2008.

The project is to create a "boulevard" from the river bridges to the Civic Centre which provides a step change in perceptions of this gateway corridor from an urban freeway to a vibrant tree lined city street which allows the connection of the City Centre to the Maritime Quarter. The Boulevard will encourage high quality architectural design, excellent public realm and landscape and provide an effective balance between its role as the key artery into the City Centre and increased pedestrian movement and permeability.

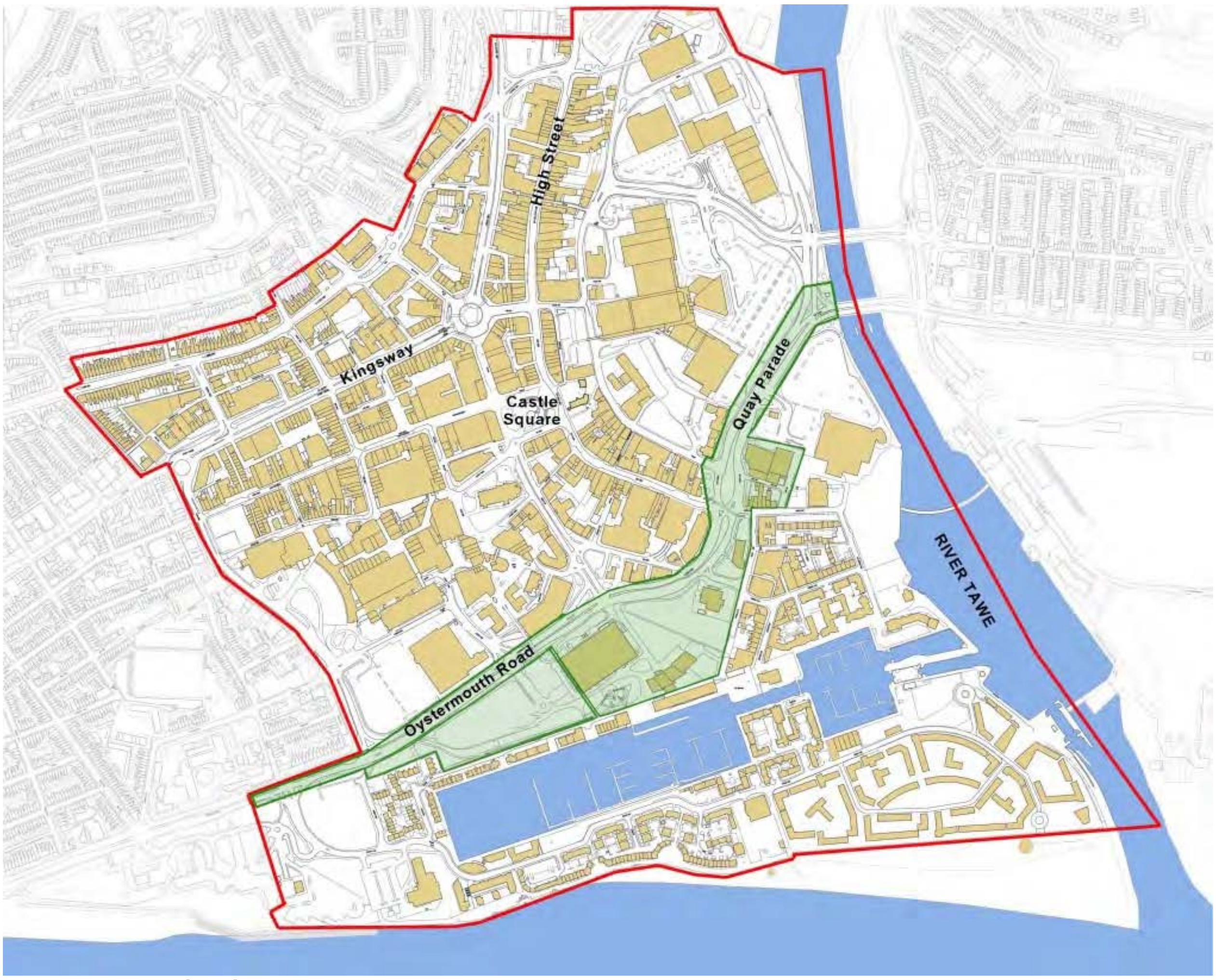
The reconfiguration of the Tawe Bridges was completed in December 2011. This constituted phase 1 of the Boulevard project and was required in order to create additional highway capacity to accommodate pedestrian, cycle and public transport enhancements along the Boulevard.

Phase 2 of the Boulevard scheme commenced in January 2013 and covered the section between the Leisure Centre to Wind Street and was completed December 2013. Phase 3 commenced during January 2014 covering Wind Street to the Tawe Bridges.

The works to Phase 2 and 3 provided the following enhancements:

- upgrading the public realm with high quality materials being used throughout;
- introduction of a bus lane between Princess Way and Wind Street;
- enhanced pedestrian/cycle crossings (toucan);
- widened footways;
- installation of a shared use path on the southern footway;
- trees to be planted in the footways and central reserve;
- lighting and CCTV upgrades;
- telematics upgrade;

- closure of minor junctions and accesses



Map 21 *Swansea Boulevard project*

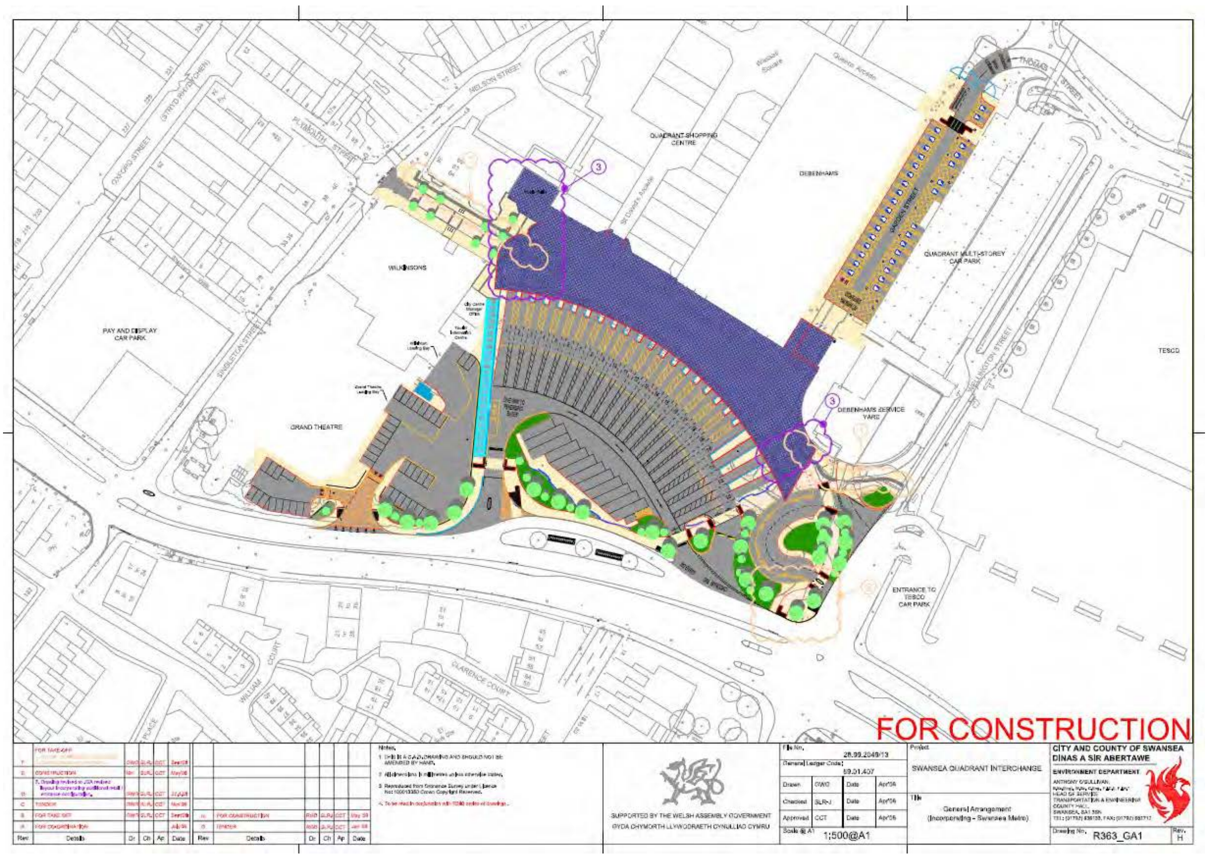
The City and County of Swansea confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.1.7 Bus and Coach Stations

Quadrant bus station

The City and County of Swansea has now completed a scheme to replace the old Quadrant bus station with a modern Transport Interchange to cater for both buses and coaches, including Swansea Metro vehicles, on a larger footprint. The old Quadrant bus station was outdated in terms of passenger convenience, comfort and security. The Council's aspiration was for a modern transport interchange with high standards of cleanliness and security. The refurbishment of the Quadrant bus station was identified as a high priority in the Swansea Local Transport Plan 2000 – 2005 and was completed during November/December 2010.

.A plan of the development area is given below as map 22.



Map 22 – *Quadrant Transport Interchange off Westway, Swansea*

Blocks of flats can be seen opposite the completed Quadrant Interchange. These blocks tend to be occupied by the elderly with warden accommodation. A basic Screening Assessment had been started during 2008 in front of one of the blocks of flats to assess both PM_{10} and NO_2. The PM_{10} light scattering analyser had suffered numerous breakdowns with the result that little meaningful data is available. Provision of a Thermo PM_{10} FDMS is not feasible due to the practical siting criteria issues to be resolved as well as the costs that would be incurred. Assessment of the new facility is required and will require both traffic counts and PM_{10} measurements to be undertaken. A MetOne EBam PM_{10} analyser was installed on Westway during August 2012 (see Sec 3.5 above) and PM_{10} data has been reported in the relevant sections above for 2013 – further assessments will be made in future reporting. A photo of the site is shown below as photo 19. The MetOne EBam location is labelled within photo 20. Funding to provide a permanent GPRS ATC (site 36) is still being sought.

Photo 20 – Westway MetOne EBam PM_{10} Monitoring Location

At present, there is existing relevant exposure within approximately 25m of the curtilage of the development. From guidance contained within LAQM.TG(09) box 5.3 section A7 page 5-19 relevant exposure is required to be assessed either within 10m of any part of the bus station where buses are present or within 20m if the bus/coach station is within a major conurbation. Major conurbation is not defined within box 5.3 section A7 page 5-19 but it is defined as a population greater than 2 million within box 5.3 Sections A3 and A4 pages 5-12 to 5-15. Major conurbation is therefore, in this scenario, taken to be the same meaning given within sections A3 and A4, which in the case of Swansea, with a population of just under a quarter of a million clearly does not apply.

3.2 Other Transport Sources

3.2.1 Airports

Swansea does have a small airport located at Fairwood Common, Upper Killay that has previously been used as a “regional airport”. However, guidance within LAQM.TG(09) box 5.4 Section B1 page 5-21 indicates that assessment for NO_2 will only be required should relevant exposure exist within 1000m of the airport boundary and if the total equivalent passenger throughput exceeds 10 million passengers per annum. Freight traffic is minimal.

There are receptor locations within 500m of the airport boundary but clearly the airport does not see passenger numbers in excess of 10 million per annum.

The City & County of Swansea confirm there are no airports meeting the assessment criteria in the Local Authority Area.

3.2.2 Railways (Diesel and Steam Trains)

3.2.3 Stationary Trains

Landore Diesel Sheds is a major servicing centre primarily for Inter City 125 high-speed trains (HST) and is located within the Swansea Air Quality Management Area 2010. The site operates on a 24 hour seven day a week basis. An aerial view of the site is shown below as map 23 indicating the proximity of domestic dwellings to the site

Site activities can be broadly classified into two categories: maintenance and servicing. Maintenance tends to occur within the sheds themselves. Here, engines are repaired, maintained and tested. It is not uncommon for several HST engine units to be under test at the same time. Exhaust emissions are vented through cowl housings to the roof of the sheds.

Map 23 – Landore Diesel Sheds and Surrounding Area

Maintenance operations involve the routine cleaning and refuelling of the HST units in dedicated sidings. Extensive warm up periods are mandated prior to movement of the HST train back out and onto the main line.

Guidance within LAQM.TG(09) requires the identification of locations where diesel locomotives are regularly stationary for periods of more than 15 minutes[39]. This is clearly the case at Landore Diesel Sheds but the guidance also indicates exposure potential for regular outdoor exposure to members of the public within 15m of the stationary locomotives. The nearest façade of any dwelling is approximately 35m

[39] LAQM.TG(09) Box 5.4 Section B2 Approach 1 page 5-22

from the servicing bay. There is also a public “open grassed area” within approximately 40 m of the servicing bays.

Observations at this location have indicated very infrequent use by the general public. Bearing in mind that the majority of servicing occurs during the night-time hours it is concluded that there is no relevant exposure from this activity at this location. A similar view has been formed over the use of the main shed complex.

An identical view has also been formed for the activities currently undertaken at Swansea Central railway Station. Inter City 125 units and other diesel locomotives are left running during periods leading up to the scheduled service departures. However, there is no regular outdoor exposure of members of the public within 15m of the stationary locomotives. It should be noted that a development on the former Unit Superheaters site at The Strand proposes several 5(+) story blocks of apartments/student flats. These apartments when complete will overlook the main platform area at Swansea Central Railway Station. The impact of the rail activities will be assessed once these apartments are complete and occupied.

“Sprinter services” are offered to/from several local stations both on the mainline Swansea – Paddington London line and also the West Wales line. However, these sprinter services are not stationary at these very local stations for periods of 15 minutes or more. Consequently, their impact is minimal.

3.2.4 Moving Trains

Guidance within LAQM.TG(09) box 5.4 Section B2 – Approach 2 page 5-23 indicates a number of criteria to determine suitable assessment. The main Swansea to Paddington London rail line is listed within table 5.1 indicating rail lines with heavy traffic of diesel passenger trains. In addition, approach 2 requires identification of whether the background annual mean NO_2 concentration is above 25ug/m^3. In order to answer this question, use has been made of the 1k by 1k background maps from http://laqm.defra.gov.uk/maps/maps2010.html .The text file for NO_2 background concentrations for 2013 has been imported into Quantum GIS and examined. If the background NO_2 1k by 1k concentrations are indexed in descending order it can be seen that the maximum 1k by 1k grid square (266500 196500) for 2013 returns a value of 24.42ug/m^3. If this grid point is plotted it can be seen that the centre of the 1k by 1k grid square is just north of the main Swansea to Paddington London line in the Plasmarl area of Swansea. The next highest 1k by 1k grid square (265500 193500) for 2013 is 20.47ug/m^3 and is located just north of Alexandra Road in the city centre and is approximately 270m from Swansea Central Railway station.

Local knowledge of the path of the Swansea to Paddington London railway line would also indicate that that there is no potential for **long-term** exposure within 30m of the edge of the tracks.

The above views have been supplemented by examination of the LAQM Support website at http://laqm.defra.gov.uk/supporting-guidance.html which includes an item under Supplementary Guidance - "**Guidance on assessing emissions of railway locomotives".** The link http://laqm.defra.gov.uk/documents/Railway_Locomotives_100209.pdf contains an Adobe PDF document entitled – Guidance on Assessing Emissions from Railway Locomotives dated 10th February 2009. This document details within table 1 the rail lines with a heavy traffic of diesel passenger trains. The Paddington to Swansea line is listed. Table 2 of the document lists 35 local authorities where the 2008 background NO_2 concentration is expected to exceed the threshold for assessment of 25 ug/m^3. The City and County of Swansea were not one of the 35 local authorities identified.

In view of the above, there is no requirement to proceed further with a Detailed Assessment for NO_2 at locations within 30m of the Swansea to Paddington London railway line.

3.2.5 Ports (Shipping)

Swansea is Associated British Ports (ABP's) most westerly South Wales port and has developed a trade base with North and Western Europe, the Mediterranean and also with Northern Ireland and the Irish Republic. The port's major cargo-handling trade is receiving and shipping steel cargoes for Tata. It is equipped with a wide range of heavy-duty handling equipment offering quayside cranes and a range of forklift trucks with capacities of up to 40 tonnes. Other traffics include containers, forest products, bulk cargoes, liquid bulks and general/project cargoes. The port can accommodate vessels up to 30,000 dwt.

Guidance within LAQM.TG(09) box 5.4 Section B3 Shipping page 5-24 requires the determination on the number of ship movements per year and also to establish if there is relevant exposure either within 250m of the quayside and manoeuvring areas should shipping movements be between 5000 – 15000 per year or exposure within 1km of the quayside and manoeuvring areas should shipping movements exceed 15000 per year. Enquiries with the Port Health Authority indicate that during 2013 there were a total of 388 vessels visiting the port which equates to 676 total shipping. If the local tug fleet is also taken into consideration this would still not bring the number of movements to above the 5000 threshold required for assessment.

For sake of completeness, there are residential properties located on Bevans Row, Port Tenant within 230m of the Kings Dock quayside. An ever increasing number of residential flats are being constructed on the nearby SA1 development sites. At present these new residential units are outside of the scope of assessment and are likely to remain so given the decreasing number of shipping movements seen at the port. A continuing decrease in movements has been observed during recent years and this has been compounded by the Swansea-Cork ferry ceasing operation from the port during 2011.

3.3 Industrial Sources

3.3.1 Industrial Installations

3.3.2 New or Proposed Installations for which an Air Quality Assessment has been carried out.

Vale, Clydach

Proposals by Vale (see map 8 within section 2.1.10 for location and surrounding area) to develop an energy from waste Pyrolysis Plant at its refinery at Clydach in the

Swansea valley may have air quality impacts locally. Whilst Planning Permission has been granted and a permit issued for operation by the now Natural Resources Wales, the project is on hold at present due to the economic downturn. Regular updates will be provided in future reporting

3.3.3 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced

The City & County of Swansea confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

3.3.4 New or Significantly Changed Installations with No Previous Air Quality Assessment

The City & County of Swansea confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

3.3.5 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Local Authority area.

3.3.6 Petrol Stations

Guidance contained within LAQM.TG(09) indicates that there is some evidence that petrol stations will emit sufficient benzene to put the 2010 5μg/m^3 objective at risk if the throughput exceeds 2000m^3 of petrol , especially if combined with higher levels from a nearby busy road[40]. A busy road is defined as one with more than 30,000 vehicles per day. The guidance goes on to indicate that relevant exposure within 10m of the fuel pumps should also be present if the above criterion is met.

[40] LAQM.TG(09) Box 5.5 Section C3 petrol Stations page 5-40

Details from the Authorisations held by the authority have been examined. There are twenty nine authorised petrol filling stations within the authority's area, with fourteen of these having a throughput greater than 2000m^3. Of these fourteen stations, seven are fitted with stage 2 vapour recovery, with the remainder being fitted with stage 1 vapour recovery. Relevant exposure was examined for each location using Quantum GIS, whereby 10m radius were plotted from the actual pumps to access if relevant exposure existed. Of the 14 petrol stations examined, relevant exposure does not exist at any, but, as in the case of previous rounds of review and assessment, two cases deserve explanation and are repeated here for sake of completeness.

One petrol filling (Mumbles Road, Blackpill) station meets the above criteria (throughput, traffic flows and relevant exposure) to have warranted further investigation. For the sake of completeness the second station (Sketty Filling Station, Gower Road) partially meets the criteria (throughput and relevant exposure).

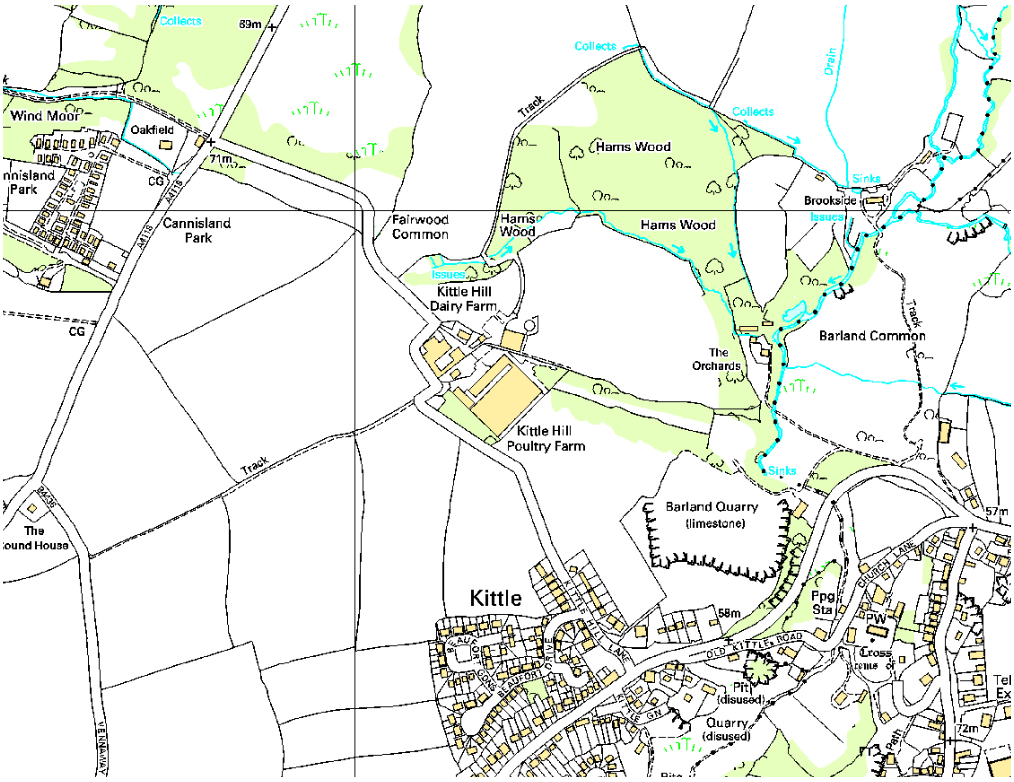
During previous assessment works (USA July 2004) it was established that whilst both of these filling stations have dwellings located within 10m of the fuel pumps, these properties have been purchased by the fuel companies and have been left vacant. These arrangements were negotiated with the relevant fuel companies many years ago, particularly to resolve late night noise nuisance complaints.

A major food retail output located in Gorseinon has indicated their intention to construct a petrol station to the existing rear car park of the outlet. The nearest dwellings are though to be located greater than 10m away from the proposed location of the nearest pump but a doctor's surgery may be within this distance. Despite this surgery not being a relevant receptor in terms of LAQM, the authority will seek to resolve any potential issues once a planning application is received.

The City & County of Swansea confirms that there are no petrol stations meeting the specified criteria within the local authority area

3.3.7 Poultry Farms

LAQM.TG(09) contains guidance on assessing potential exceedences of the PM_{10} objectives associated with emissions from poultry farms. Guidance is contained within box 5.5 Section C4 page 5-41. There are two poultry farms located within the authority's area. The first at Kittle Hill Farm is shown below
within Maps 24 and 25.



Map 24 – Location of Kittle Hill Poultry Farm, Kittle, Gower, Swansea

Map 25 – Aerial view – Kittle Hill Poultry Farm, Kittle, Gower, Swansea

Previously under the Environment Agency permit application granted during 2007 up to a total of 400,000 chicken laying hens were permitted to be housed, split over 3 sheds containing approx. 100,000 birds each with a deep litter pit system of waste collection. However the Environment Agency during May 2011granted a PPC permit (Ref JP3838KF) to permit up to 400,000 birds to be housed. However, information to hand indicates that the operators only intend to house 295,680 birds at present due to a planning restriction. As indicated within map 25 above, the direction of the mechanical ventilation of the sheds is in a south easterly direction between the sheds and then finally out, over a field adjacent to the premises. The nearest domestic receptor/dwelling is approximately 290m from the sheds. However, there is relevant exposure from a residential property that forms part of the farm itself. There is therefore, relevant exposure within 100m of the sheds housing the birds. There have been previous historical complaints regarding dust from local residents but these were not substantiated. Numerous complaints have also been received regarding noise from the ventilation system.

Whilst there is relevant exposure as defined by LAQM.TG(09) box 5.5 Section C4 page 5-41 at Kittle Hill Farm itself, **the number of housed birds remains below the assessment threshold**. In addition, a separate establishment at Highfield Poultry Farm, Parkmill, Gower, Swansea, now receives birds a few days old which are then taken away to a farm in Pembrokeshire for completion. Map 26 below indicates the proximity of this establishment to local residential properties.

Map 26 – Highfield Poultry farm, Parkmill, Gower.

Previously under the Environment Agency permit application granted during 2007 up to a total of 120,000 birds were permitted to be housed within several sheds that are provided with mechanical ventilation. The current EA PPC permit (Ref VP3039UR) repeats this number of permitted birds at this establishment. However, only 105,000 birds are currently on site. Residential properties are within 80m of the sheds at Highfield Poultry Farm with the proprietor's residence being located within 15m of the sheds**.**

There have been numerous historical complaints regarding noise from the ventilation system. Again, whilst there is relevant exposure as defined within LAQM.TG(09) box 5.5 Section C4 page 5-41 at Highfield Poultry Farm itself, **the number of housed birds falls below the assessment threshold.**

3.4 Commercial and Domestic Sources

3.4.1 Biomass Combustion – Individual Installations

3.4.2 Swansea Leisure Centre

There is a wood-chip biomass burner installation at the new LC2 Leisure Centre. However, due to control issues, the burner has never operated

The City & County of Swansea confirms that there are no longer any Biomass Combustion – Individual installations meeting the specified criteria within the local authority area

3.4.3 Biomass Combustion – Combined Impacts.

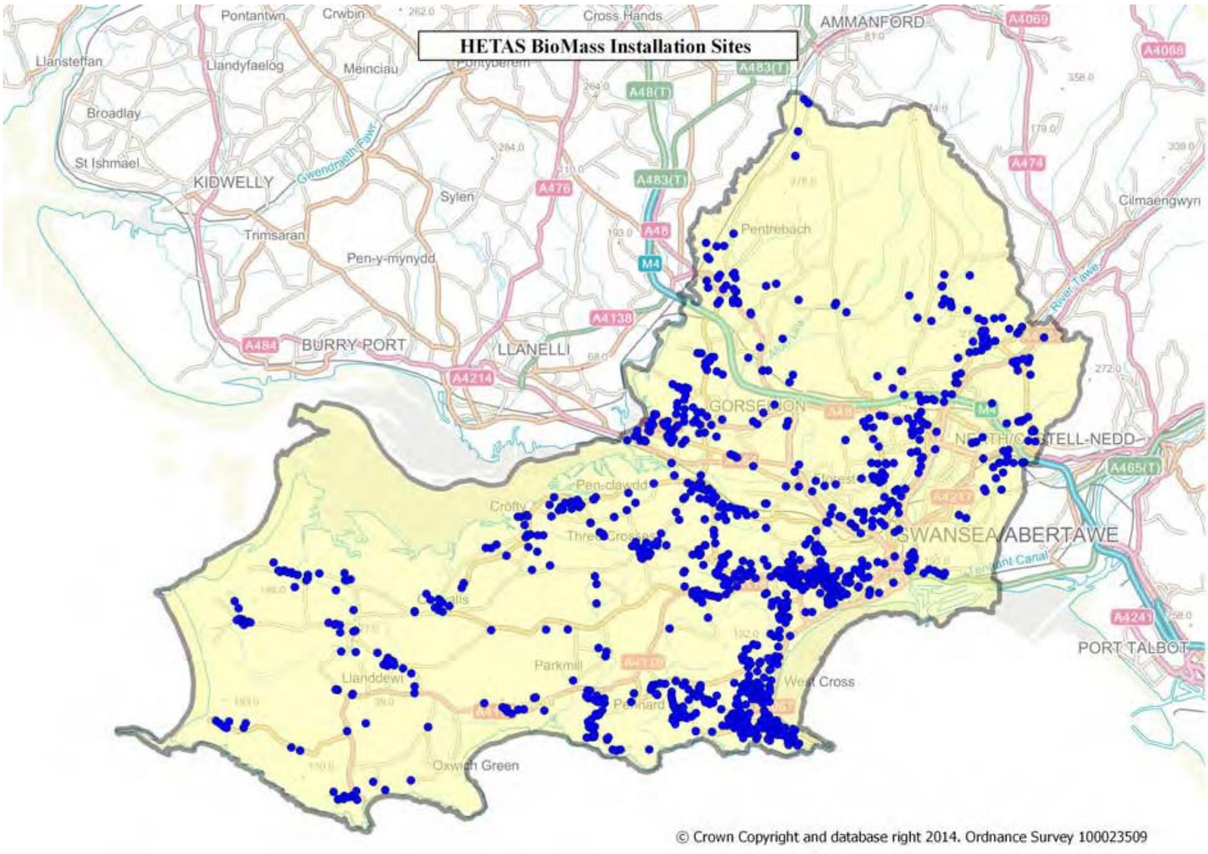
LAQM.TG(09) outlines within Section D.1b of chapter 5 a method to assess the impact of small, domestic biomass combustion. It has been noticed through conversations held with colleagues within Building Control that a record of domestic biomass installations is held where those installations have been undertaken by a HETAS approved installer of an approved HETAS appliance.

HETAS Ltd approval of appliances consists of assessment of a type test report from a Notified Laboratory to the relevant BSEN supported by the manufacturer's production control, followed by periodic surveillance of the product as appropriate. HETAS Ltd also checks manufacturers Installation and Operating Instructions to confirm that they meet UK Building Regulations and conform to UK practice. While the appliance remains in the Guide, this surveillance continues, to ensure that the product remains the same as the original unit tested. Any solid fuel appliance that was approved at the time of manufacture, and which was subsequently installed, maintains its approved status even if at a later date the model is removed from the Guide. New units of the model, produced after removal from the Guide are, however, not approved as they will have been produced at a time when the product surveillance by HETAS Ltd had ceased. It would not, therefore, be possible to ensure that the new units were the same as the unit originally tested.

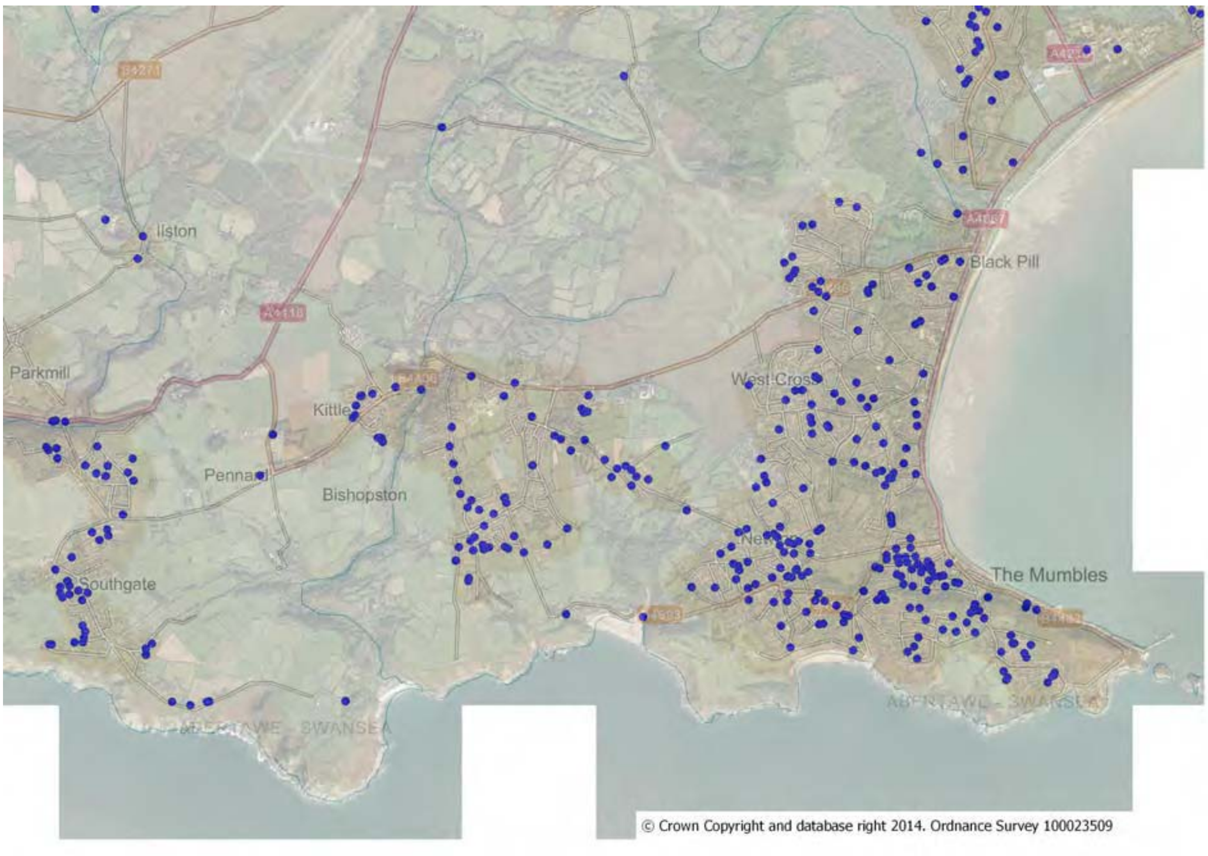
Building Control has supplied a list of total notifications received under the above scheme, complete with Ordnance Survey easting and northing coordinates to allow plotting within Quantum GIS system. The only problem found is that the description on the registration doesn't specifically state the type of appliance i.e. wood burners. It is thought that wood-burners are the more likely installation to be registered within domestic premises. With this limitation in mind and accepting the scope of description, the complete list has been plotted so that an understanding of the spatial distribution of appliances can be made. It is important to recognise that it is probable that appliances have been purchased and installed by home owners themselves or installers that do not "comply" with the above scheme and that the situation may be different to that presented within map 27 below.

As can be seen from map 27 there are several distinct clusters which, for the purposes of this report are assumed to be primarily wood-burning appliances. The major cluster is within the affluent area(s) of Mumbles, Bishopston, Langland and Mayals of south-west Swansea. The authority has investigated 20 complaints during 2011 relating to nuisance from "wood-burning appliances". During 2012 the number of complaints received and investigated was 22. During 2013, the authority received and investigated 19 complaints. Over 50% of the complaints received during 2011 - 2013 emanated from the above mentioned areas. The majority of the complaints related to smoke nuisance where flue terminals were not extended sufficiently or poorly sited.

For information, map 28 indicates the location of installations within the above areas.

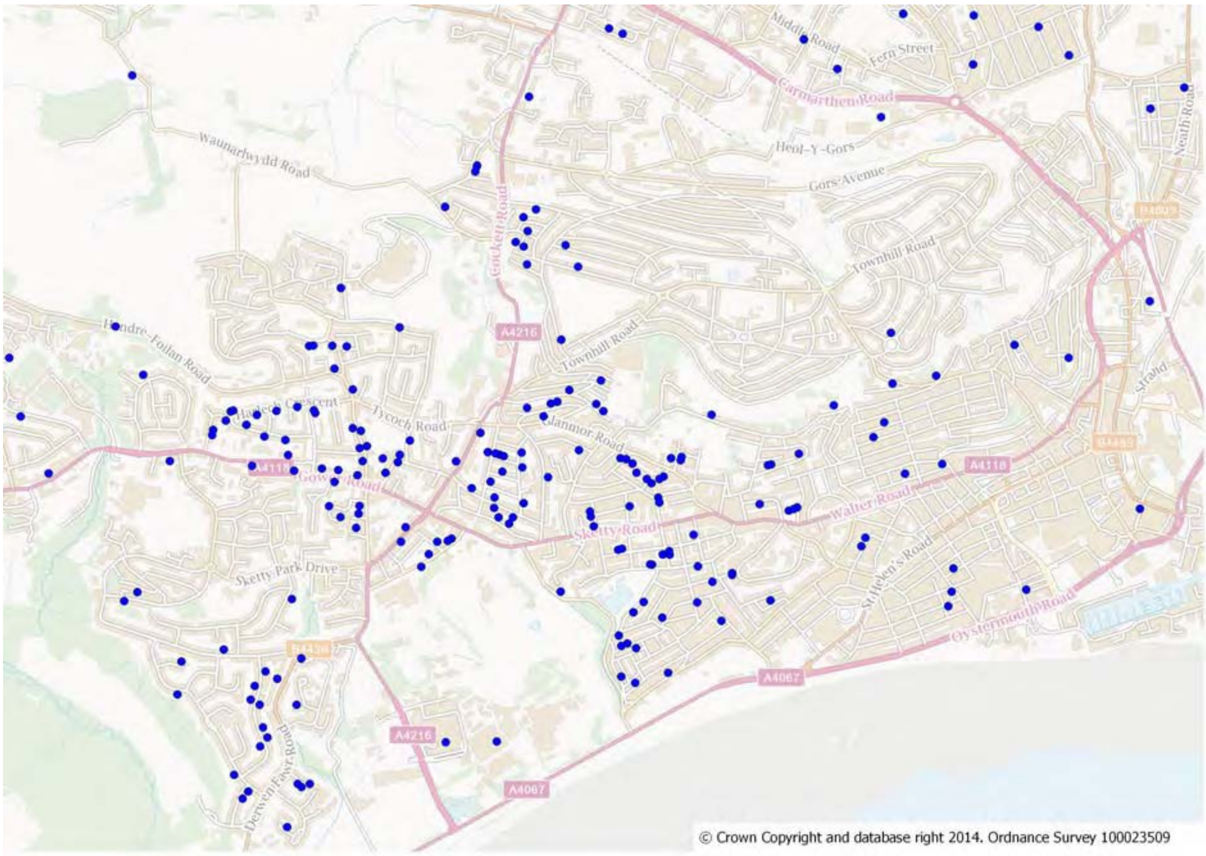


Map 27 - Indicative Biomass Combustion



Map 28 – South West Swansea – Wood Burning Appliance Installations

From map 27 another cluster of installations can be seen within what appears at first to be the city centre. However, map 29 indicates that the vast majority of this cluster is within areas just outside of the city centre, primarily within Tycoch, Sketty, Brynmill and Uplands.



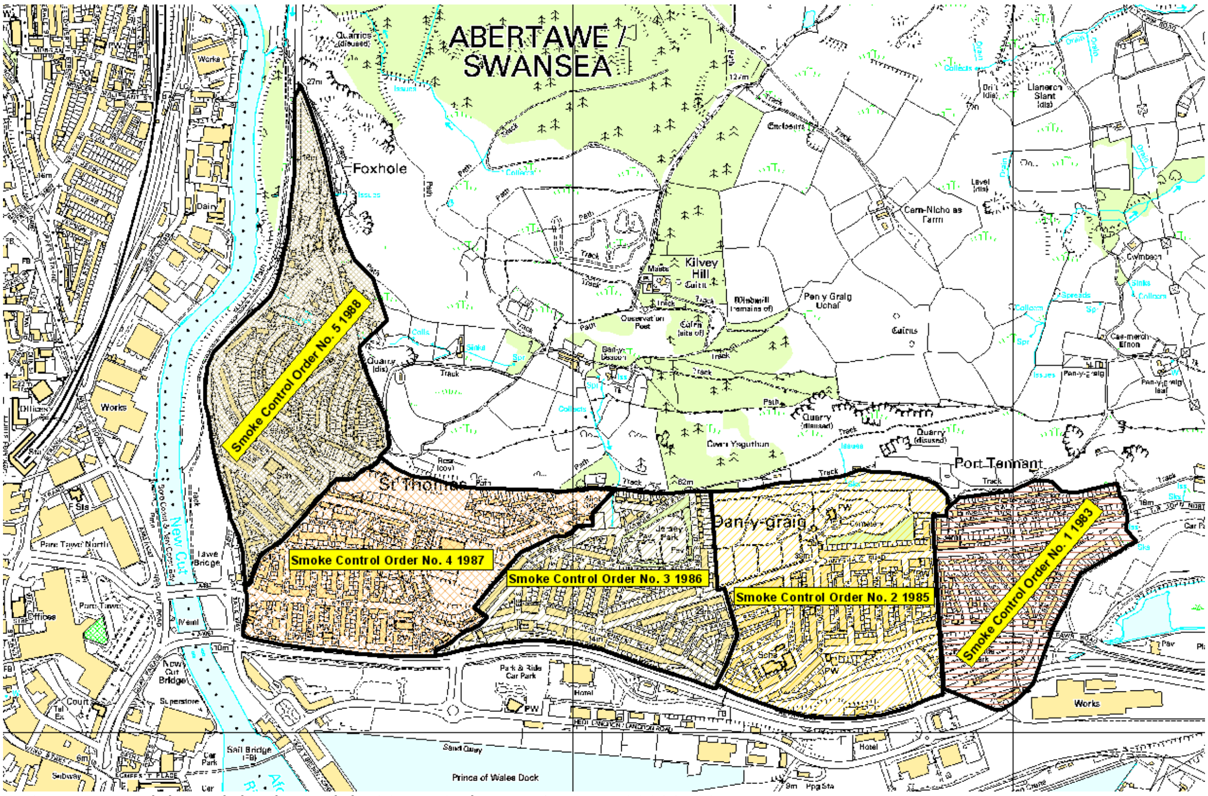
Map 29 - *Wood Burning Appliance Installations- Brynmill/Tycoch/Sketty/Brynmill*

It is clear from the basic spatial picture presented above that in order to undertake the screening as required by LAQM.TG(09) Box D.1b that details need to be clarified on the type of installation. However, the number of installations within individual 500m by 500m squares is not thought likely to lead to unacceptably high PM_{10} concentrations. This view is supported by comments within LAQM.TG(09) box D.1b (PM_{10} Overview) but it is recognised that more details are required to undertake the screening method as described within LAQM.TG(09). Discussions will take place during 2014 with Building Control to establish a method of appliance identification within the installation notifications that are received by the authority. These discussions have not taken place as yet on how the reporting of these installations can be improved.

3.4.4 Domestic Solid-Fuel Burning

Swansea City Council, the predecessor to the City and County of Swansea, declared 5 Smoke Control Areas within the Port Tennant and St.Thomas areas between 1983 and 1988 – these Orders can be seen below within map 30.

Whilst these orders limited the burning of solid fuel in approved appliances to smokeless solid fuels, the tradition of burning solid fuel has dramatically declined within Swansea over the last two decades, not solely because of the declaration of the Smoke Control Areas but as part of the national trend away from coal to natural gas consumption as a domestic fuel. This trend continues to this day. Therefore, despite smokeless solid fuel having similar sulphur content to coal, the burning of such fuels in any approved appliances that may remain in these areas is thought to be minimal.



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Map 30 – City & County of Swansea Smoke Control Orders 1-5

Guidance within LAQM.TG(09) requires the identification of significant areas of domestic coal burning. Significant areas of domestic coal burning are given as a density of premises burning coal exceeding 50 per 500 by 500 meter area[41]. Local knowledge would indicate that there are no longer any areas within Swansea that have this density of domestic coal burning. This situation has not altered from the previous Updating and Screening Assessments/Progress Reports submitted.

The actual number of properties within the City and County of Swansea's area that burn solid fuel as the primary fuel for central heating is given as 4,398 within the 1997 Welsh Household Information Survey published in 2000. This equates to 4.9% of properties within Swansea. For completeness, the number of properties burning fuel oil as their primary source of heating is given as 1,759, which equates to 2% of properties. The figures for the whole of Wales are 7.4% and 5.3% respectively. In reality, the number of properties that burn solid fuels has in all probability, reduced significantly from those published in the Welsh Household Information Survey.

The City & County of Swansea confirms that there are no areas where the burning of Domestic Solid Fuel meets the specified criteria within the local authority area

3.5 New Developments with Fugitive or Uncontrolled Sources

Following the rational mentioned elsewhere within this report, details previously reported are reproduced here again for completeness. Guidance within LAQM.TG(09) box 5.10 Section E page 5-53 indicates an approach to adopt to assess fugitive sources of PM_{10} from a number of sources including quarrying, landfill sites, coal and material stockyards, or materials handling. Where dust is emitted, a proportion, (typically about 20%) will be present as PM_{10}. The guidance indicates that relevant exposure "near" to the sources of dust emission be established. Near is defined as within 1000m if the 2004 objective PM_{10} annual mean background concentration taken from background maps is greater than or equal to 28μg/m^3, within 400m if the 2004 objective PM_{10} annual mean background concentration taken

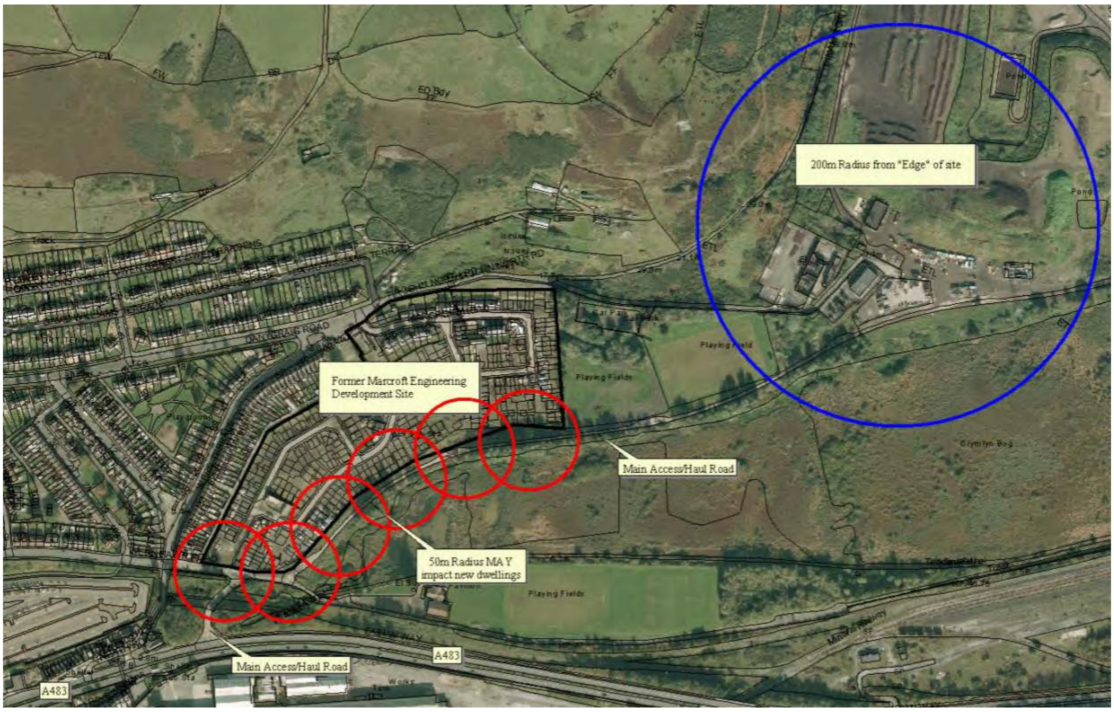
[41] LAQM.TG(09) box 5.8 section D2 page 5-51

from background maps is greater than or equal to 26µg/m^3, and within 200m for any background

Based on the 1k by 1k grid squares background PM_{10} maps downloaded for 2013 from http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011, and after indexing the field Total_PM_{10} it can be seen that the maximum 1k by 1k grid square (266500 195500) background concentration is 14.80ug/m^3. Therefore, "near" is taken to be the latter distance i.e. 200m.

3.5.1 Tir John Landfill Site

LAQM.TG(09) Section E.1 of box 5.10 expands on the issue of relevant exposure if exposure is within 50m of an offsite road used to access the facility. These sections of road which may extend up to 1000m from the site entrance are considered to be near, as long as the background concentration is above 25ug/m^3 and there are visible deposits on the road. Map 30 below shows the situation currently at Tir John landfill site. There is very marginal relevant exposure within 50m from the main access road at properties on Wern Terrace, Port Tennant (shown by red circle). In addition, the former Marcroft Engineering site has been developed over recent years to provide numerous new properties. Development of the site was completed during early 2013 with only a small parcel to the south west section available for any additional construction. The development can be seen below within the Ordnance Survey MasterMap data as map 30. Obviously, now the development is complete, dozens of new properties fall within the 50m radius (red circles) from the access road. At present, as the maximum background PM_{10} concentrations do not exceed 26ug/m3 anywhere within the authority's area and, as there are no visible deposits on the road, these locations can be discounted. This view is reinforced by knowledge that no complaints have been received from either the long-term existing residents along Wern Terrace or the new residents surrounding the landfill site.

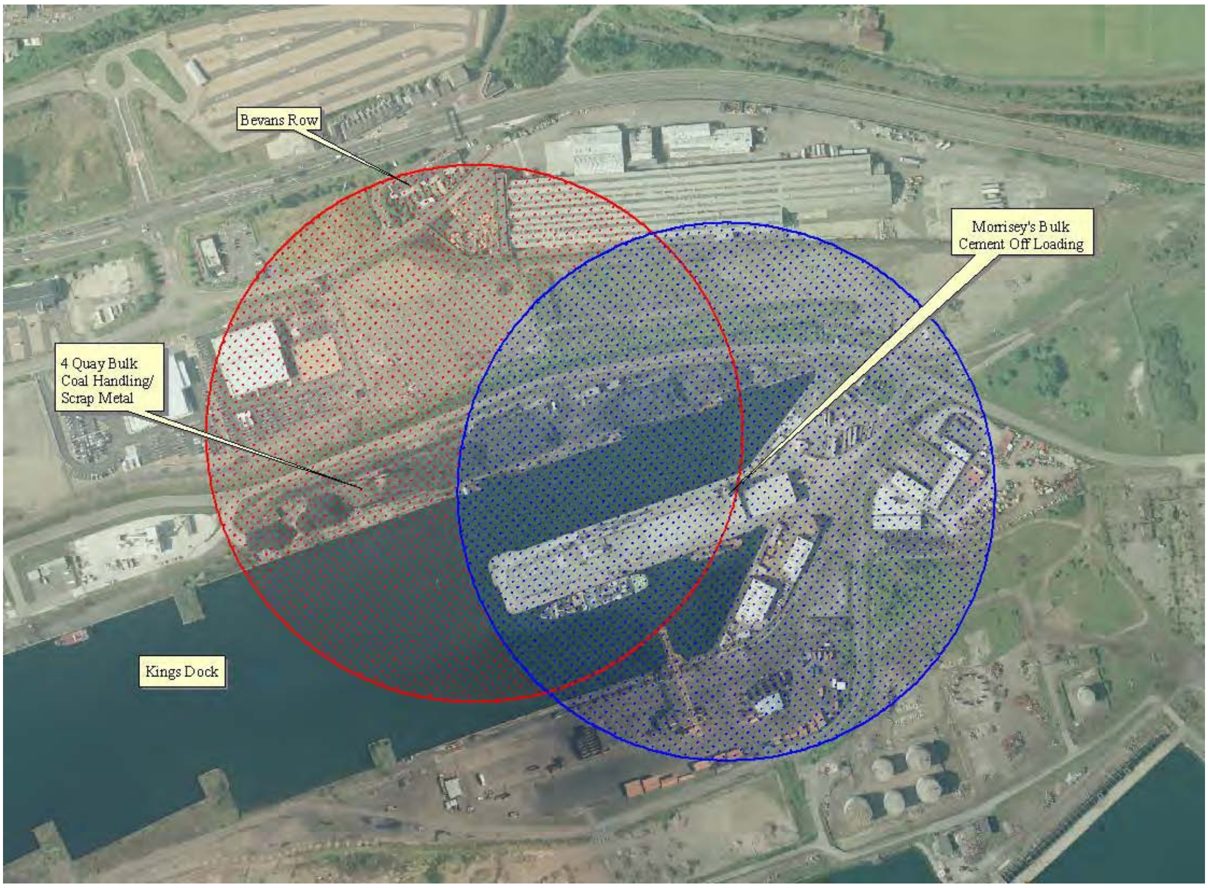


Map 30 –Tir John Landfill Site, Port Tennant, Swansea

There are no receptor locations within 200m of the main landfill area (blue circle). The Environment Agency (since April 2013 in Wales now known as Natural Resources Wales) refused to issue a permit for the ongoing use of Tir John to the LAWDC – Swansea Waste Disposal Company as a landfill site. The site therefore ceased operation for several years, pending an appeal by the LAWDC. The LAWDAC subsequently won the appeal and the site is now once again fully operational. However, during 2012 the LAWDAC was disbanded and the operations at Tir John have been brought back under the direct control of the authority.

3.5.2 ABP Port of Swansea

There are operations carried out within the ABP Port of Swansea that have the potential for fugitive emissions i.e. 4 Quay bulk coal-handling facility and Morrisey's Cement Bulk off loading facility both located around the Kings Dock. The Port Health Authority regulates both of these operations. Map 31 below identifies both these activities at Kings Dock. 4 Quay handles a bulk coal handling facility on the dock side.



Map 31 – Location of 4 Quay and Morriseys Bulk Cement Kings Dock, Swansea
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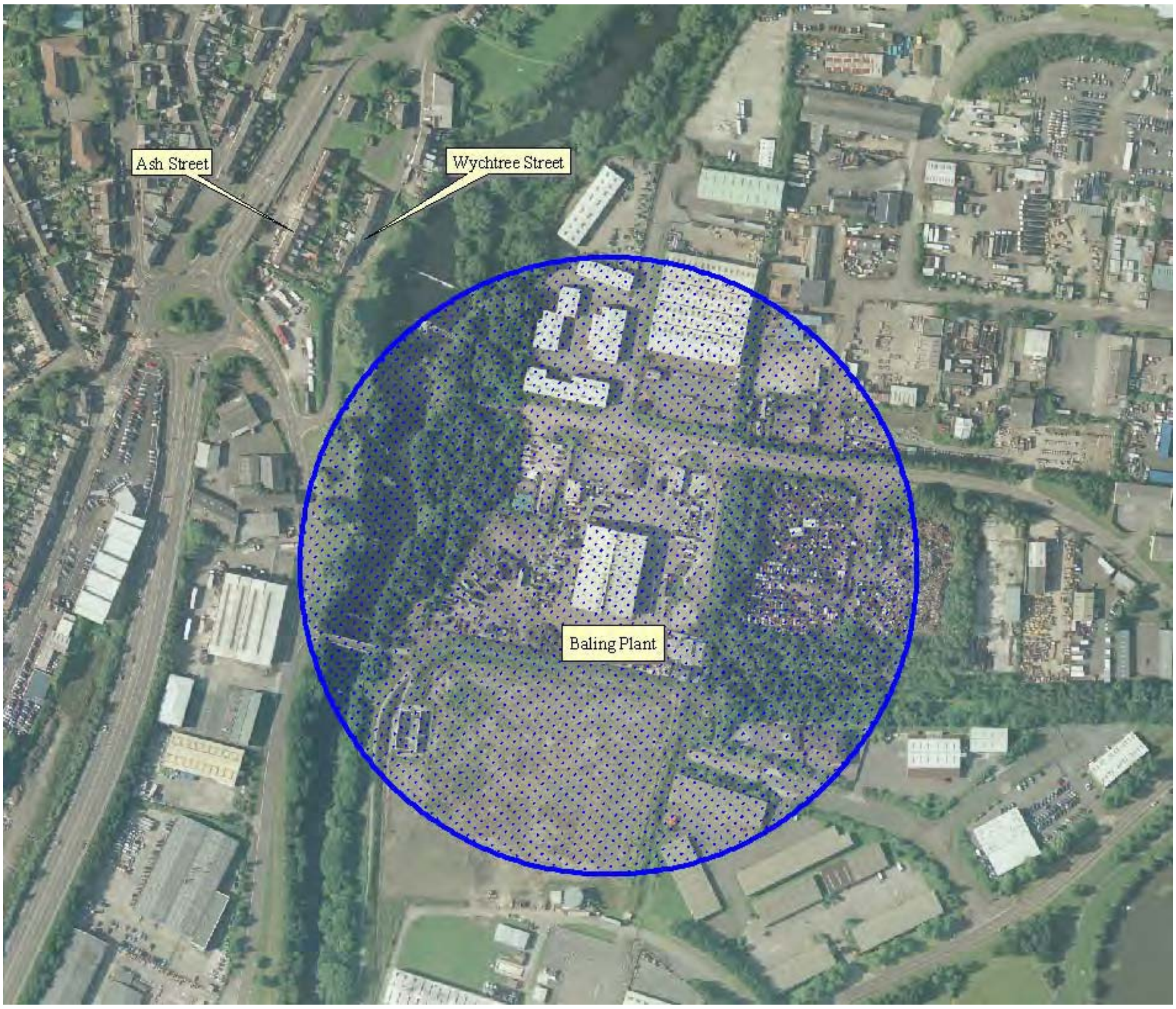
In recent years, stockpiles of scrap metal are also handled on 4 Quay. Receptor locations at Bevans Row, Port Tenant are located within 200m of the bulk coal/metal stockpiles (red circle). Litigation several years ago, resulting from an action from residents of the wider Port Tenant community resulted in a High Court judgement ruling in favour of the operators. It is not intended to revisit this issue in the light of the complete lack of dust complaints from Bevans Row. Morrisey's cement bulk off loading facility has been the subject of enforcement actions by the Port Health Authority to affect abatement techniques. Negative pressure systems, combined with a new bagging plant and construction of internal walls within the offload area have now negated the previous substantial fugitive emissions from the offload process. There is no relevant exposure within 200m of the bulk cement offload operations (blue circle).

3.5.3 Waste Management Facility – Baling Plant

The LAWDAC operated the Baling Plant off Ferryboat Close, Morriston Enterprise Park until the authority disbanded the LAWDAC during 2012 and took back complete operational control of the facility during 2012. The facility handles all domestic waste arisings within Swansea as well as being the main recycling centre within Swansea. Domestic waste in all its forms is transported into the Baling plant pending its bulk transportation to Tir John Landfill site and elsewhere. Map 32 shows the proximity of the facility to the nearest receptor locations.



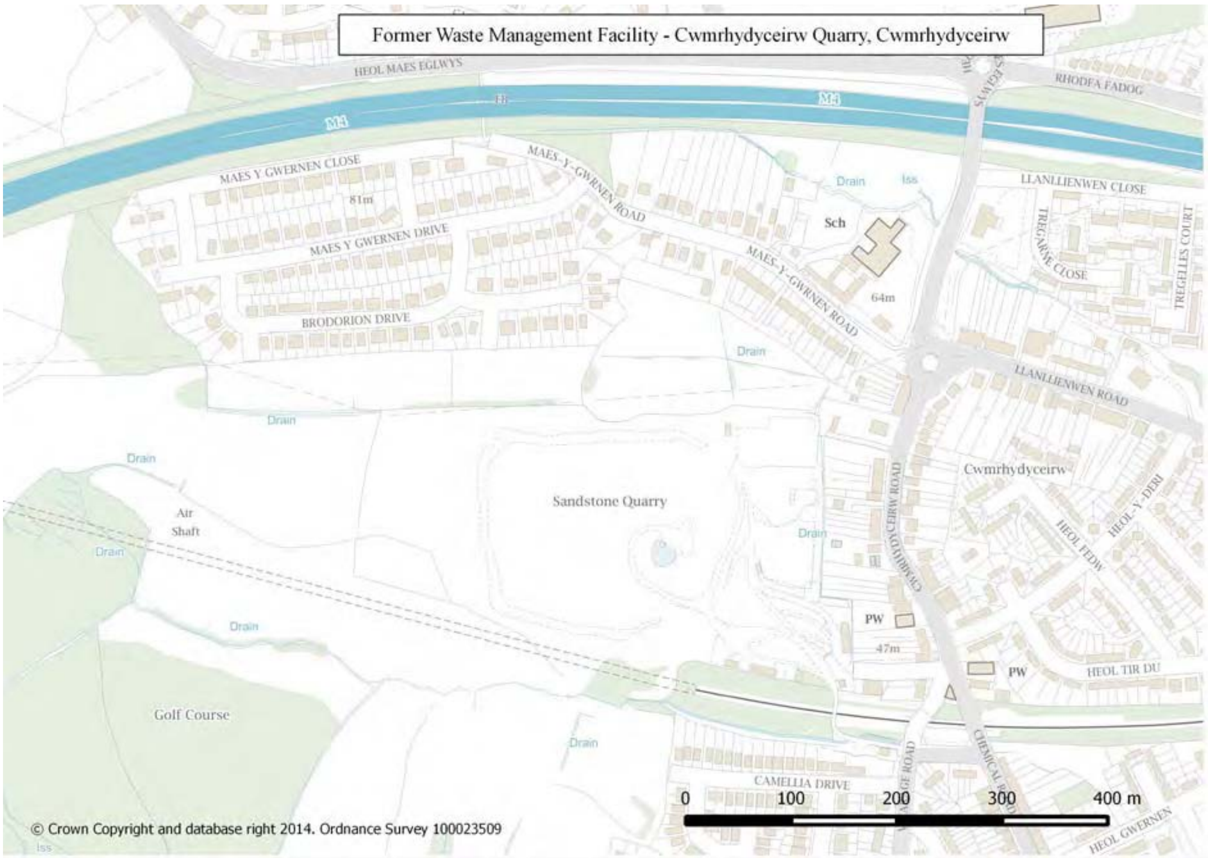
Map 32 – Baling Plant, off Ferryboat Close, Morriston Enterprise Park

There have been numerous complaints of odour spanning several years, resulting mainly from the composting activities at the facility, but no substantive dust complaints. Composting activities have now ceased at the facility. In any case, with reference to LAQM.TG(09) box 5.10, there are no receptors within 200m of the centre of the facility (blue circle).

3.5.4 Waste Management Facility – Cwmrhydyceirw Quarry

Cwmrhydyceirw Quarry had previously been used as a landfill site up until the late 1990's for low grade industrial as well as domestic waste arising. However, following the refusal of the Environment Agency to issue a permit for its operation, the facility closed. The facility remained dormant with low maintenance aftercare operations being undertaken until the site was purchased by new operators. Following protracted negotiations between the Environment Agency and the new owners, a permit was issued for deposits of waste to recommence following extensive preparatory works. Details of the preparatory works undertaken have been reported within previous LAQM reporting. During 2011 and after these preparatory works were complete the site became totally inactive. During late 2013 the authority became aware of the possibility that the site would be made available for housing. An outline Planning Application has been received during early 2014 and the site remains totally inactive. All PM_{10} monitoring equipment deployed has been removed from site. All nuisance dust investigations have also ceased.

For information purposes only, a map of the former waste management facility is enclosed below as map 33



Map 33 Former Waste Management Facility – Cwmrhydyceirw Quarry, Cwmrhydyceirw

3.6 Operational Opencast Coal Mines or Quarries

There are no operational opencast coal mines or quarries within the Swansea area

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

The City & County Swansea 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.

The Strategy and accompanying biennial action plans are reviewed every two years and in both the 2010 and 2012 reviews, strategic priority ST3 received a red RAG status and ST4 an amber status. The most recent review summary report commented that *"Whilst the monitoring of air pollution in Swansea is still at a high standard, air quality remains a major concern and the Swansea Air Quality Management Area has been extended."*

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 is also 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

Various specific actions were proposed to address these aims and updates on progress with these actions were discussed at air quality task group meetings in 2010 and 2011.

In February 2011, the air quality task group invited Prof. Ronan Lyons to present on urban design and health. This stimulated much discussion and interest was expressed in a number of potential research projects and initiatives.

In March 2011, Swansea Environmental Forum organised a seminar on Low Emission Zones with speakers from Cardiff University School of Medicine, AEA environmental consultants and the local authority. This was well attended by a variety of stakeholders including hauliers and bus companies, and there was constructive discussion about the potential for an LEZ scheme in Swansea.

Though the task group did not meet during 2012, the group did reconvene in September 2013. The action plan was reviewed and ‘promote cycling’ was added to action no.6. it was agreed that the group should meet on an annual basis.

A review of the Environment Strategy is currently being undertaken and a report and new action plan are expected to be published towards the end of June 2014.

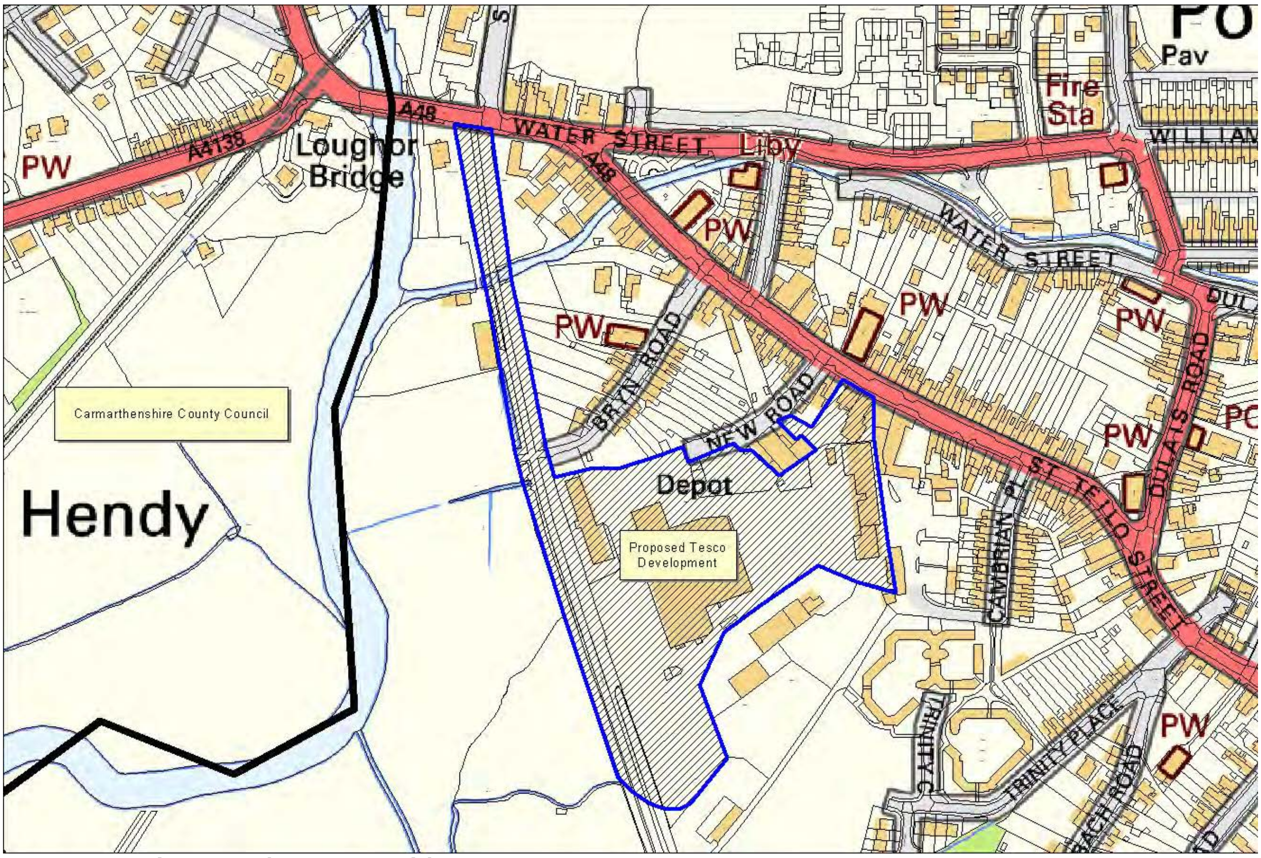
5 Planning Applications

Prior to the economic downtown nationally over the last couple of years, Swansea had seen in the preceding years, a substantial amount of interest in development of both green field sites and brown field sites. The catalyst for this upsurge in development was undoubtedly the DIEN (Department of Innovation Enterprise and Networking – formally the Welsh Development Agency) led redevelopment of the old docklands within Swansea Port that has become known as the SA1 development. This major investment site has seen developers submitting Planning Applications both within the SA1 area and more lately outside of that area but to the main within the influence zone of the SA1 development.

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 have largely been 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. Some application site details are repeated here where they are significant, where works have just commenced or works are nearing completion or works have been completed. Where works have been completed a brief update on observed impacts are made where these are possible.

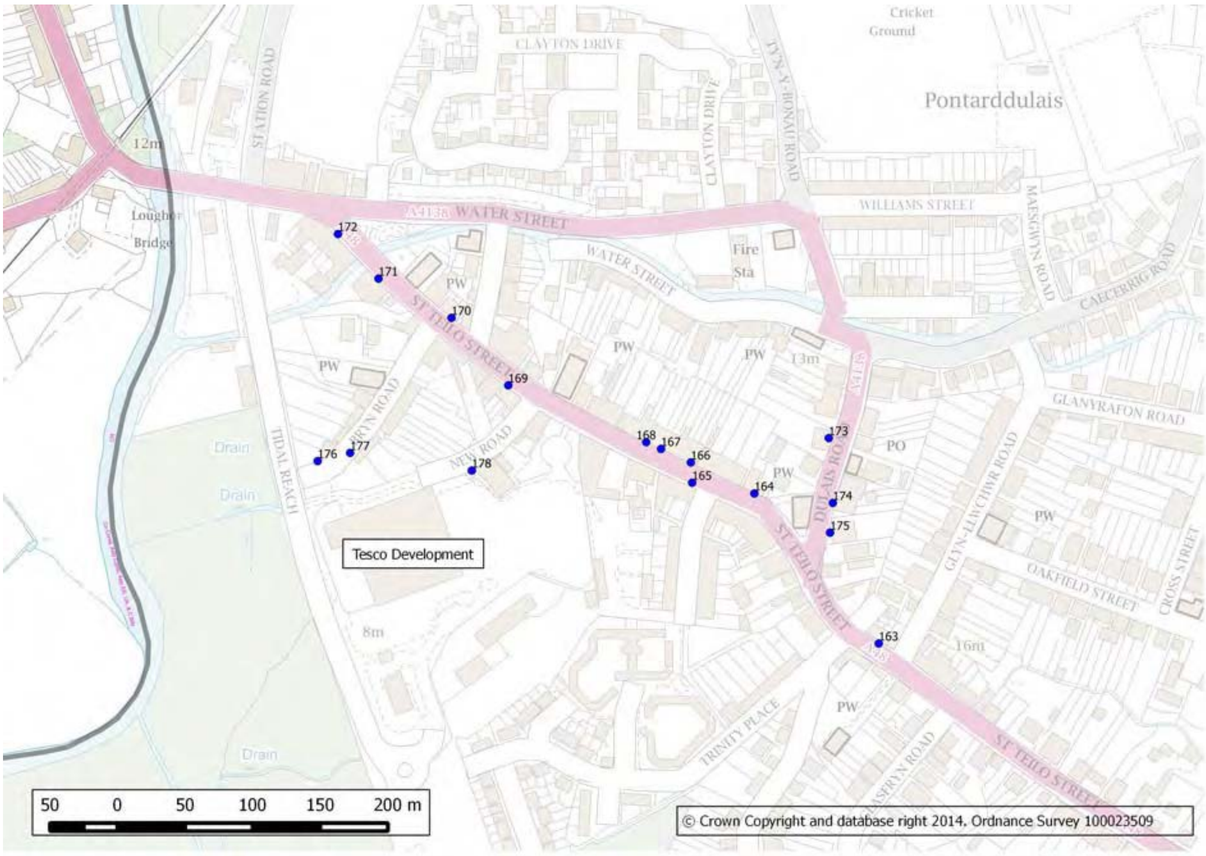
5.1 Tesco Stores, Pontardulais

Works were completed for the provision of a Class A1 Retail Food Store during late 2011. These works provided a store with a gross total floorspace of 4,168 sq. metres (44,874 sq.ft.) with associated parking (324 spaces) and servicing, petrol filling station / car wash and the formation of a new vehicular access along the line of a disused railway line incorporating a new signalled controlled junction on Station Road (A48), a roundabout at the junction of Iscoed Road (A4138) and Fforest Road (A48), a pedestrian link to St Teilo Street and associated landscaping works. The development can be seen below within map 34.



Map 34 Proposed Tesco Development, Pontardulais, Swansea.

Despite traffic queuing back up Walter Street/St Teilo Street from the new signal controlled junction, monitoring results from the area indicate that all sites remain compliant with the nitrogen dioxide annual mean objective during the last 4 years (see sites 163-178 within table 10 above). The development has had little or no impact on local concentrations within St Teilo Street which was considered to be at risk of breaching the objective due to the narrow nature of this one-way congested road. For information, the monitoring sites are outlined below within map 35.



Map 35 – Passive NO_2 sampling locations 2010-2013 around Retail Food Outlet development

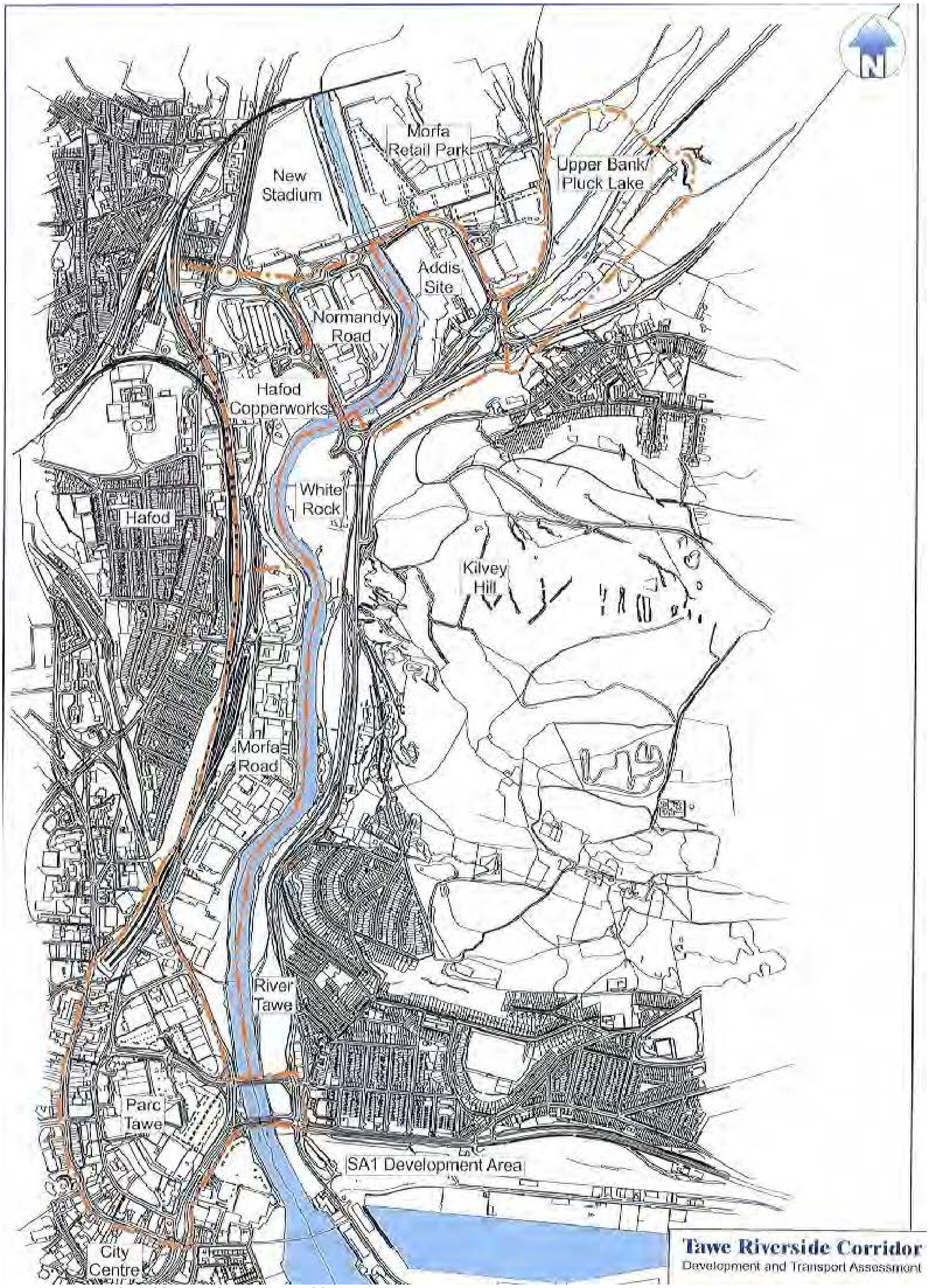
5.2 The Tawe Riverside Development Corridor

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 map 36 below[42]. 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 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.

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



Map 30 Tawe Riverside Development Corridor.

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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.

5.2.1 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 2013.

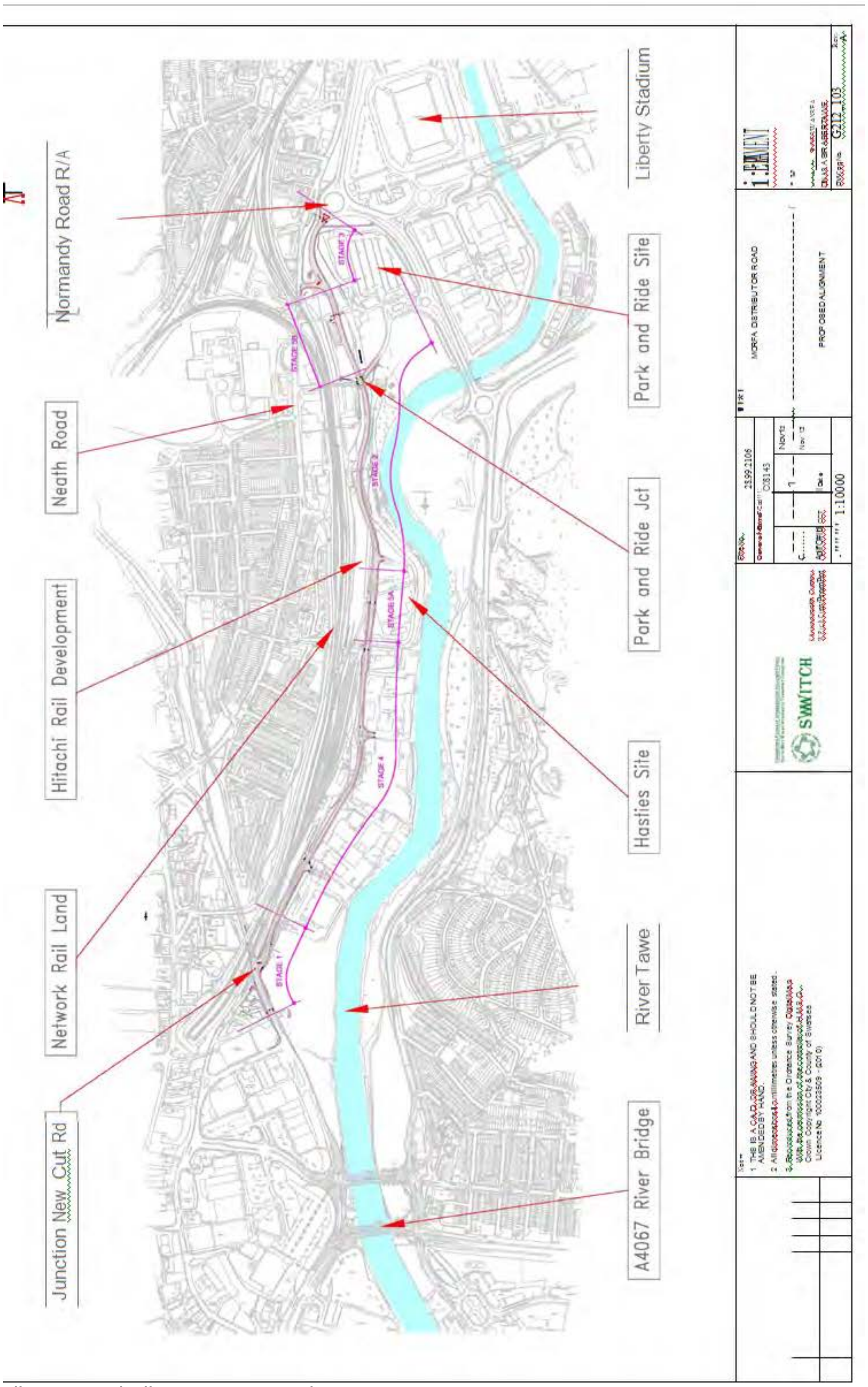
Upper Bank/ Pluck Lake

- 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

5.2.2 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.



Map 37 Morfa Distributor Road Alignment Proposals

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It is intended that the road would have a “distributor route” function aiming to serve development in the area. Map 37 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.

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.

5.2.3 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 map 38 below.

Map 38 - 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);
  - Office development of the former dairy site, average of three storeys (1.55 ha, approximately 23,250 m^2 gross floor area);
  - 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 2013 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.

5.2.4 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 map 39.

Map 39 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.

5.2.5 Normandy Road Industrial Estate

Normandy Road is an industrial estate lying to the east of the Hafod Site and the south of the Liberty Stadium and Morfa Retail Park. It is almost fully developed and bounded by the river on the eastern boundary, the A4217 to the west and stadium to the north. The estate is occupied predominately by industrial premises, with the exception of the Territorial Army premises and a three-storey office block. The estate is visually prominent in an area, which has seen considerable recent development.

It is considered that the industrial estate serves an important function in providing premises close to the city centre, and it would neither be desirable or easily achievable (given the large number of occupiers and leases with the local authority) to comprehensively redevelop the estate. The buildings are however relatively dated and the estate could benefit from selective redevelopment and refurbishment. The location of the industrial estate is shown below as map 40.

Map 40 Normandy Road Industrial Estate

The site is not proposed for comprehensive redevelopment and therefore the proposals involve a package of environmental improvements rather than a master plan for the site. The strategy for the future of Normandy Road is therefore to:

- Retain the site as a location for employment and industry;
- Visually enhance the site and reduce the visual impact on adjacent land uses;

5.2.6 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)

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 1 and 2.[43] The Master plan for the site produced for the application is included as map 41.

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 2013 and construction of other dwellings within the overall scheme is well advanced.

Map 41 – Former Addis Development Site

[43] Images courtesy of Hyder Consulting Final Report Tawe Riverside Corridor June 2006

5.2.7 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 map 42 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

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 is proposed to include a small food store (approximately 10,000 sq ft) and associated parking, serving the immediate local area and offering a different product to the Morrison's superstore within the retail park.

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.

Map 42 Upper Bank/Pluck Lake Development Site

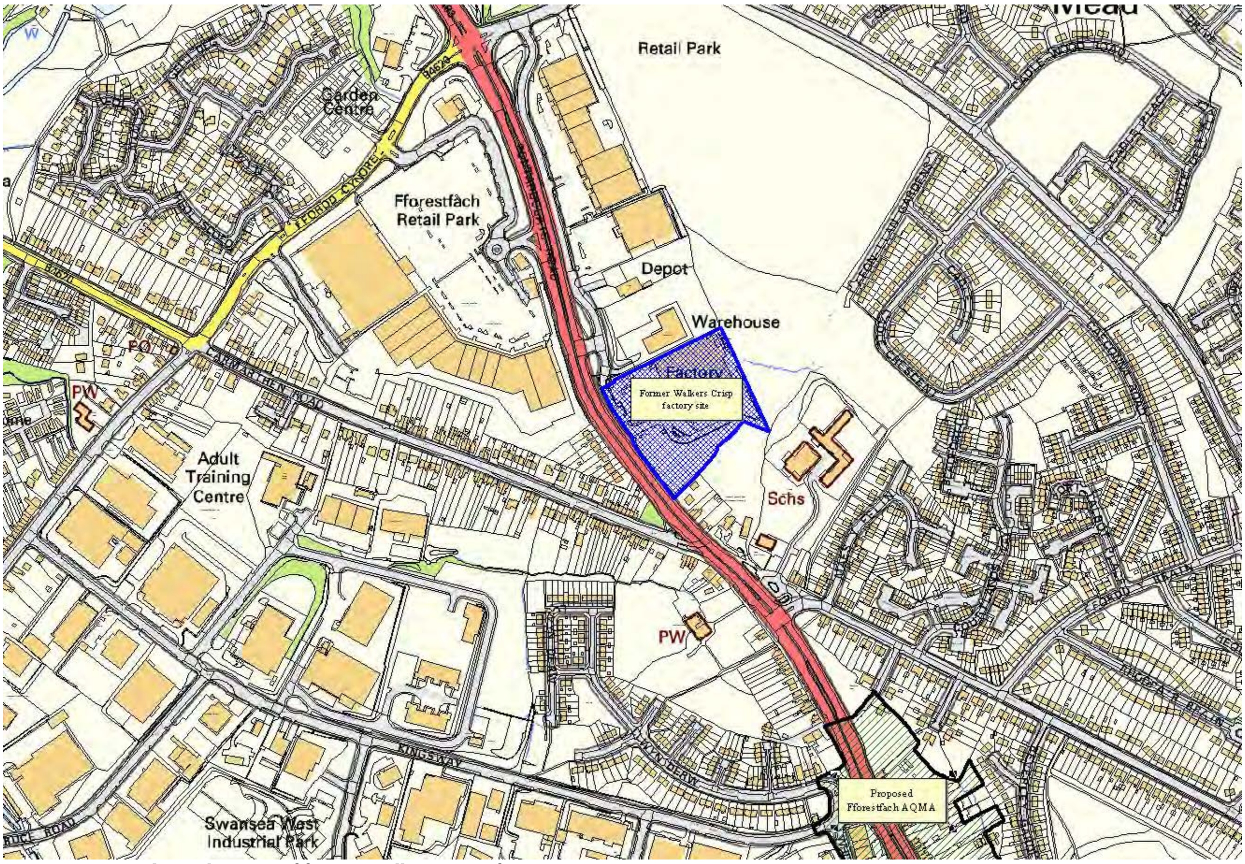
The master plan includes the provision of an area to safeguard the future operations and expansion of the Railway Society site. The proposal includes the recommendation that the site redevelopment includes for implementation of Phase 1 works (by negotiation between the Railway Society and City and County 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 commence during early 2014 but now appear to have stopped.

5.2.8 Former Walkers Crisp Factory, Pontardulais 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 Pontardulais 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. Map 39 below outlines the proposed development site. As of early 2014, the development has not commenced.



Map 43 Proposed Development of former Walkers Crisp factory site

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5.2.9 Liberty Stadium Expansion

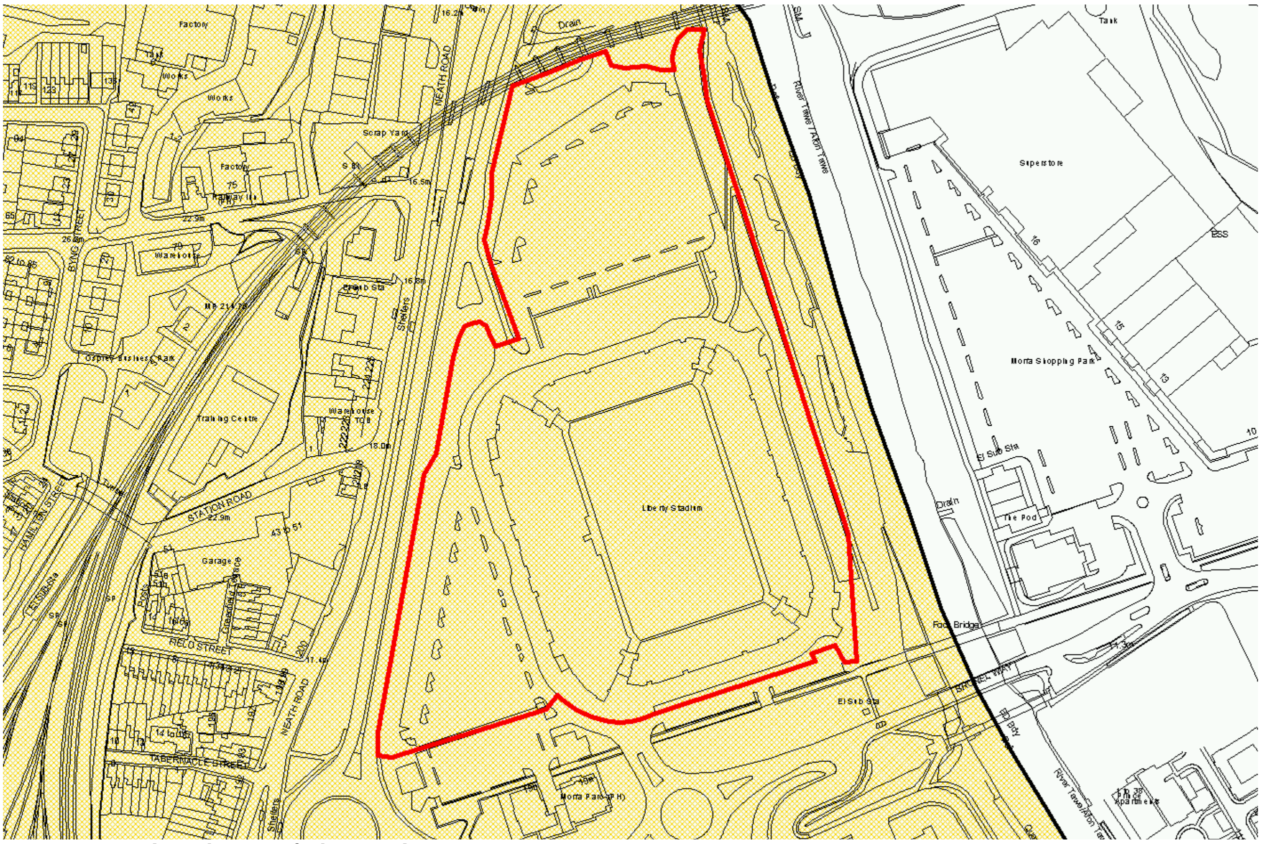
A Planning Application was submitted by Swansea City AFC (ref 2013/0554) to expand the Liberty Stadium, Landore, Swansea from 21,600 seats to 34,000 seats.

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 proposedto 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 works are yet to commence. Further updates will be provided in due course.

A map of the proposed development location is given below as map 44. The Swansea 2010 Air Quality Management Area is highlighted as the shaded area.



Map 44 Proposed Development of Liberty Stadium

5.2.10 Additional Planning Applications Received

A list of additional planning applications received where the scheme could possibly impact upon local air quality are listed below within table 42.

App Ref. No.	Location	Description	Decision	Decision date
2013/0261	Land at Cae Duke Loughor Road Loughor Swansea	Construction of 106 residential units and associated works, including a new access spine road, public open space, recreational space, surface water attenuation ponds & reed bed, and public footpath linking onto Waun Road	S106P, Perm Subj to S106 Agree	25/4/14
2013/0741	T D Williams Site, Pleasant Road, Gorseinon, Swansea	Change of use of warehouse distribution centre to Local Authority corporate transport depot (including associated vehicle maintenance), layout out of vehicle/staff car parking, external alterations to existing office/warehouse building, 3m high perimeter fencing, ancillary outbuilding/structures and alteration of existing vehicle access points (Council Development Regulation 3)		
2013/1017	Tidal Lagoon Swansea Bay Swansea	Proposed application for development consent to construct a tidal lagoon for the purpose of generating renewable energy (consultation under Section 42 of the Planning Act 2008)		
2013/1069	Maliphant Rail Depot, Maliphant Street, Landore, Swansea, SA1 2EN	Construction of Intercity Express Programme Maintenance Depot including a pedestrian footbridge and access ramp, maintenance building, train wash facility, two storey accommodation building, fuel pump room & tank, CET pump room & water tank, train wash plant room, HV substation, LV switch & transformer rooms, with associated security fencing, lighting, CCTV, retaining wall, groundworks, trackworks, car parking and landscaping (amendment to Planning Permission 2011/1305 granted 1 February 2012	GPC, Grant Permission Conditional	17/12/13
2013/1114	Land south of Heol Dulais Birchgrove Swansea	Construction of 148 residential units and associated works	S106P, Perm Subj to S106 Agree	8/5/14
2013/1254	Former Clayton Works Site, Station Road, Pontarddulais, Swansea, SA4 8TJ	Construction of up to 53 residential units including public open space, public car parking (13 spaces), pedestrian access to Water Street, new vehicular access from Station Road and secondary emergency vehicle access onto High Street (outline)		
2013/1360	Eastern plot of Cwmbwrla Park, Gerddi Alexander, Swansea	Construction of new Burlais Primary School (two storey / part single storey) building incorporating roof-top PV array, with associated playground / sports courts, waste and sprinkler tank building, delivery area, 2.4m - 2.1m high perimeter fencing, cycle shelter, associated landscaping, external lighting, CCTV and external works. Demolition of	GPC, Grant Permission Conditional	2/12/13

		existing fire damaged changing facilities building and construction of replacement pavilion building and new 69 space car park with vehicular lay-by on Maes Glas for drop-off / pick up (Council Development Regulation 3).		
2013/1402	Plot D5A, Langdon Road, SA1 Swansea Waterfront, Swansea	Construction of 5 storey residential block incorporating 69 no. apartments (Class C3) with undercroft parking, external amenity space and landscaping (variation of Condition 13 of planning permission 2009/0330 granted on the 27th May 2009 to vary the proportion of affordable housing to be provided within the development).		
2013/1403	Former Castle Cinema, Worcester Place, Swansea, SA1 1JQ	Substantial demolition of the former Castle Cinema with retention of two storey entrance foyer to Worcester Place elevation & two storey element to the Strand elevation, and construction of a part 5 / part 4 storey mixed use development incorporating parking / storage on the Strand, commercial space (Class B1) on lower ground floor, commercial unit (Class A1, A2 / A3) at ground floor (to Worcester Place), with 66 student study bedrooms within 16 cluster flats		
2013/1522	Swansea Gors TEC site Heol y Gors Cockett Swansea SA1 6SB	Residential development for up to 73 dwellings (outline)		
2013/1665	The River Bank Pentrechwyth Swansea SA1 7DD	Construction of 4 blocks of three storey residential apartments (60 No in total) with associated car parking, cycle, bin, caretakers stores and associated works (amendment to planning permission 2006/0344 granted 13th September 2006)	GPC, Grant Permission Conditional	13/2/14
2013/1806	Former Pantycelyn Hotel 368-370 Oystermouth Road Swansea SA1 3UL	Construction of 29 no. 1 bedroom flats	GPC, Grant Permission Conditional	29/5/14
2013/1815	Phase 1 Parc Tawe Plantasia Swansea SA1 2AL	Alterations to existing retail park comprising demolition of vacant piazza units, kiosks, and some retail floorspace (Class A1/A3 use), substantial demolition of the enclosed walkway, potential demolition of vacant Class A3 former pizza restaurant, sale of DIY goods in proposed unit 6A, extension of Unit 6A into rear servicing area to form external garden centre with associated enclosure, alterations and refurbishment of building facades, physical enhancements to the existing footbridge and associated ramp, erection of a standalone drive-thru restaurant unit (Class A3), reconfiguration of car parking layout, erection of 3m screen walling; landscaping and public realm works and associated highways works.		
2013/1844	Land at Elba Playing Fields Ffordd Beck	Construction of new Gowerton primary school with associated playground, car parking, vehicular access, perimeter fencing, landscaping, external	GPC, Grant Permission	14/4/14

	Gowerton Swansea	lighting / CCTV and external works including reconfigured children's play area (Council Development Regulation 3).	Conditional	
2014/0275	Land at Samlet Road Llansamlet Swansea SA7 9AF	Demolition of existing buildings and construction of a 1,764sqm (gross) food store (Class A1) with associated access, parking, landscaping and ancillary works		
2014/0328	Land to the rear of 212-222 High Street Swansea SA1 1NN	Construction of 5 storey block with roof accommodation (incorporating mezzanine/plant room within roof void), comprising lower ground floor restaurant/coffee shop (Class A3), with 5 storeys for creative cluster activities or office use (primarily Class B1 and ancillary uses), external alterations to existing Kings Lane warehouse and use of building for creative cluster activities or office use (primarily Class B1 and ancillary uses) over 3 floors with new bridge/walkway linking the northern elevation to High Street level, creation of lower level courtyard public open space and temporary extension of car parking area at The Strand level; associated infrastructure works, means of enclosure and landscaping.	GPC, Grant Permission Conditional	
2014/0434	Swansea University Bay Campus, Fabian Way, Jersey Marine, Neath	The construction of 545 residential student bedspaces, gym, sports hall, creche and student union facilities and associated works (Bay Campus Phase 1B) (referral from Neath Port Talbout County Borough Council)		
2014/0626	Former Sketty Junior & Infants School Carnglas Road Sketty Swansea SA2 9BP	Construction of 45 flats within 3 three storey blocks with associated car parking and external works, with vehicular access and additional car parking on Carnglas Road (Variation of condition 18 of planning permission 2010/1813 granted 15th July 2011 to vary the proportion of affordable housing to be provided within the development from 100% to reflect Council's Policy).		

Table 42 – List of Planning Applications Received

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(09) sections 4.37 – 4.39 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 have now been redeployed but an RTP Progress Report update was submitted to the Welsh Assembly in October 2013 which is reproduced within Annexe 8 in its entirety.

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.

The SEF Built Environment and Energy Subgroup (BEES) was formed in 2005 to support the development of aspects of the Swansea Environment Strategy, including carbon management issues. In the same year, Swansea Council's Sustainable Development Unit produced a Sustainable Energy Action Plan (SEAP) for Swansea (published in 2008).

The SEAP set out a vision for Swansea's carbon future and included the UK targets for carbon reduction, four strategic aims based upon resilient evidence and wide consultation, and a programme of actions to reduce Swansea's use of fossil fuels and carbon emissions by increasing energy efficiency and developing renewable energy technology capacity in the region.

Also 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 group (a subgroup of BEES) 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 outcome will be a measurable reduction of carbon emissions level to or exceeding national targets.

The Project outputs will include:

- 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 has received funding from Environment Agency Wales and the Welsh Government, enabling SEF to employ a project manager for two years from April 2012. A Low Carbon Swansea Partnership has been formed, initially involving representatives of LSB bodies and other major public sector organisations. The partners provided data for a carbon footprinting baseline study, which was commissioned in collaboration with Carbon Trust Wales. Eleven successful partnership meetings have been held between December 2011 and March 2014 facilitating information exchange and encouraging collaboration between organisations. Low Carbon Swansea has helped to initiate a working group to explore the promotion and expansion of electric vehicles in Swansea and has promoted an initiative to develop district heating schemes in Swansea.

A second tranche of data has now being collected, the partnership has been widened to include large commercial organisations and the project is also starting to engage community organisations.

The Low Carbon Swansea project website is http://www.lowcarbonswansea.weebly.com

9. Implementation of Action Plans

The authority submitted its Action plan in relation to the Hafod Air Quality Management Area in December 2004. Delays were incurred in the formulation of the plan due to the extensive planning and consultation works that were thought vital to delivering a workable plan.

The Action Plan detailed 10 action points to be taken forward by the authority. The authority intends to take these action points forward with the now Swansea Air Quality Management area 2010. Progress against each of these action points are briefly summarised within the table below and each action point expanded on below.

As a result of the considerable testing and development works that have taken place, coupled with ever dwindling resources, progress, it has to be admitted, has been slow.

It is imperative that it is recognised and understood, that further expansion and development of the system will be severely restricted if not cancelled, by a combination of the existing budgetary constraints, and the further impending and likely severe cuts in local government funding following spending reviews.

Summary of Action Plan Progress

No.	Measure	Focus	Planning phase	Implementation phase	Indicator	Progress to date	Progress in last 12 months	Estimated completion date
1	Traffic management on Neath Road	Improve safety, environment and facilities for pedestrians, cyclists and bus users	2005	Ongoing – dependant upon funding for the Hafod Integrated Transport Study		Provision of some bus stops and shelters. Gateway treatment undertaken	none	unknown
2	Park & Ride Provision	Effect modal shift	2004-onwards	2005-2007	Increased uptake in Park & Ride	3 site completed and operational along with dedicated express bus routes	Consider 4th site to west of city	3 sites completed by 2007
3	Improved Bus Provision	Effect modal shift	2004	2004 – to date	Increased patronage figures	Achieved	Ongoing provision	N/a
4	Bus Corridor Enhancements	Effect modal shift		2004-2009	Increased patronage figures	Achieved		N/a
5	Enhancement of Bus and Rail Stations	Effect modal shift		2004-2009	Increased patronage figures	Swansea High Street Transport Interchange completed during 2004. Quadrant Bus station redevelopment completed	Quadrant Bus station redevelopment completed	
6	Safe Routes to School	Reduce car usage around schoolsites				Numerous schemes implemented	none	Achieved
7	Vehicle Emissions testing	Reduce number of polluting vehicles	2005	2005		None due to costs/manpower to be incurred	None	N/a

No.	Measure	Focus	Planning phase	Implementation phase	Indicator	Progress to date	Progress in last 12 months	Estimated completion date
8	Quay Parade Bridges Improvements	To make more effective use of the existing highway network by improving traffic flows/reduction in congestion around bridges/junctions	2005		Reduced congestion		Scheme completed	
9	City & County of Swansea Vehicle Fleet							
10	Traffic Management Systems with Air Quality Monitoring Feedback	Development of computer modelling/forecast system that will aid management of traffic flows before/during/after forecasted pollution episodes	2004-12	2004 - 2014	Reduced Congestion/Modal shift/Improved air quality within areas	Considerable but certain items remain outstanding	Additional 3 Variable Message Signs installed – grant funding provided by Welsh Assembly	Unknown

- ### Action Point 1 - Traffic Management measures on Neath Road

The majority of measures identified for this action point depend upon funding being made available to undertake the recommendations of the Integrated Hafod Transport Study. Some identified action points have been completed and have been undertaken as part of phase 1 works in relation to the Landore Park & Ride Express Bus Route scheme. Items completed as part of this scheme include:

- Provision of some bus stops and shelters
- Gateway treatment to entrance to Neath Road from the Normandy Road roundabout
- Creation of traffic control point

All other identified action points within the Action Plan remain outstanding at present. The recommendations of the Hafod Integrated Transport Study are to be phased in after the renewals program being undertaken along Neath Road as part of the Hafod Renewals Program if funding can be established. This program is undertaking complete renovation of both domestic and commercial properties within the Hafod. As these works entailed extensive building works taking over part of the footway/highway with scaffolding, skips etc along Neath Road, it has been decided to undertake the Hafod Integrated Transport Study works after the renovation works are complete, as to do so earlier would result in the damage of any finished surfaces.

However, identification of the relevant funding is now proving a major issue in taking this action point forwards. It is unknown at present if the Transport Study recommendations will ever be implemented. The Action Plan initially indicated a target of December 2005.

- **Action Point 2 - Park and Ride provision**

Provision of Park & Ride is seen as a fundamental element of Swansea's Transportation Strategy. Significant progress has been made in respect to this action point:

- Landore and Port Tennant Park and Ride sites are now fully operational.
- Fforestfach Park & Ride was opened during November/December 2006 and with the site becoming fully operational during February 2008. Map 45 below shows the location on the A483 Carmarthen Road.

Map 45 Location of Fforestfach Park and Ride Site
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Patronage statistics for 2008-2013 show the continued popularity of the park and ride provisions provided by the authority but overall, the figures for 2013 continue to show a drop in previous year's usage.

Table 43 shows the total vehicles using the facilities at the 3 sites during 2008-2013.

Site	Total Spaces	2008	2009	2010	2011	2012	2013
Landore	550	133,025	137,232	121802	131101	116839	109105
Fabian Way	550	125,737	116,954	107043	123732	104915	95948
Fforestfach	449	64,134	66,581	67,241	66890	60445	60712

Table 43 Park & Ride Vehicle Usage Figures 2005-2012

- Phase 1 of the dedicated express bus route serving the Landore Park and Ride site has been completed. Phase 2 was due to commence during September 2005 but did not commence until April 2008 and is now complete.
- The construction of a new dedicated express bus route into the city centre from the Fabian Way Park and Ride site was completed during 2007/early 2008. Phase 1 of the express bus route crossed over the A483 Fabian Way at the site of an old railway bridge, which has now been removed. This crossing has been replaced with a "sail-bridge" during 2007. The express bus route then runs parallel at ground level, adjacent to and parallel with the inbound carriageway of the A483 to Quay Parade Bridges.
- There are proposals for the provision of a fourth park and ride site to serve the west of the city including the Gower. These plans are at a very early stage with identification of and acquisition of land now taking place with the aim of easing the pressure on the additional western AQMA’s.

All other identified action points within the Action Plan remain outstanding and were not complete by the indicated target of December 2005.

- **Action Point 3 - Improved Bus Provision**

The action points contained within the Action Plan were to the main being achieved upon submission of the Action Plan. However, in order to continue to achieve these aims, the authority continues to:

- Use its revenue budget to ensure that most areas have at least a minimum level of service.
- Make use of the National Assembly's Bus Subsidy Grant to ensure breaks in service are kept to a minimum

- Promote bus priority routes
- Fund a local concessionary bus fares scheme for certain categories of people
- Provide free unlimited bus travel within the authorities area for elderly people

The identified action points within the Action Plan are being achieved now but ongoing provision remains desirable.

- **Action Point 4 - Bus Corridor Enhancements**

Progress made to date includes:

- Transport Grant funded improvements to A48 Bus priority Demonstration Corridor completed during early 2005
- Bus priority proposals for Neath Road being reviewed. Works have been completed during 2009 for a new concept Metro service linking Morriston Hospital with the city centre and Singleton Hospital. The aim is to provide advantages of modern tram at modest costs. The service uses the Landore express bus route, thereby avoiding much of Neath Road. Bus priority has been introduced at key junctions along the route.
- Variable Message displays installed along a number of trial routes to improve dissemination of travel information to passengers. These trials have been abandoned due to vandalism issues.
- Accessibility to bus services for residents who are disabled or who suffer from limited mobility increased, following Transport Grant funding to raise kerb levels along with the provision of road markings and bus clearway orders at bus stops.
- Bus shelters upgraded on a number of routes

The identified action points within the Action Plan are being achieved now but ongoing provision and enhancements remain desirable.

- **Action Point 5 - Enhancements of Bus and Rail Stations**

Progress made to date includes:

- Swansea High Street Transport Interchange was completed during March 2004. Funded through a combination of Transport Grant and Objective 1 funding, this scheme has provided improved access to the railway station by bus, taxi, and on foot, together with a new public realm, improved security and improved parking facilities.
- Discussion ongoing with network rail and Arriva Trains Wales on how to improve passenger facilities at the station itself.

Quadrant Transport Interchange

The City and County of Swansea has completed a scheme to replace the existing Quadrant bus station with a modern Transport Interchange to cater for both buses and coaches, including Swansea Metro vehicles, on a larger footprint. The previous bus station was outdated in terms of passenger convenience, comfort and security. The Council's aspiration was for a modern transport interchange with high standards of cleanliness and security. The refurbishment of the Quadrant bus station was identified as a high priority in the Swansea Local Transport Plan 2000 – 2005. However, delays were encountered with not only procedures involving the compulsory purchase of land but also with ensuring the necessary funding was fully in place prior to commencement of works.

The main components of the scheme comprised the following elements:

- 20 bus bays,
- 3 coach stands
- 2 Swansea Metro "stations" on Westway.
- 12 lay-over spaces
- Modern coach station facility to serve the long distance services,
- Enhanced passenger concourse with support facilities.
- Safe access to and from West Way

- New staff and office facilities
- Travel Shop (Information/ticket sales area.)
- Shopmobility Facility. In the Garden Street tunnel area
- Associated Retail Units.
- Enhanced links into the Quadrant shopping area.
- Improved access to the Grand Theatre and Wilkinson's service areas
- Taxi rank for 9 vehicles
- Short stay parking for 5 cars (Passenger pick-up) adjacent to the coach area
- Passenger drop-off area

- ## Action Point 6 - Safe Routes to School

Safe Routes to School has been delivered in Swansea for the last several years with numerous schemes undertaken.

- Currently, Safe Routes to school schemes have been developed at:
  - Clydach,
  - Brynhyfryd,
  - Pennard,
  - Birchgrove.
  - Gowerton Comprehensive and its Primary feeder schools
  - Penllergaer
  - Whitestone Primary
  - Oystermouth Primary
  - Newton Primary

The aim again, is to encourage more pupils to walk and cycle to school through improved facilities, the introduction of traffic calming measures, together with complementary educational work and road safety training.

The focus of this work with schools is now based on the development of school travel plans. These have previously been prepared for YGG Bryniago (Pontardulais), Penllergaer Primary, Penyrheol Primary (Gorseinon), Whitestone Primary (West

Cross), Oystermouth Primary and Newton Primary. In addition, travel plans are in the process of development for Manselton Primary, Plasmarl Primary, Crws Primary, Cwmbwrla Primary, Hafod Primary, Pentrepoeth Juniors, Bishopston Primary, Knelston Primary, Mayals Primary, Sketty Primary. These travel plans will provide the basis for both infrastructure and educational work.

- ## Action Point 7 - Vehicle Emissions Testing

No additional progress has been made with respect to this action point. The equipment had, until recently, been kept serviced and calibrated until budgetary pressures forced a review, ultimately resulting in the disposal of the equipment. The primary reasons for the lack of progress were:

- No funding for Policing costs
- Lack of staff resources due to the labour intensive nature of the work.
- The Welsh Assembly Government fund for this purpose was not offered to the City & County of Swansea.

- ## Action Point 8 - Quay Parade Bridges Improvements

Savell Bird & Axon (SBA) was commissioned to develop traffic models and to investigate highway and transport solutions in the City Centre. This commission was designed to test the Boulevard proposals and key findings indicate that significant public realm and pedestrian connectivity benefits can be achieved without affecting the existing capacity for drivers.

The Tawe Bridges poses a significant capacity constraint to the strategic highway network, which is clearly largely due to the severance imposed by the River Tawe. SBA identify that the current Tawe Bridges are a significant impediment to free flowing traffic during peak hours which occur largely because of:

- **long and inefficient traffic light cycle time of 144 seconds;**
- **poor pedestrian crossing facilities;**

- **Congestion problems particularly along the northern bridge to/from Pentreguinea Road where there is uneven lane usage.**

The City Centre Transport Model recommends that the reconfiguration of the existing infrastructure, including the two bridges, can produce significant highway capacity improvements including significant reductions in existing overall delay. These capacity improvements are not only necessary to improve the present operation of the bridges but also to accommodate future planned development within the city centre area. The improvements to the bridges are critical to the delivery of the Boulevard concept, and without it the Boulevard scheme is unlikely to be able to achieve the ambition of improving pedestrian movement and upgrading the environmental setting whilst not significantly affecting vehicular flows.

The capacity of a junction is commonly measured by 'degrees of saturation', this is a measure of how much demand it is experiencing compared to its total capacity. A value of 100% means that demand and capacity are equal and no further traffic is able to progress through the junction. Values over 85% indicate that the approach to a junction is suffering from traffic congestion, with queues of vehicles beginning to form. Currently in the AM peak 8 out of the 11 links around the bridges operate above the 85% limit with 2 above 100%. In the PM peak, 6 out of the 11 sequences operate above 85% limit with 2 of these being above the 100% level.

At peak times therefore the river bridges are operating beyond their capacity. In terms of traffic growth, the development proposed around the City Centre will significantly increase demand at the river bridges. If no improvements are made, and the predicted growth in traffic to 2020 occurs, there will be severe congestion at peak times with long queues tailing back from every arm of the junction. Congestion on this scale would inhibit the city centre's capability to function and attract inward investment.

Reconfiguration Options

The City Centre Transport Model considered many iterative options for reconfiguration of the Tawe Bridges eleven of which were tested in full. Of these fully tested options two were shown to operate most efficiently and provide the greatest capacity improvements.

Option 3 provides an arrangement which involves a two way section of traffic flow across the southern bridge deck with all remaining movements travelling clockwise around the remainder of the junction. This option delivers significant improvements to all users including motorists, pedestrians and public transport users as well as creating capacity to enable the future City Centre redevelopment. The proposed layout for Option 3 is included in map 45 below

Option 7 provides a full gyratory operation utilising both the north and south bridge within this movement. This option would require the provision of additional lanes to the Tawe Bridges junctions, but provides the best capacity benefits at the Tawe Bridges junction.

Comparison of Options 3 and 7

A Transyt model has been used to assess Swansea’s city centre road network. Transyt is a software model to assess and optimise the performance of networks of road junctions by assigning ‘cost’ against vehicle stops and delays.

The following table compares the "total delay" for all vehicles in the network passing through the junction during a peak hour. This figure provides an aggregate position for the whole junction and allows a comparison to be undertaken to assess the implications of different scenarios. The 2009 base position figures reflect the current situation and indicate that at peak times the junction is saturated with significant congestion and long queues on most arms. The figures for Options 3 and 7 reflect the changes in the capacity and efficiency of the junction based upon projected increased traffic levels in 2020. The key results of the TRANSYT analysis for the AM and PM peaks can be seen in the table below.

Summary of Transyt Output

Total Delay	AM Peak Total Delay	PM Peak Total Delay
2009 - Base position	209	200
2020 - No improvement	242 (+ 16%)	248 (+ 24%)
2020 - Part Gyratory (Option 3)	109 (- 48%)	183 (- 9 %)
2020 - Full Gyratory (Option 7)	138 (- 34%)	268 (+ 34%)

In summary, the bridges are currently operating significantly beyond their capacity and congestion will worsen as traffic levels grow as a consequence of traffic generated by new developments. A do-nothing approach cannot be considered as by 2020 the AM peak delay will worsen by 16% and the PM peak by 24%.

As indicated in the table above, based on projected traffic levels in 2020 in comparison with the 2009 baseline position, Option 3 will produce a 48% improvement in the efficiency of the junction in the AM peak, and 9% improvement in the PM peak. Option 7 will produce a 34% improvement in the efficiency of the AM peak but would result in a 34% deterioration against the baseline position in its efficiency in the PM peak.

Option 3 therefore provides more capacity benefits and future proofing than Option 7.

Conclusion

The River bridges are currently operating significantly beyond their capacity in the AM and PM peaks which causes traffic congestion across the City. If nothing is done to address this then by 2020 the situation will worsen by between 16% in the AM peak and 24% in the PM peak.

Option 7 is the best of the full gyratory options identified. By 2020 this could bring improvements in the AM peak, but will make matters significantly worse in the afternoon. Most importantly Option 7 would create more congestion in the PM than if the bridges were left as they are now.

Option 3, the part gyratory, provides significant improvements in both the AM and PM peak hours.

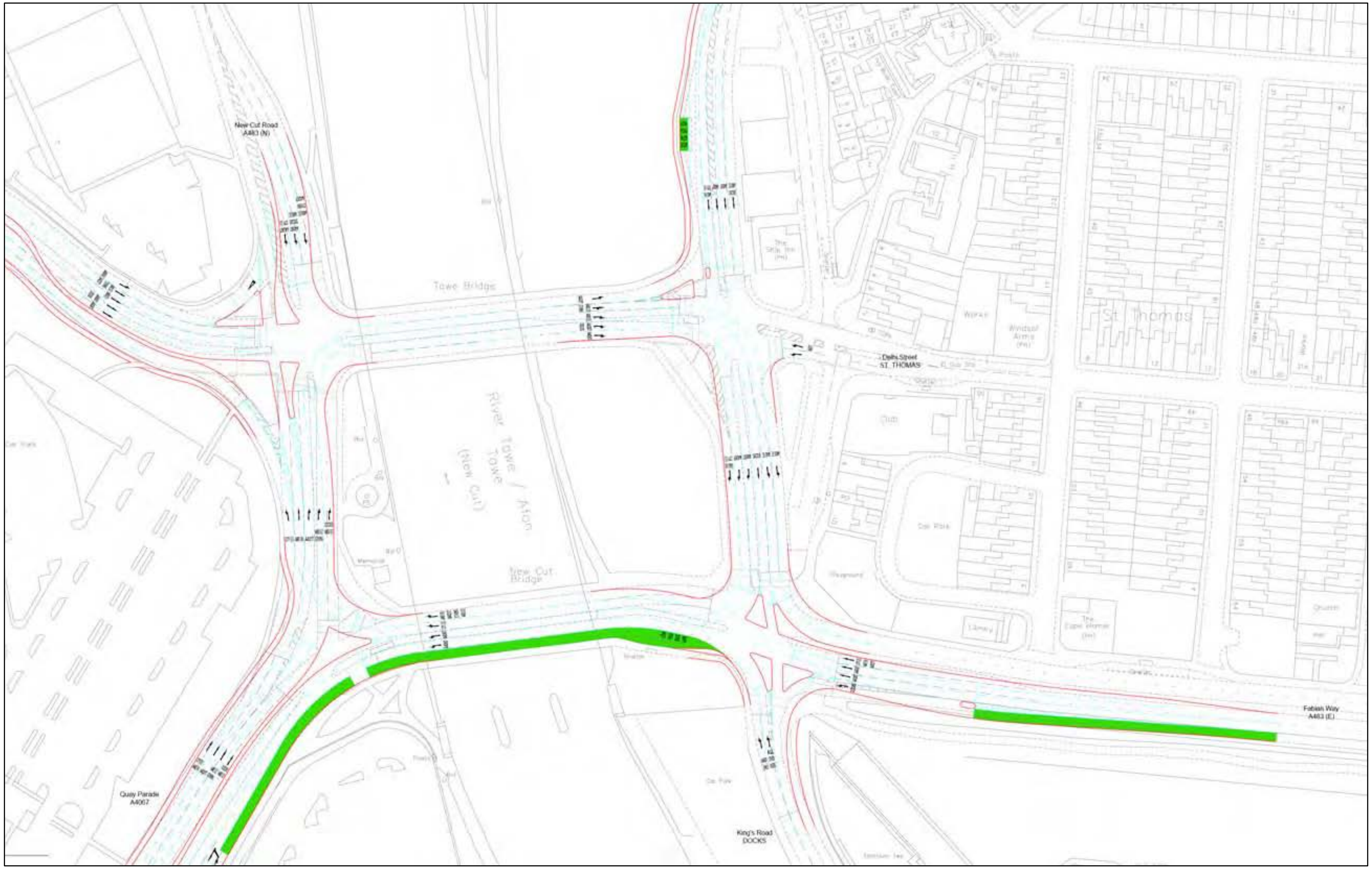
This scheme has now been completed. Flows around the junction have improved. Latest air quality monitoring would appear to paint an improving picture but it is too early to form firm conclusions at present.

TRANSYT Output for Tawe Bridges (AM Peak: 0800-0900; 2020+ Development)

LINK	Option 6		Option 7		Option 9		Option 10		Option 11		Option 3		Base 2009	
	Cycle time 116s		Cycle time 106s		Cycle time 116s		Cycle time 110s		Cycle time 110s		Cycle time 78s		Cycle time 144s	
	DOS %	Q (Pcu	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)
Parc Tawe exit	92	14	91	12	85	11	89	12	95	13	54	11	102	20
New Cut Rd (southbound)	70	6	56	5	61	6	58	5	51	5	74	11	103	18
Northern bridge	89	16	81	16	66	16	75	15	64	14	68	23	88	18
Pentreguinea	144	97	92	15	94	17	112	35	102	24	55	16	87	34
Delhi St	84	5	77	4	-	-	80	5	-	-	47	2	90	9
Eastbank	85	15	85	7	82	8	67	4	60	12	89	26**	82	14**
Fabian Way westbound	99	34	93	25	104	44	90	25	76	20	87	21	98	64
South bridge westbound	71	11	86	16	92	17	92	17	94	18	87	35	76	41
South bridge right turn	60	13	56	12	56	14	54	13	58	12	90	31	-	-
New Cut Road northbound	68	8	59	9	59	10	58	10	59	9	59	10	99	28**
South bridge eastbound	-	-	-	-	-	-	-	-	-	-	94	23	93<<	31
Quay Parade eastbound	70	19	84	21	81	22	83	22	78	20	78	13	75<<	28
Total Delay pcu.hr/hr	311		138		172		173		141		109		209	

TRANSYT Output for Tawe Bridges (PM Peak: 1630-1730; 2020+

LINK	Option 6		Option 7		Option 9		Option 10		Option 11		Option 3		Base 2009	
	Cycle time 116s		Cycle time 106s		Cycle time 116s		Cycle time 110s		Cycle time 110s		Cycle time 84s		Cycle time 144s	
	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu)	DOS %	Q (Pcu	DOS %	Q (Pcu)	DOS %	Q (Pcu)
Parc Tawe exit	164	165	94	18	89	15	103	26	89	16	90	31	100	22
New Cut Rd (southbound)	92	8	58	6	53	5	51	5	54	5	89	14	100	15
Northern bridge	83	13	73	8	39	15	65	17	64	11	80	39	86	19
Pentreguinea	150	93	135	57	85	12	203	97	84	13	57	17	72	23
Delhi St	66	3	74	4	-	-	68	4	-	-	59	3	73	5
Eastbank	91	15**	85	13	94	17**	52	12	59	7	98	48**	51	18
Fabian Way westbound	104	39	101	34	213	203	150	148	225	229	100	46**	87	26
South bridge westbound	81	13	88	17	97	25**	93<<	20**	92<<	20**	98	60**	79	42
South bridge right turn	51	7	54	7	44	8	38<<	6	38<<	6	91	28	-	-
New Cut Road northbound	73	9	66	9	65	9	63	9	61	10	76	12**	96	28**
South bridge eastbound	-	-	-	-	-	-	-	-	-	-	89	19	85	44
Quay Parade eastbound	75	14	70	15	77	15	81	16	79	16	78	13	82	31
Total Delay pcu.hr/hr	572		268		630		710		707		183		200	



Map 46 - Option 3 Adopted layout now competed and operational

- An air quality monitoring station along Pentreguinea Road has been established with measurements commencing during September 2005. The system measures the pollutants nitrogen dioxide, sulphur dioxide, ozone, benzene, along a 280-meter open path. The system comprises of a transmitter and a receiver. The transmitter shines a xenon lamp along the path length to the receiver module where the light is focused and transmitted down a fibre optic cable and into a spectra analyser where the measurements take place. The system is now providing spatial data over the 280-meter path length.

Photo 8 - St Thomas DOAS Transmitter

Photo 9 - St Thomas DOAS Receiver Station

- ## Action Point 9 - City & County of Swansea Vehicle Fleet

Improvements are ongoing within the fleet of vehicles operated by the authority as the authority proactively manage down the environmental impact of a 750 vehicle fleet operation within the Council's area. Latest developments/initiatives include,

- A robust time based maintenance and inspection regime that specifies oil and filter changes twice a year
- A vehicle renewals programme that consolidates technological advancements within the fleet, and maintains an appropriate mechanical condition and age profile
- Detailed consultation with users on specifications to ensure maximised utility for the supplied vehicle
- A replacement component strategy that " builds in " disposal and recycling requirements for tyres, oils, batteries, cleaning products, asbestos free linings etc

- Specifying Euro 5 compliant engines on new heavy commercial vehicles and Euro 4 on light commercials
- Specifying AdBlue nitrous oxide reduction systems for new heavy commercial vehicles
- Introduction of Bio Diesel to the Council's fuel stocks
- Introduction of vehicle tracking to monitor and improve vehicle utility and reduce mileage
- Trial of magnets to improve fuel system efficiency
- Establishing carbon footprint database to monitor and improve impact of vehicle operations

The authority actively enforces a "good neighbour "approach in terms of the Council's driver conduct, vehicle operations and parking arrangements.

- **Action Point 10: Traffic Management Systems with Air Quality Monitoring Feedback.**

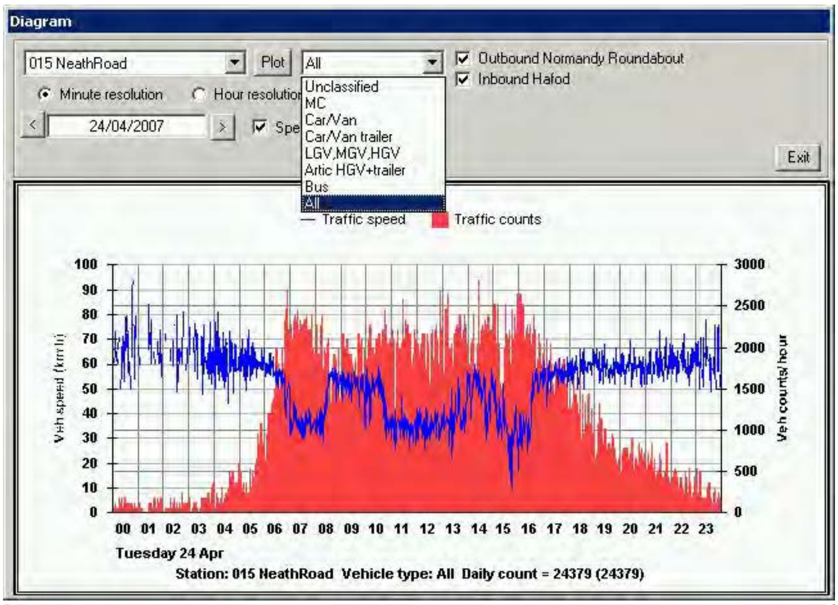
Considerable efforts are being made to ensure that all data feeds into the system under development operate reliably. The major data feeds are:

- Vehicle by Vehicle Traffic flow
- Ambient Air Quality Monitoring data
- Meteorological forecast

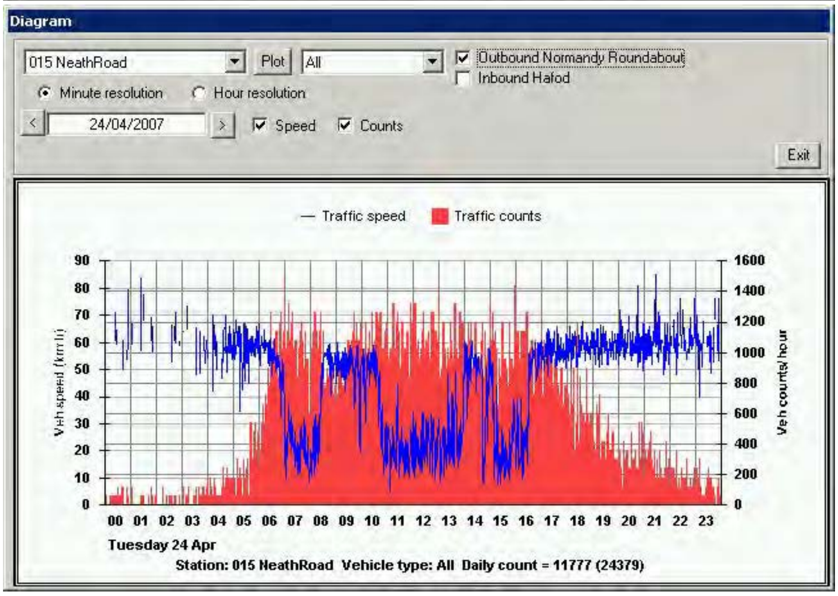
A total of 55 GPRS vehicle by vehicle (VbV) automatic traffic counters have been installed and commissioned and data quality is being assessed **-** see map 46 below for the location of the existing 55 GPRS traffic counters. Additional temporary surveys are underway within "local streets" for a period of one week to establish basic flow information.

The GPRS automatic traffic counters transmit data to an FTP server every 5 minutes. The vehicle by vehicle data is compiled into 1 minute integration and stored within databases linked to the emissions database (EDB). An example of the information that is now available to both the models and for dissemination to local radio media traffic bulletins (i.e. detection of congestion forming) is given below.

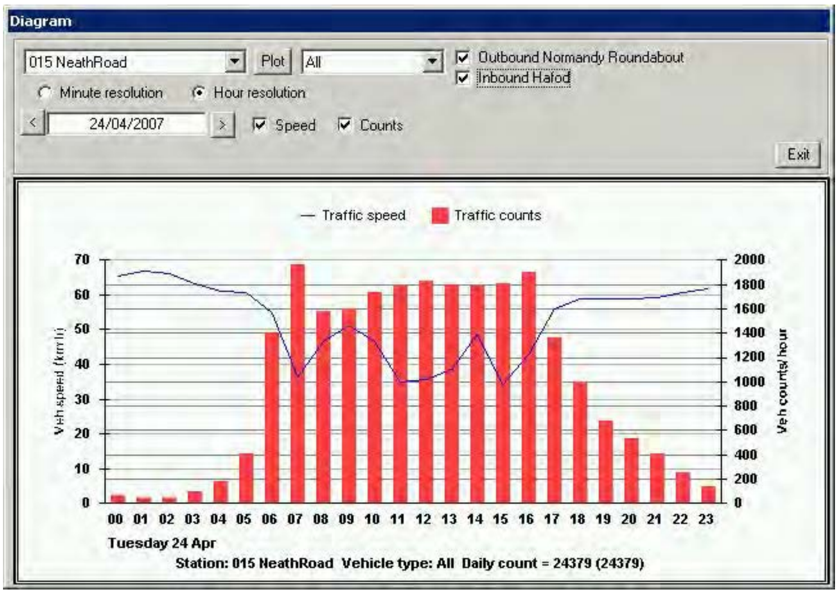
All vehicles are classified into the EUR6 classification scheme at point of detection as well as the speed of the vehicle. This information has again been provided for use within the modelling under development.



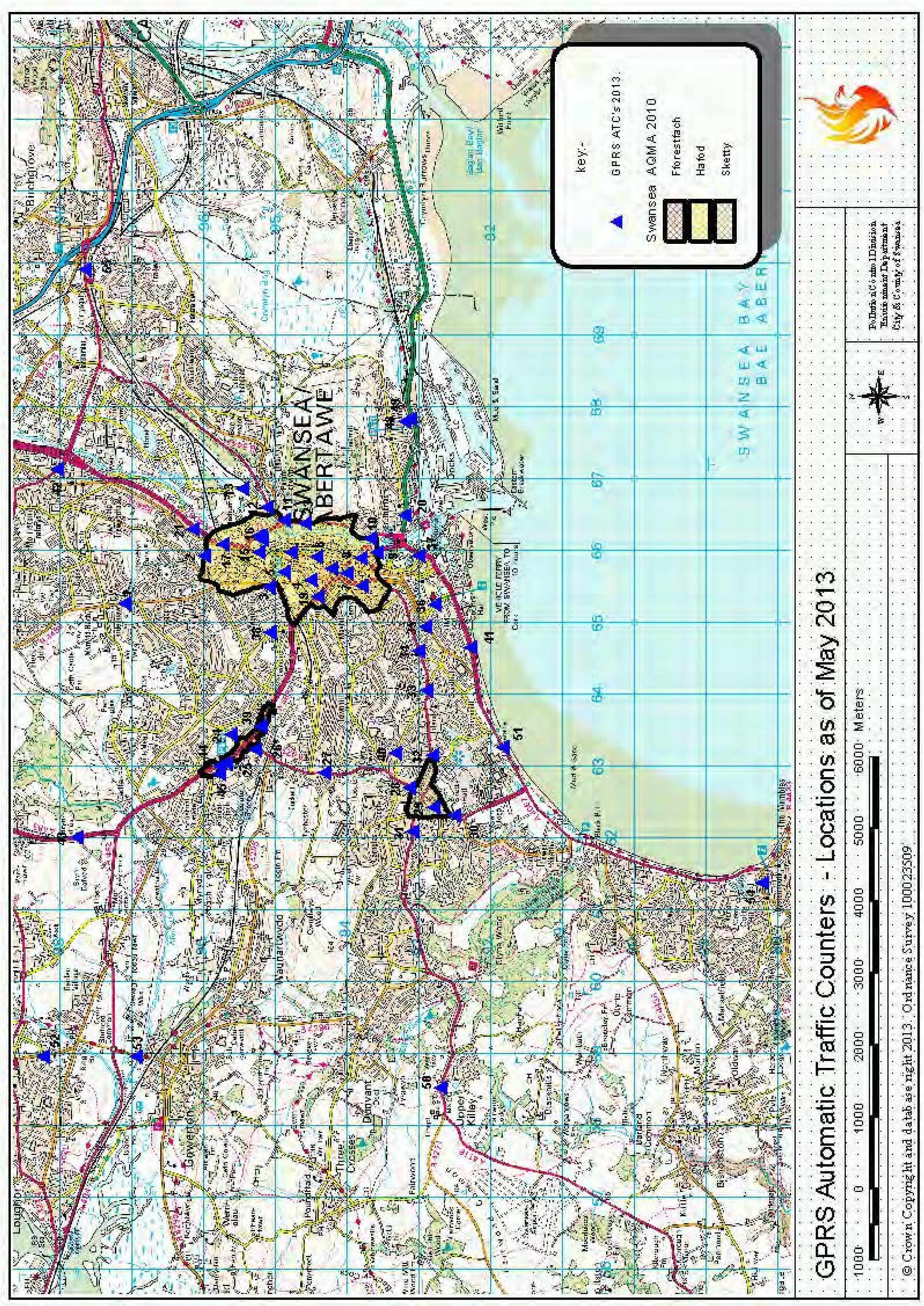
ATC 15 Neath Road is located opposite Morfa Terrace on the B4603. The AADT for 2006 is 20,544 with the AWDT being 21,864. 1 minute resolution traffic flow data enables detection of congestion in almost "real-time".



The direction of formation of congestion can be established by separation of the directions. Here the congestion can be seen within the outbound lane. Notice the 3 significant periods of slow moving vehicles during the AM, midday and PM periods.



This 1 hour data integration view does not enable easy detection of these significant congestion periods



Map 47 - Location of GPRS Automatic Traffic Counters2013

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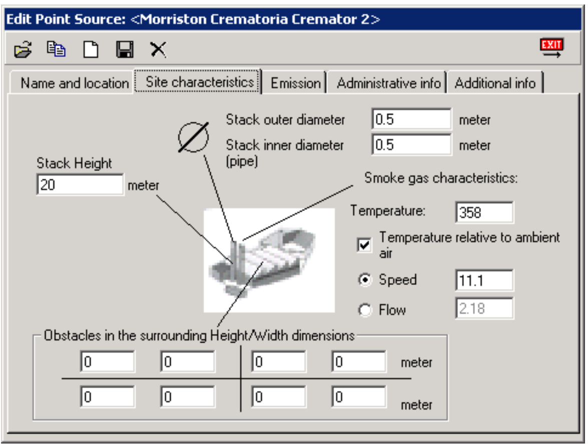
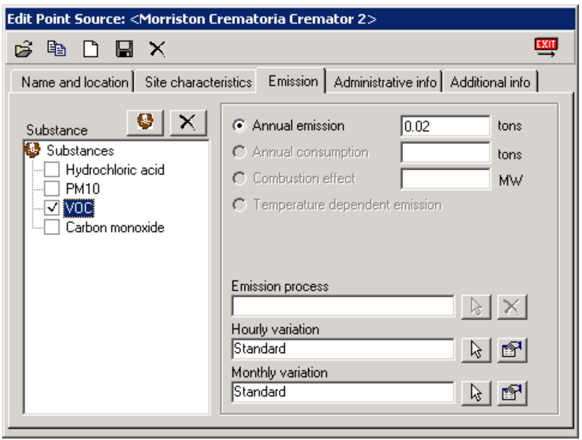
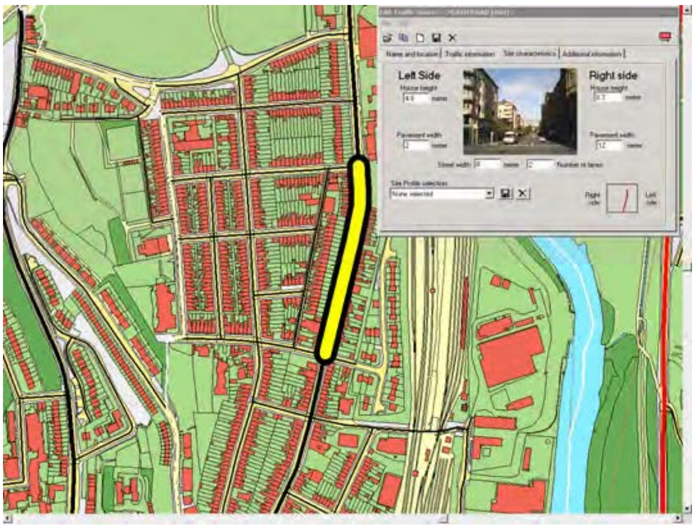
- Discussions have commenced to develop an interface to manage the dissemination of information to local media i.e. traffic bulletins and roadside signage. This system will receive output predictions from Nowcaster and will take logical decisions upon what messages are disseminated to the local news media as well as the variable message signs located initially within the lower Swansea valley. Discussions are ongoing with regard to the specification of the variable message signs.

- Emissions data is being collated and inputted into an emissions database (EDB) which will be central to the system. The information required is extensive and includes all point source /area/grid emissions sources.





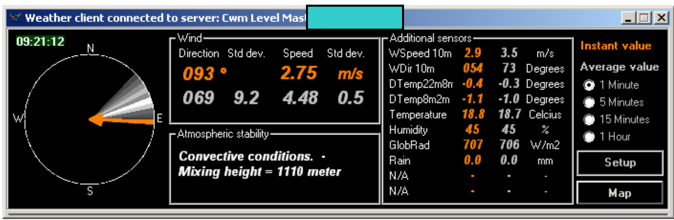


Every road **link** is in process of being classified and the details inputted into the EDB in order that the model understands the local geometry and conditions influencing dispersion in that road link.Width of road/pavement and building heights are being provided as parameters into the emissions database.

- Installation of a dedicated 30m meteorological mast at Cwm Level Park within the lower Swansea Valley to provide high quality temperature and wind profiles data in the lowest atmospheric layer in the valley into the models.

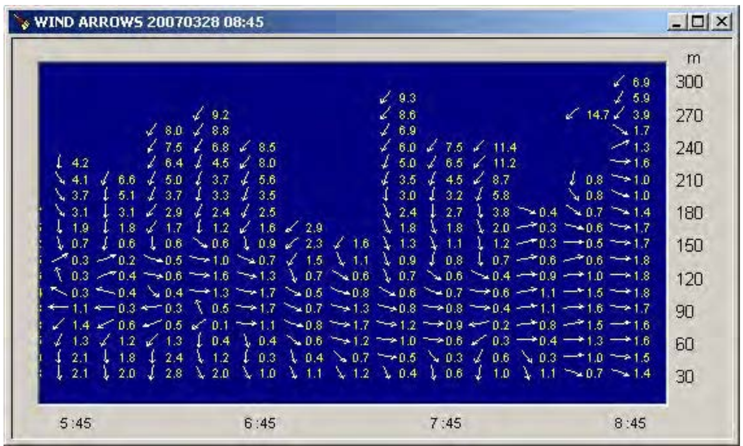
Meteorological parameters measured

- Wind Speed at 30m
- Wind Direction at 30m
- Global Radiation at 30m
- Wind Speed at 1Om
- Wind Direction at 10m
- 22m Differential Temperature
- 8m Differential Temperature
- 2m Absolute Temperature
- 2m Relative Humidity
- Rainfall



- Installation of an AQ500 “Wind Profiler” within the lower Swansea Valley.

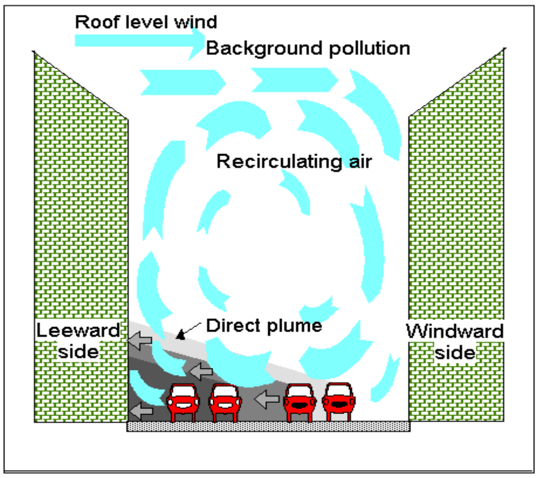
This equipment measures the wind speed and wind direction in 15m “layers” up to its maximum height range of 300m.

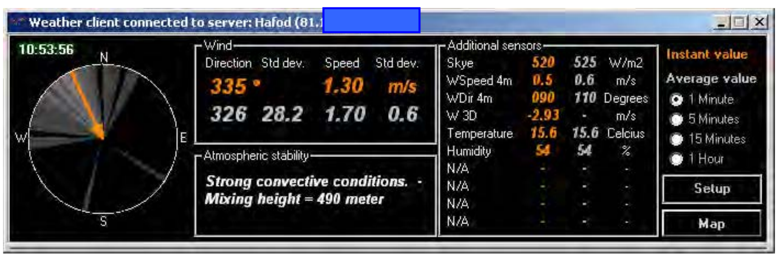


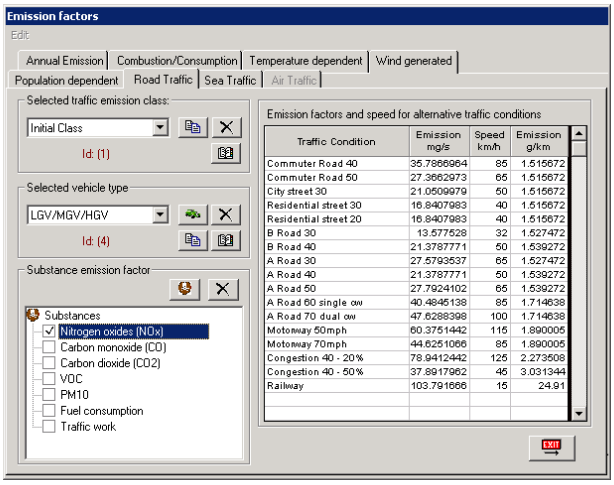
- Establishment of a street canyon meteorological station within Neath Road. This station has been fixed to the front elevation of the Hafod Post Office opposite the open path air quality measurements being undertaken by the Hafod DOAS. This station will supply the meteorological information to validate Nowcaster and other modelling output/predictions/forecasts within street canyon environments.

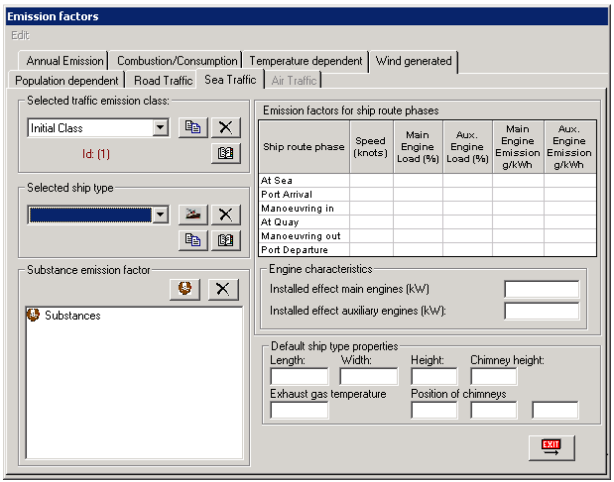
Meteorological parameters measured

- Global Radiation
- Wind Speed 5m above roof ridge level
- Wind Direction 5m above roof ridge level
- Horizontal Wind Speed at first floor level
- Horizontal Wind Direction at first floor level
- Vertical Wind Speed at first floor level
- Air Temperature at first floor level
- Relative Humidity at first floor level



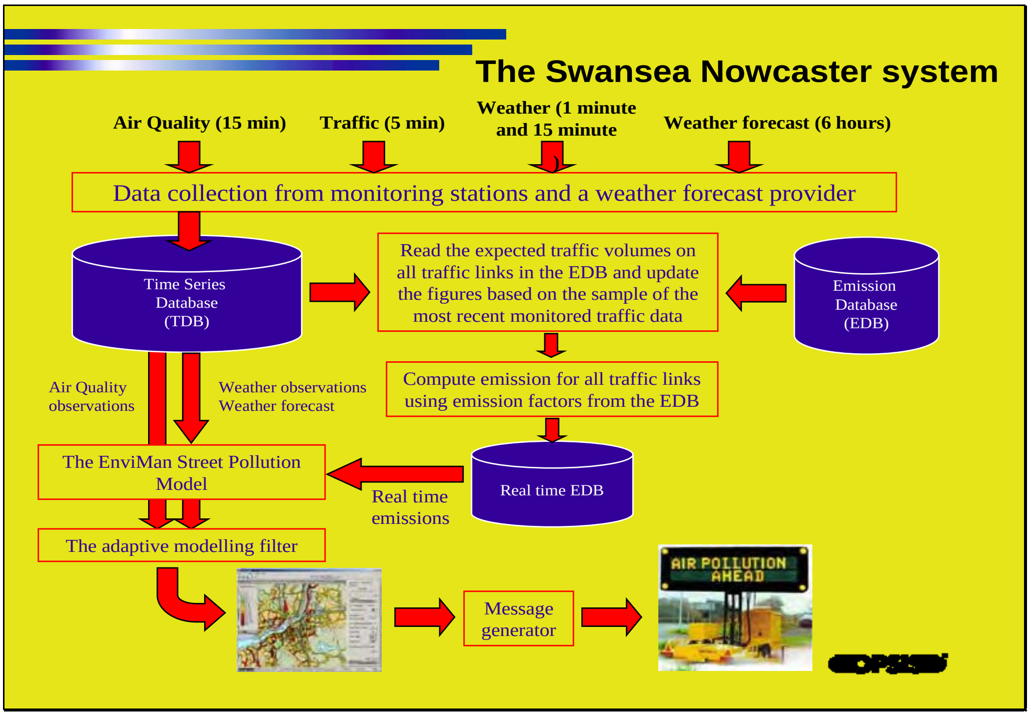






- Development of emission factors for all modes of transportation.

- A schematic of the system under development is shown below



Schematic 1 - Swansea Nowcaster Traffic Management System

- Additional air quality monitoring stations have been installed within St.Thomas (see action point 8 above)

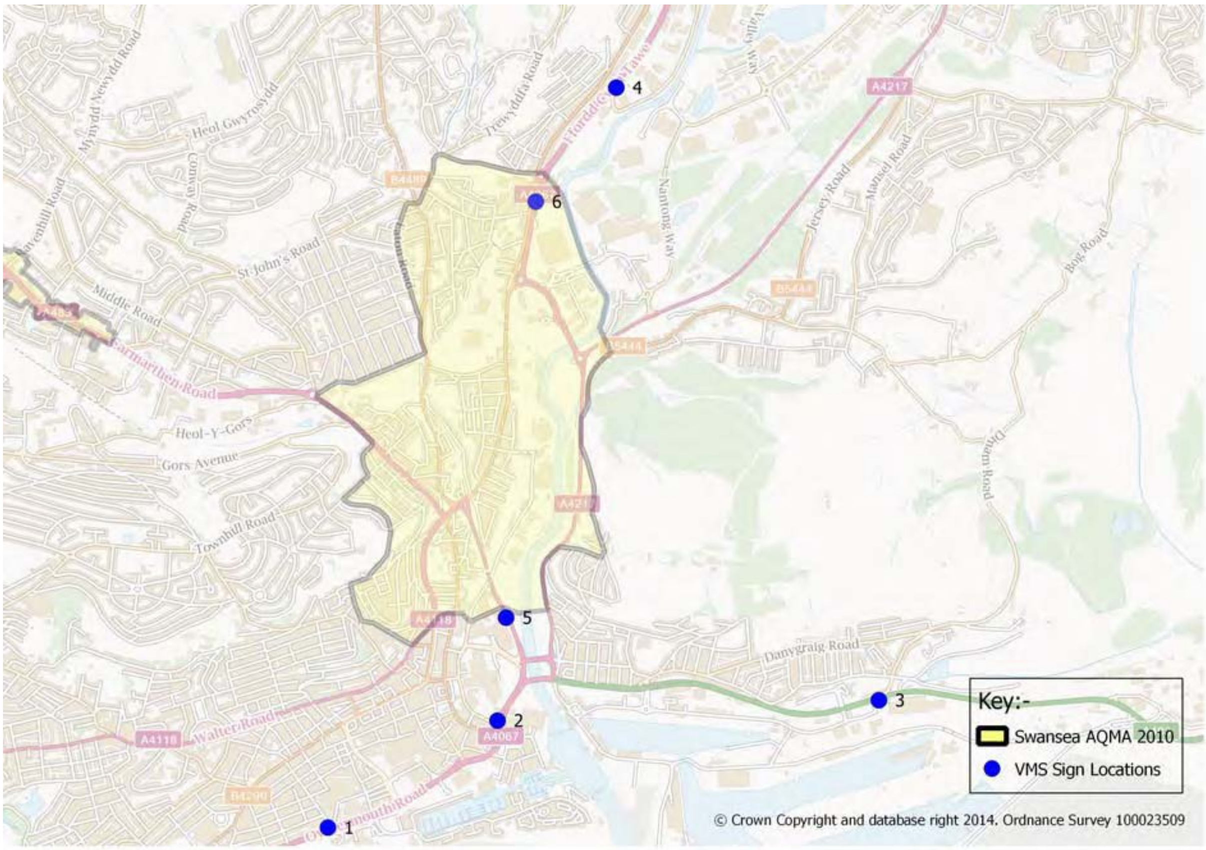
- The Nowcaster model interface with the system under development is still undergoing customisation to allow unattended import of all required datasets and automatic operation and output of predictions. This is taking longer than anticipated and is dependant upon funding steams being made available.

- An interface is being developed to allow local media and the public to view the live Nowcaster mapping predictions – they will be able to view the statistics for the nearest traffic counter, look at the air quality forecast for the roads and even chart the data if they wish.
- The system will send emails to local media i.e. The Wave, Swansea Sound, Real Radio and even national stations (Radio 2,3,4 etc) for use in their traffic forecasts. The system can detect traffic congestion in almost real time from the ATC network data and broadcast this information via email etc.
- In addition, messages will be sent to roadside signs to try and encourage a certain % of the traffic flow to divert from the failing area/ congested area and also to provide additional information regarding detected congestion/planned road works notifications etc. An example VMS sign is shown below

- As of 2013, there are a total of 6 variable message signs physically installed that form phase 1 and phase 2 of the sign deployment at roadside locations within Swansea. Testing of communications is now awaited during July 2014. Their locations can be seen within map 48 below with their site locations detailed within table 44 below.

Site ID	Site Address	x-coordinate	y- coordinate
1	Glamorgan Street	265018	192414
2	Quay Parade	265930	192990
3	Bevans Row	267981	193100
4	Ffordd Cwm Tawe junc. of Beaufort Road	266569	196400
5	New Cut Road	265976	193545
6	Ffordd Cwm Tawe – near Liberty Stadium	266136	195786

Table 44 – Site Location details of variable message Signs



Map 48 – Location of Variable Message Roadside Signs

Typical view of installed variable message sign – site ID 6 Ffordd Cwm Tawe

As a result of the budgetary constraints, it is not known when the entire infrastructure previously identified as major and critical elements of the Action Plan (completing the deployment of roadside variable message signs etc.) will be funded. This “final hurdle” would have a capital cost in the region of £300,000 - £500,000 for the third phase of sign deployment.

10. Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

Nitrogen Dioxide (Passive 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 corridor, Cwm Level Road (Brynhyfryd Cross Roads) and Carmarthen Road (Dyfatty area). Additionally exceedences continue to be seen within the Fforestfach and Sketty areas of the AQMA. Additional monitoring within the AQMA area around the High Street Railway Station has highlighted the exceedence of the annual mean objective.

Monitoring from outside of the existing Swansea AQMA 2010 has identified new areas that are failing the annual mean objective. Numerous locations within the city centre are failing the annual mean objective. However, monitoring during 2013 has indicated that exceedences of the 1-hour objective have not been seen around the café type environments along the Kingsway and Dillwyn Street areas. One site (site 75) within the Uplands area (at the junction of Brynymor Crescent and Uplands Terrace) had indicated exceedence of the annual mean objective during 2010-2012 but monitoring during 2013 now indicates compliance with the nitrogen dioxide annual mean objective. This site is situated between the city centre and the Sketty area which forms part of the Swansea AQMA 2010.

Continued monitoring along Newton Road within the Mumbles area has shown a continuing and improving picture with only two sites closest to the junction with Mumbles Road now showing during 2013 an exceedence of the annual mean objective. These sites are free of the complications caused by a canopy over commercial premises where there are flats at first floor level above the canopy structure on one side of Newton Road. The situation along Newton Road is exacerbated by tourism traffic during the summer months. Table 9 displays the annual means for sites 206-216 during 2010-2013 along Newton Road. A continued decline in annual mean concentrations can be seen with the likelihood that this trend will continue. The authority does not propose, given the continued downward trend in annual mean concentrations to declare an AQMA along Newton Road. Monitoring will continue for the foreseeable future to verify the trend in concentrations. During 2013, sites 206 and 209 are only marginally above the annual mean objective level. The situation along Newton Road is discussed and outlined within section 2.2.3, map 17 and photos 17 and 18.

Sites in Morriston at Woodfield Street, and Martin Street (sites 41 and 285) have now indicated compliance with the annual mean objective during 2012-2013. Site 43 on Clase Road Morriston, continues to show marginal compliance with the annual mean objective. Sites at Nantyffin Road Llansamlet (site 50) and another in Ynystawe at a property (site 45) overlooking junction 45 of the M4 have now shown full compliance with the annual mean objective during 2011– 2013 and are now no longer considered to be at any risk of exceeding the annual mean objective.

Site 35 within the St Thomas area (Delhi Street) indicated exceedence of the annual mean objective during 2011 but monitoring during both 2012 and 2013 has now shown full compliance. This maybe due to the improvements made with the gyratory system around the Quay Parade bridge area. Site 291 (Vale of Neath Road) on the outbound A483 towards the M4 has shown exceedence of the annual mean objective during 2012 and 2013. This site is discussed in section 2.2.3 above (see photo 19). Transportation colleagues have indicated that they feel that the phasing of the signal controlled junction of the A483 with the SA1 junction can be further modified to improve conditions. This area may become critical should the Swansea Bay Tidal Lagoon Development obtain approval as this junction will see an increase in HGV traffic resulting from materials delivery to the project site. At present it is thought that the rock required to form the lagoon structure will be delivered via sea routes but there is a possibility that significant HGV traffic will be seen at the SA1 junction area should this sea delivery method not prove possible.

Additional monitoring undertaken outside of the exiting Swansea AQMA 2010 has identified sites with the potential to exceed the annual mean objective (being within the 37-40ug/m^3 range). These sites will continue to be monitored to establish trends

Annual mean NO_2 future year projections made for 2012 to 2020 using both the updated January 2012 guidance as outlined within LAQM.TG(09) and a further update note from DEFRA entitled "Note on Projecting NO2 concentrations" [44] dated April 2012 has shown that using both methods to project forwards to 2020 it is clear that whilst the LAQM.TG(09) method indicates full compliance with the annual mean objective being seen as early as 2016, using the revised April 2012 method, paints a totally different picture, as in 2020, widespread exceedences remain, together with indications that additional numerous sites would still exhibit the potential to exceed the annual mean objective. It is thought that the April 2012 method may well paint a more realistic picture.

Nitrogen Dioxide Real Time Continuous Automatic Monitoring Data

Compliance with both the annual mean and hourly objectives were seen at the Swansea AURN and Morriston Groundhog monitoring stations during 2013. However, real-time open path monitoring along Neath Road, Hafod (Hafod DOAS) continues to show exceedence of the annual mean objective. The number of exceedences of the hourly NO_2 objective has reduced against the permitted 18 from 16 during 2011 to 6 during 2013. During 2011, the annual mean objective was exceeded at the other open path monitoring location at the St.Thomas DOAS monitoring station along Pentreguineau Road. However since 2012 and through to 2013 marginal compliance has been observed. This would tie into the result obtained for site 35 (Delhi Street) which is within 75m of the DOAS path and is another indication of the probable success of the gyratory now operational at Quay Parade bridges.

Annual mean NO_2 future year projections made for 2013 to 2020 using both the updated January 2012 guidance as outlined within LAQM.TG(09) and a further update note from DEFRA entitled "Note on Projecting NO2 concentrations" [45] dated April 2012 indicate continued full compliance with both objectives at suitable receptor locations at the Swansea AURN and Morriston Groundhog sites. However, using the original LAQM.TG(09) method at the Hafod DOAS site indicates that the Hafod

[44] http://laqm.defra.gov.uk/review-and-assessment/modelling.html#ProjectingNO2Note and http://laqm.defra.gov.uk/documents/BureauVeritas_NO2Projections_2766_Final-30_04_2012.pdf
[45] http://laqm.defra.gov.uk/review-and-assessment/modelling.html#ProjectingNO2Note and http://laqm.defra.gov.uk/documents/BureauVeritas_NO2Projections_2766_Final-30_04_2012.pdf

DOAS will see compliance with the annual mean objective during 2018. If the further updated note from DEFRA dated April 2012 is used then a different outlook is obtained. Compliance with the annual mean objective at the Hafod DOAS site is not seen even within 2020. Again, it is thought that the April 2012 method may well paint a more realistic picture.

Sulphur Dioxide Real Time Continuous Automatic Monitoring Data

No exceedences 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 exceedence 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 exceedences of the annual mean objective were seen at any of the monitoring stations during 2013. Similarly, no breach of the 35 permitted exceedences of the 24 hour objective was seen, nor, where data capture was below 90% did the 90th percentile (given in brackets after the number of exceedences in table 13) exceed 50ug/m^3. For the first time in several years, PM_{10} data capture has been above the 90% required by LAQM.TG(09) giving added confidence to the monitoring results.

Projections made to 2015 and 2020 show compliance with the annual mean objectives at all sites – indeed, there is remarkable harmony between the projected PM_{10} concentrations in 2020.

Benzene

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

Ozone

Compliance with the UK objective (not set in regulation) has been seen during 2013 at both the Hafod DOAS and Morriston Groundhog monitoring stations whilst exceedences of the 8-hour ozone mean target were seen at Cwm Level Park and St.Thomas. Whilst ozone is considered a national rather than local problem it will continue to be measured for the foreseeable future.

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 constrictions 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 during 2013 to be completed at YGG Gellionnen. Future heavy metals monitoring will now only be undertaken from 2014 onwards at the two UK network funded sites located at Coed Gwilym Cemetery and Morriston Groundhog.

Monitoring results during 2013 have shown **nickel** concentrations to be below the 4th Daughter Directive annual mean target value following improved abatement at the release point.

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.

Proposals to develop the Tawe Riverside development Corridor may have air quality implications within a wide area of the lower Swansea valley. However, these concerns may be offset by provision of the Morfa Distribution Road and the improvements already being seen around the Quay Parade bridges area. Due to the continued economic downturn it may prove to be many years before the aspirations of the scheme as a whole are realised in full or part. Regular updates will be provided as and when significant developments occur.

The proposals by Vale to develop an energy from waste Pyrolysis Plant at its refinery at Clydach in the Swansea valley may have air quality impacts locally. Whilst Planning Permission has been granted and a permit issued for operation by the now Natural Resources Wales the project is on hold at present again, due to the economic downturn. Regular updates will be provided in future reporting.

Several planning applications have been received that may impact upon local air quality notably the Swansea Bay Tidal Lagoon development and the Liberty Stadium expansion.

10.3 Proposed Actions

Due to the reductions in nitrogen dioxide annual mean concentrations being witnessed year on year, along Newton road, Mumbles, it is not proposed to declare any AQMA. 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. Similarly, it is not proposed to declare parts of Fabian Way around the SA1 junction as an AQMA. Additional monitoring will be undertaken along Fabian Way and Bevans Row to gain an understanding of the impacts of the signal controlled junction at SA1. The phasing of this junction will be altered and the inpacts further assessed. In addition, discussions will be undertaken with Associated British

Docks to reopen alternative access/egress points into SA1 to ease flows at the main SA1 junction.

Additional monitoring will be undertaken at façade of new flats within the Kingsway area of the city centre to determine if NO_2 annual mean concentration replicate those seen in the areas where monitoring around the café type environments have established no exceedence of the one-hour objective but indicate exceedence of the annual mean objective.

The authority intends to locate a real-time chemiluminescent analyser within the High Street area of the city centre during July/August 2014.

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. Technical Guidance LAQM.TG(09) and subsequent updates

xii. Air Quality (Wales) Regulations 2000, No. 1940 (Wales 138)

xiii. Air Quality (Amendment) (Wales) Regulations 2002, No 3182 (Wales 298)

xiv. Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective AEAT/ENV/R/264 Issue 1 May 2008

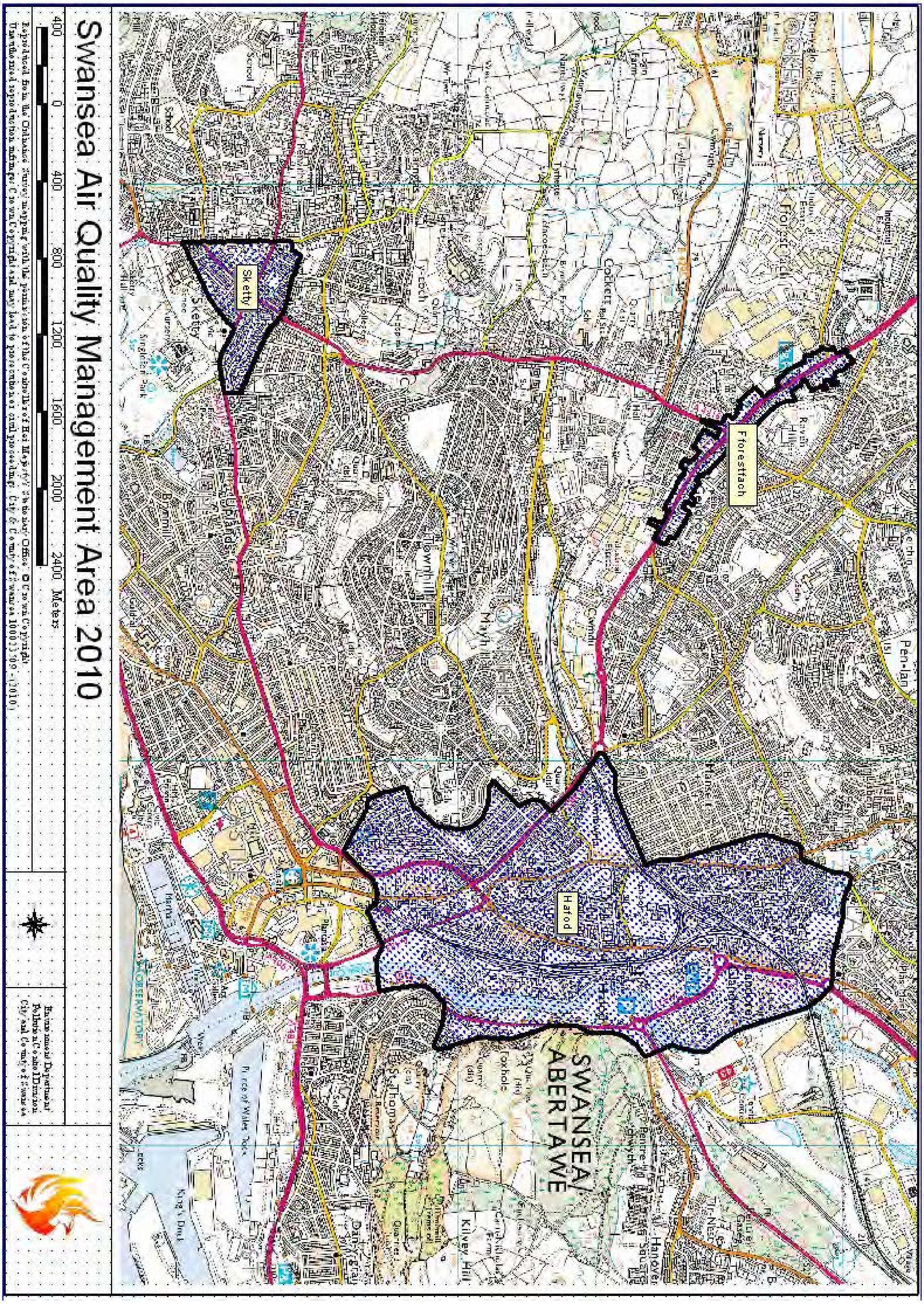
Appendix 1

Hafod AQMA


Hafod Air Quality Management Area
400 0 400 800 1200 Meters
Pollution Control Division
Environment Department
City & County of Swansea.
SWANSEA/
ABERTAWE
Hafod
Landore
Glandŵr
Mayhill
Townhill
Cwmbwrla
Manselton
Kilvey Hill
St Thomas
Hanover Square
Bon-y-maen

Appendix 2

Swansea AQMA 2010


Swansea Air Quality Management Area 2010
400 0 400 800 1200 1600 2000 2400 Meters
Sketty
Fforestfach
Hafod
SWANSEA
ABERTAWE

4

Appendix 3

Environmental Scientific Group

WASP Results

Current best 4 from 5 current Z-score average:	0.14

Year	WASP Round	Period	Samples Dispatched	Results Deadline	HSL Calculations (Pre-Sendout)		Harwell Analysis						HSL Calculations (Pre-Sendout)		Harwell Analysis					
					Sample A		Tubes A						Sample B		Tubes B					
					Calculated Spiked Value	Measured Value	Result Tube 1	Result Tube 2	Average	Standard Deviation	RSD	Z-Score	Calculated Spiked Value	Measured Value	Result Tube 1	Result Tube 2	Average	Standard Deviation	RSD	Z-Score
2011	115	Sept-Dec																		
	114	Jul-Aug																		
	113	Apr-Jun			1.532	1.524	1.478	1.471	1.475	0.005	0.30%	-0.5	2.304	2.292	2.296	2.254	2.275	0.030	1.30%	-0.1
	112	Jan-Mar			2.10	2.07	2.103	1.090	2.097	0.010	0.50%	0	0.94	0.93	0.952	0.953	0.953	0.027	0.10%	0.2
2010	111	Sept-Dec			1.84	1.85	1.821	1.821	1.821	0.000	0	0.1	1.54	1.57	1.512	1.482	1.497	0.022	1.50%	-0.4
	110	Jul-Aug			0.99	1.00	0.972	0.987	0.980	0.011	1.1	0	2.37	2.47	2.367	2.394	2.381	0.020	0.80%	0.1
	109	Apr-Jun			1.03	1.06	1.053	1.053	1.053	0.000	0	0.3	1.27	1.27	1.265	1.268	1.267	0.003	0.20%	0
	108	Jan-Mar			1.92	1.91	1.921	1.896	1.910	0.018	0.9%	-0.1	1.47	1.47	1.409	1.422	1.420	0.009	0.6%	-0.5
2009	107	Oct-Dec			2.03	2.04	1.905	1.914	1.910	0.007	0.4%	-0.8	2.20	2.20	2.049	2.046	2.048	0.003	0.1%	-0.9
	106*	Jul-Sept			1.84	1.84	1.880	1.439	1.660	0.312	18.8%	-1.3	1.42	1.44	1.880	1.429	1.655	0.319	19.3%	2.1
	106*	Jul-Sept			1.84	1.84	1.880	1.880	1.880	0.000	0.0%		1.42	1.44	1.439	1.429	1.434	0.007	0.5%	
	105	Apr-Jun			1.68	1.69	1.795	1.784	1.790	0.008	0.4%	0.8	0.96	0.96	1.031	1.035	1.033	0.003	0.3%	0.9
	104	Jan-Feb			2.02	2.01	2.017	2.047	2.032	0.022	1.1%	0.0	1.22	1.19	1.269	1.230	1.252	0.024	1.9%	0.2
2008	103	Sept-Dec			1.22	1.22	1.242	1.234	1.238	0.006	0.5%	0.1	0.94	0.95	0.957	0.951	0.954	0.005	0.5%	0.1
	102	Jun-Aug			1.37	1.38	1.470	1.472	1.471	0.043	2.9%	0.5	2.28	2.30	2.435	2.386	2.411	0.035	1.5%	0.4
	101	Apr-Jun			0.92	0.94	0.974	0.991	0.983	0.013	1.3%	0.5	1.86	1.93	1.947	1.958	1.953	0.008	0.4%	0.4
	100	Jan-Mar			1.36	1.37	1.395	1.384	1.390	0.008	0.6%	0.2	1.47	1.45	1.511	1.516	1.514	0.004	0.3%	0.2
2007	99	Oct-Nov			2.15	2.16	2.242	2.235	2.239	0.005	0.2%	0.3	0.84	0.84	0.906	0.901	0.904	0.004	0.4%	0.6
	98	Jul-Sept			1.83	1.85	1.877	1.854	1.866	0.013	0.7%	0.2	1.19	1.20	1.229	1.223	1.226	0.005	0.4%	0.2
	97	Apr-Jun			0.89	0.87	0.920	0.918	0.919	0.002	0.2%	0.2	1.58	1.59	1.619	1.640	1.630	0.015	0.9%	0.2

All Results In ug

*Results disputed. Results in yellow are official results

Appendix 4

Tube bias tri-location studies

- ## 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[46] to determine tube bias as well as checking the accuracy and precision of the diffusion tube measurements. The results can be seen below.

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	09/01/2013	30/01/2013	52.2	70.7	51.5	58	10.9	19	27.0	48.1	99.8	Good	Good
2	30/01/2013	01/03/2013	46.2	45.2	49.7	47	2.4	5	5.9	37.61	99.5	Good	Good
3	01/03/2013	27/03/2013	47.8	44.2	47.7	47	2.1	4	5.1	41.63	95.3	Good	Good
4	27/03/2013	30/04/2013	34.2	33.1	30.3	33	2.0	6	5.0	31.3	99.8	Good	Good
5	30/04/2013	29/05/2013	26.1	24.6	25.8	26	0.8	3	2.0	20.10	99.8	Good	Good
6	29/05/2013	26/06/2013	26.6	25.6	25.3	26	0.7	3	1.7	20.59	99.8	Good	Good
7	26/06/2013	31/07/2013	27.6		27	27	0.4	2	3.8	24.25	99.6	Good	Good
8	31/07/2013	02/09/2013	27.5	27.9	27.1	28	0.4	1	1.0	20.08	96.7	Good	Good
9	02/09/2013	07/10/2013	31.1	34.2	30.6	32	2.0	6	4.8	29.57	99.8	Good	Good
10	07/10/2013	08/11/2013	35.2	35.3	29.6	33	3.3	10	8.1	27.00	99.8	Good	Good
11	08/11/2013	04/12/2013	54.2	50.8		53	2.4	5	21.6	45.69	99.8	Good	Good
12	04/12/2013	08/01/2014	38.5	31.4	38.6	36	4.1	11	10.3	32.79	99.88	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

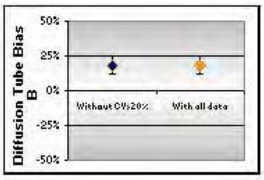
Site Name/ ID: Swansea AURN

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.85 (0.81 - 0.9)
Bias B	17% (11% - 24%)
Diffusion Tubes Mean:	37 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	32 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	31 (30 - 33) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.85 (0.81 - 0.9)
Bias B	17% (11% - 24%)
Diffusion Tubes Mean:	37 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	32 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	31 (30 - 33) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

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

Bias correction factor 1 – Swansea Roadside AURN 2013

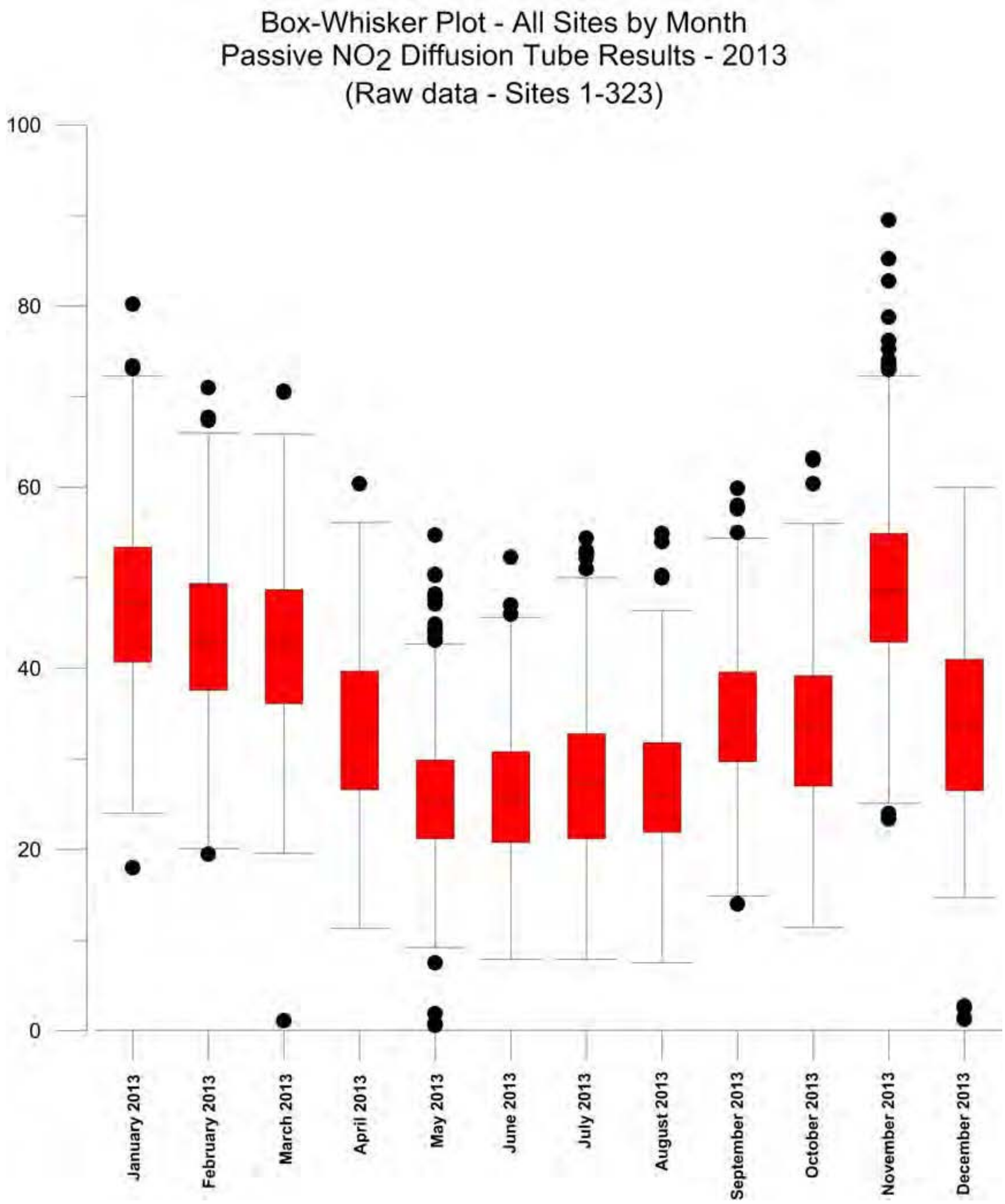
The derived bias correction factor of 0.85 (0.81-0.9) has been calculated with all diffusion tube data periods having a coefficient of variation below 20%. Accuracy (with 95% confidence interval) indicates a bias B factor using 12 periods of data of 17% (11% - 24%)

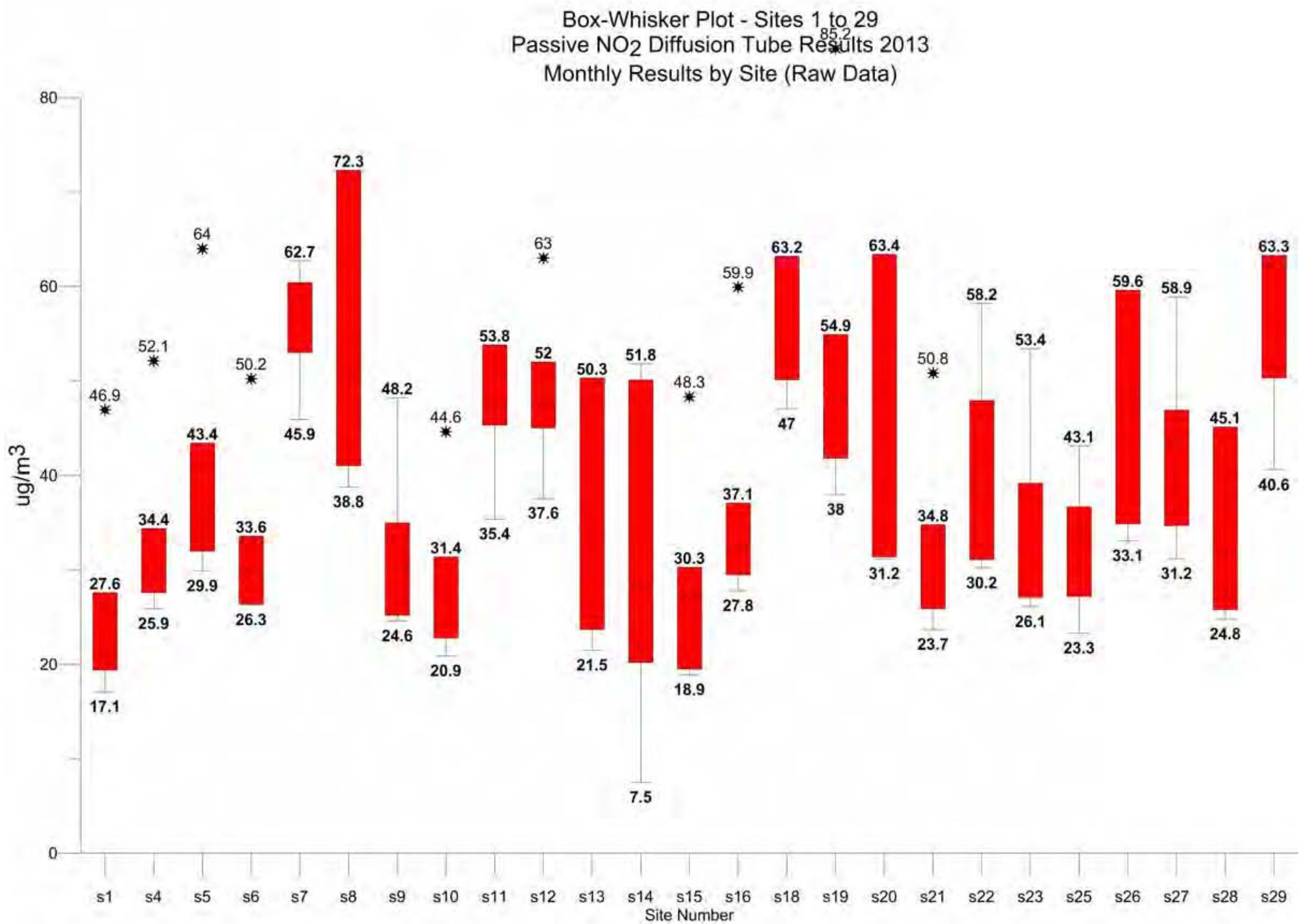
46 http://www.airquality.co.uk/archive/laqm/tools/AEA_DifTPAB_v03.xls

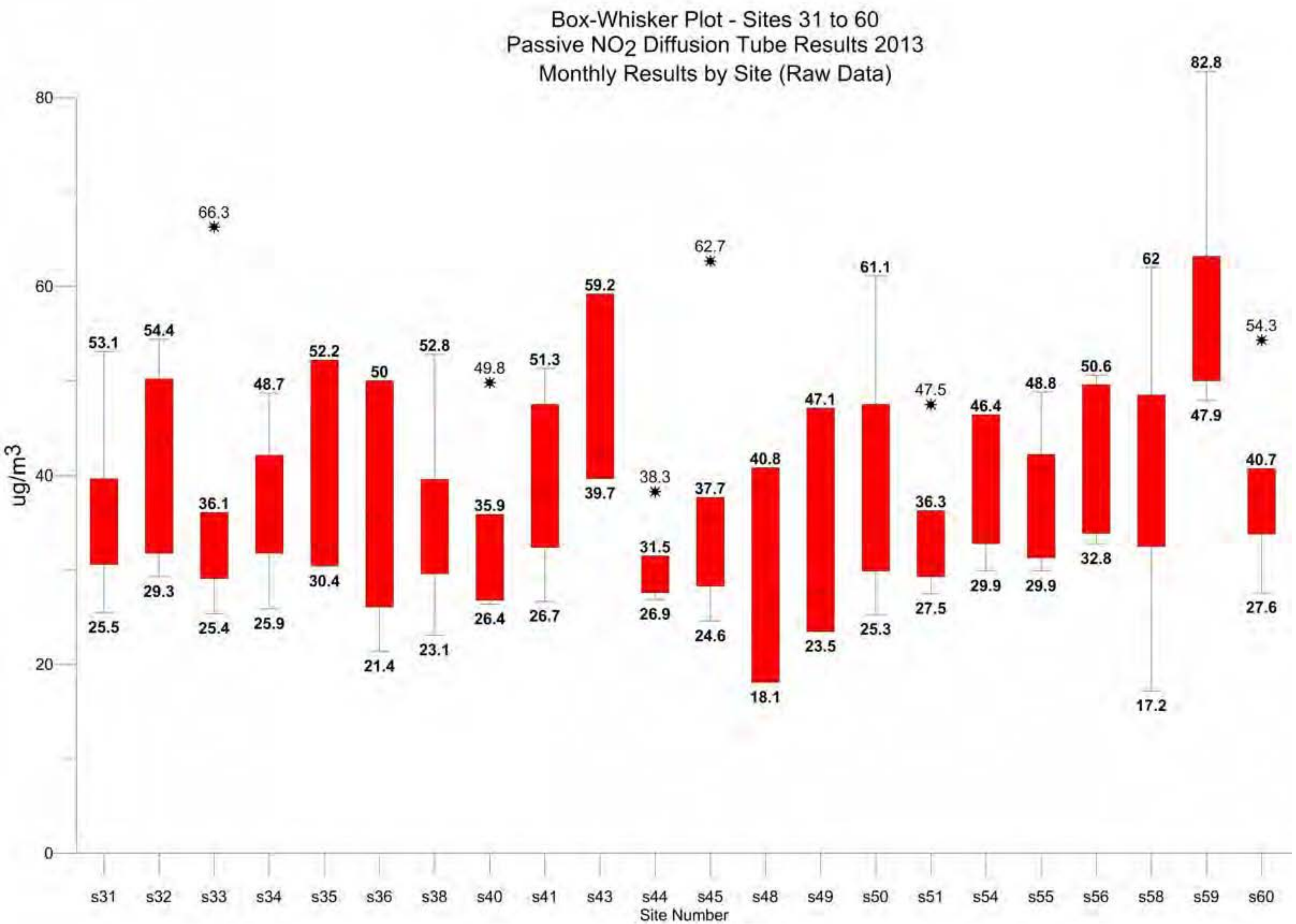
Annexe 5

Box-Whisker Plots 2013

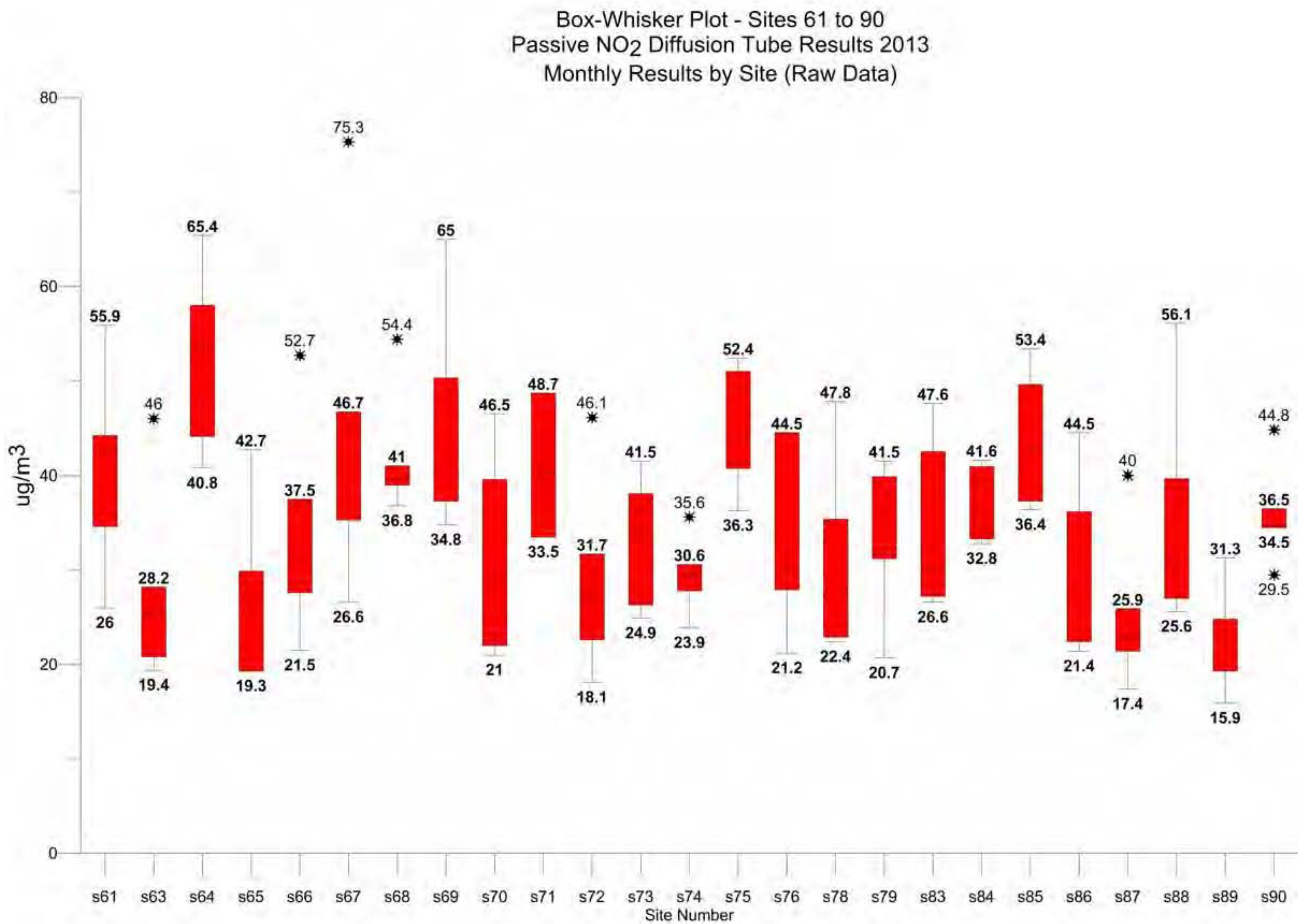
Nitrogen Dioxide Passive Diffusion Tube Data (RAW - uncorrected)


Box-Whisker Plot - All Sites by Month
Passive NO2 Diffusion Tube Results - 2013
(Raw data - Sites 1-323)
100
80
60
40
20
0
January 2013
February 2013
March 2013
April 2013
May 2013
June 2013
July 2013
August 2013
September 2013
October 2013
November 2013
December 2013

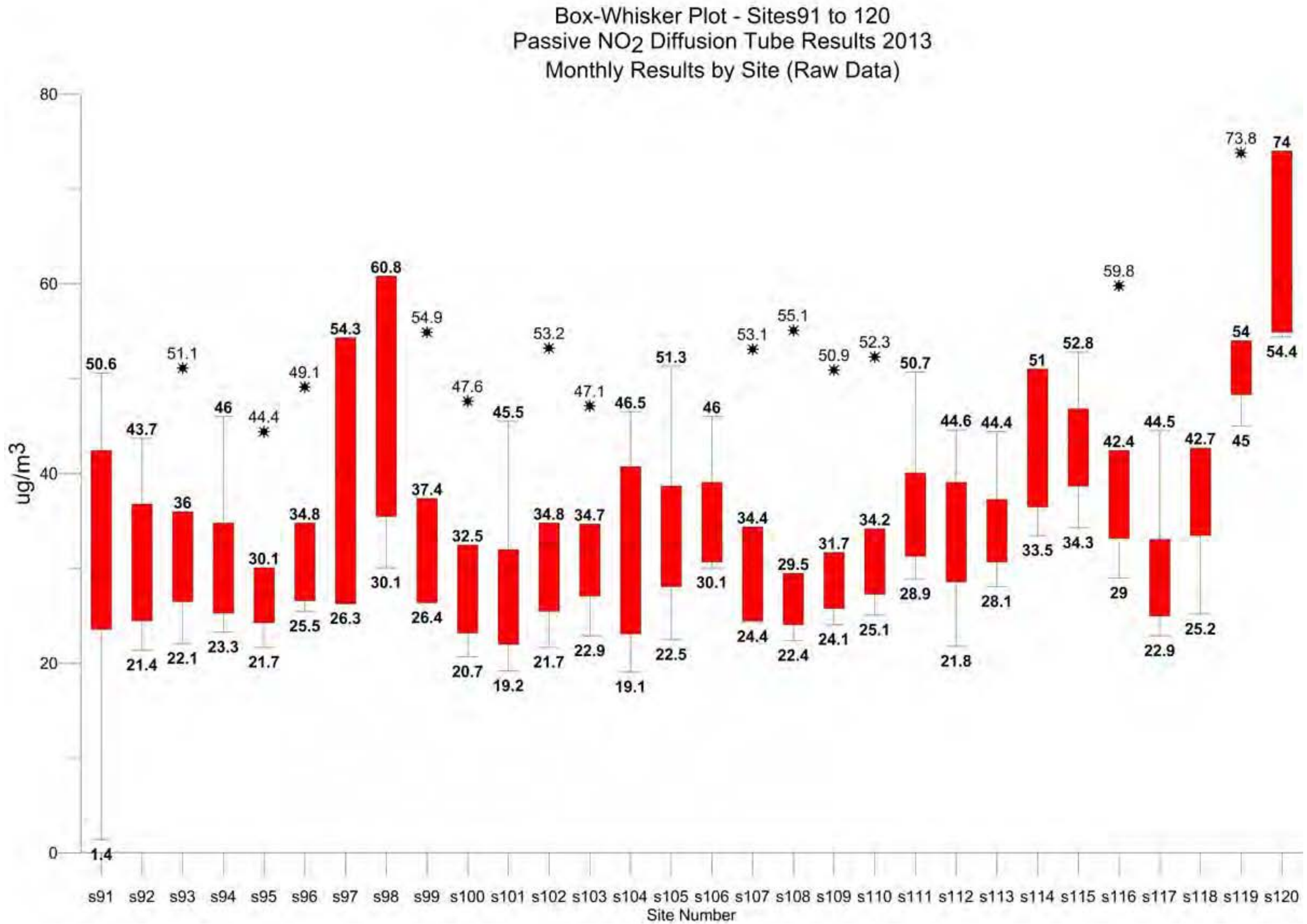

Box-Whisker Plot - Sites 1 to 29
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s1 s4 s5 s6 s7 s8 s9 s10 s11 s12 s13 s14 s15 s16 s18 s19 s20 s21 s22 s23 s25 s26 s27 s28 s29
85.2
46.9 27.6 17.1
52.1 34.4 25.9
64 43.4 29.9
50.2 33.6 26.3
62.7 45.9
72.3 38.8
48.2 24.6
44.6 31.4 20.9
53.8 35.4
63 52 37.6
50.3 21.5
51.8 7.5
48.3 30.3 18.9
59.9 37.1 27.8
63.2 47
54.9 38
63.4 31.2
50.8 34.8 23.7
58.2 30.2
53.4 26.1
43.1 23.3
59.6 33.1
58.9 31.2
45.1 24.8
63.3 40.6

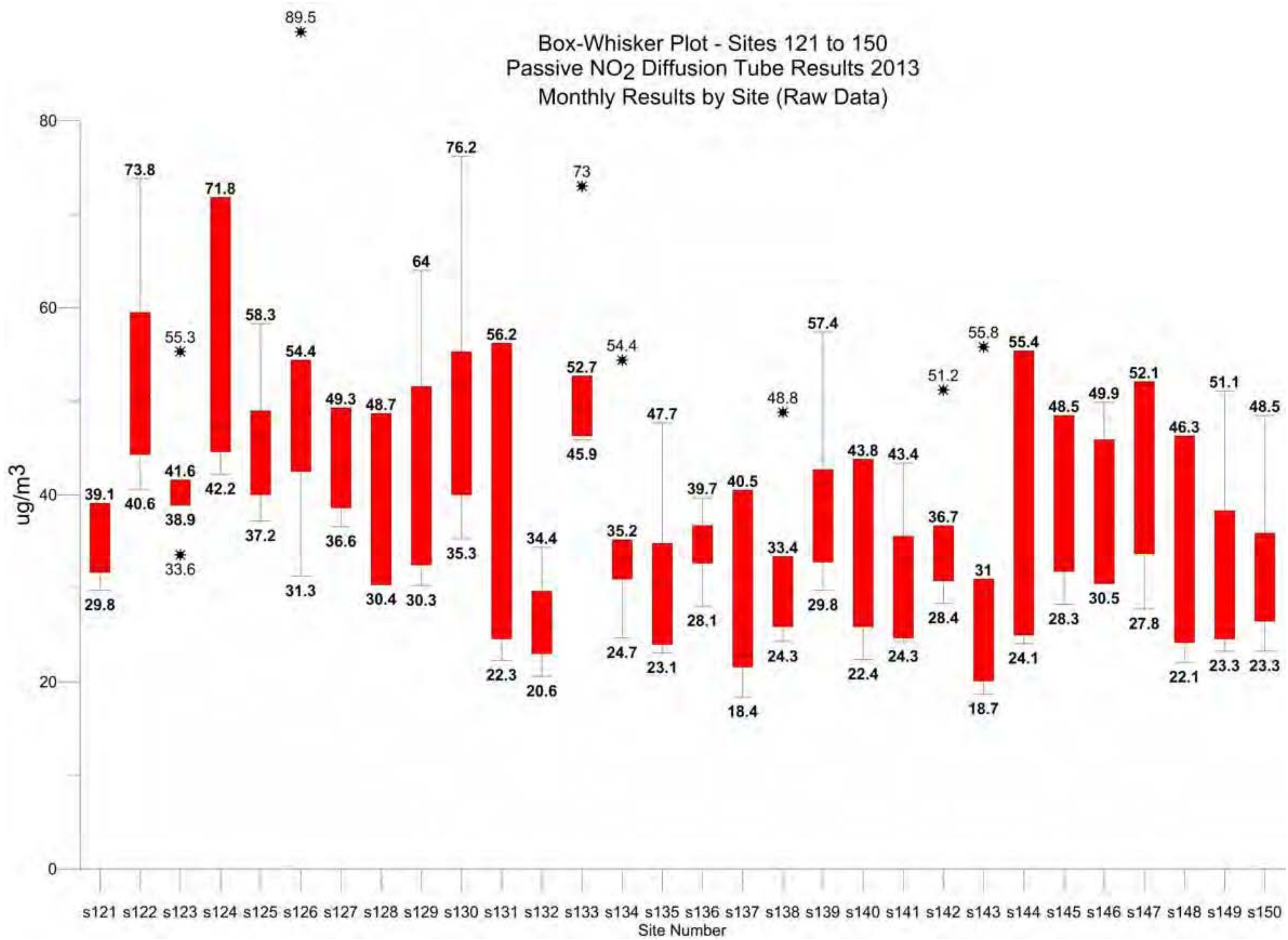


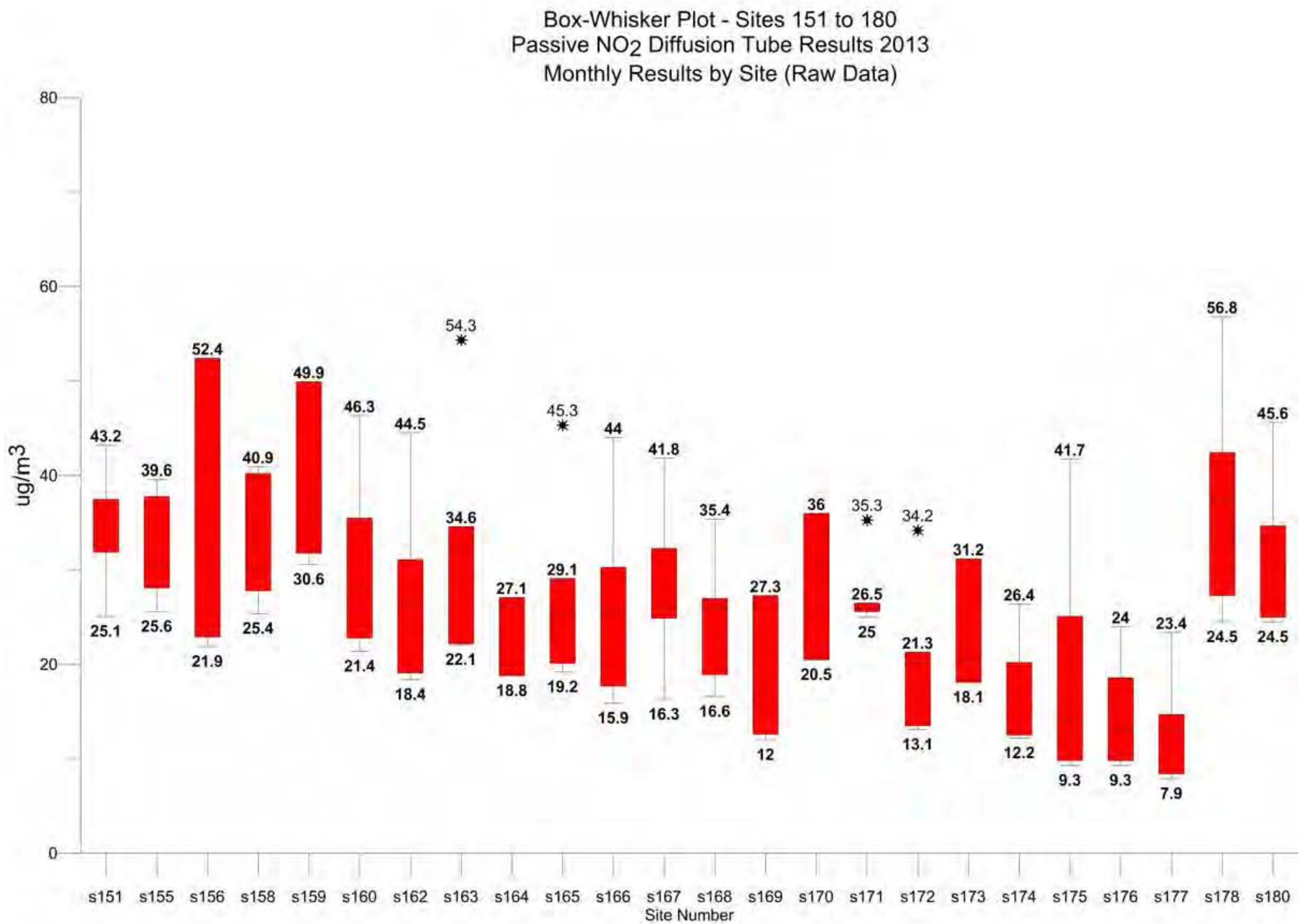
Box-Whisker Plot - Sites 31 to 60
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s31 s32 s33 s34 s35 s36 s38 s40 s41 s43 s44 s45 s48 s49 s50 s51 s54 s55 s56 s58 s59 s60
0 20 40 60 80
53.1 25.5
54.4 29.3
66.3 36.1 25.4
48.7 25.9
52.2 30.4
50 21.4
52.8 23.1
49.8 35.9 26.4
51.3 26.7
59.2 39.7
38.3 31.5 26.9
62.7 37.7 24.6
40.8 18.1
47.1 23.5
61.1 25.3
47.5 36.3 27.5
46.4 29.9
48.8 29.9
50.6 32.8
62 17.2
82.8 47.9
54.3 40.7 27.6



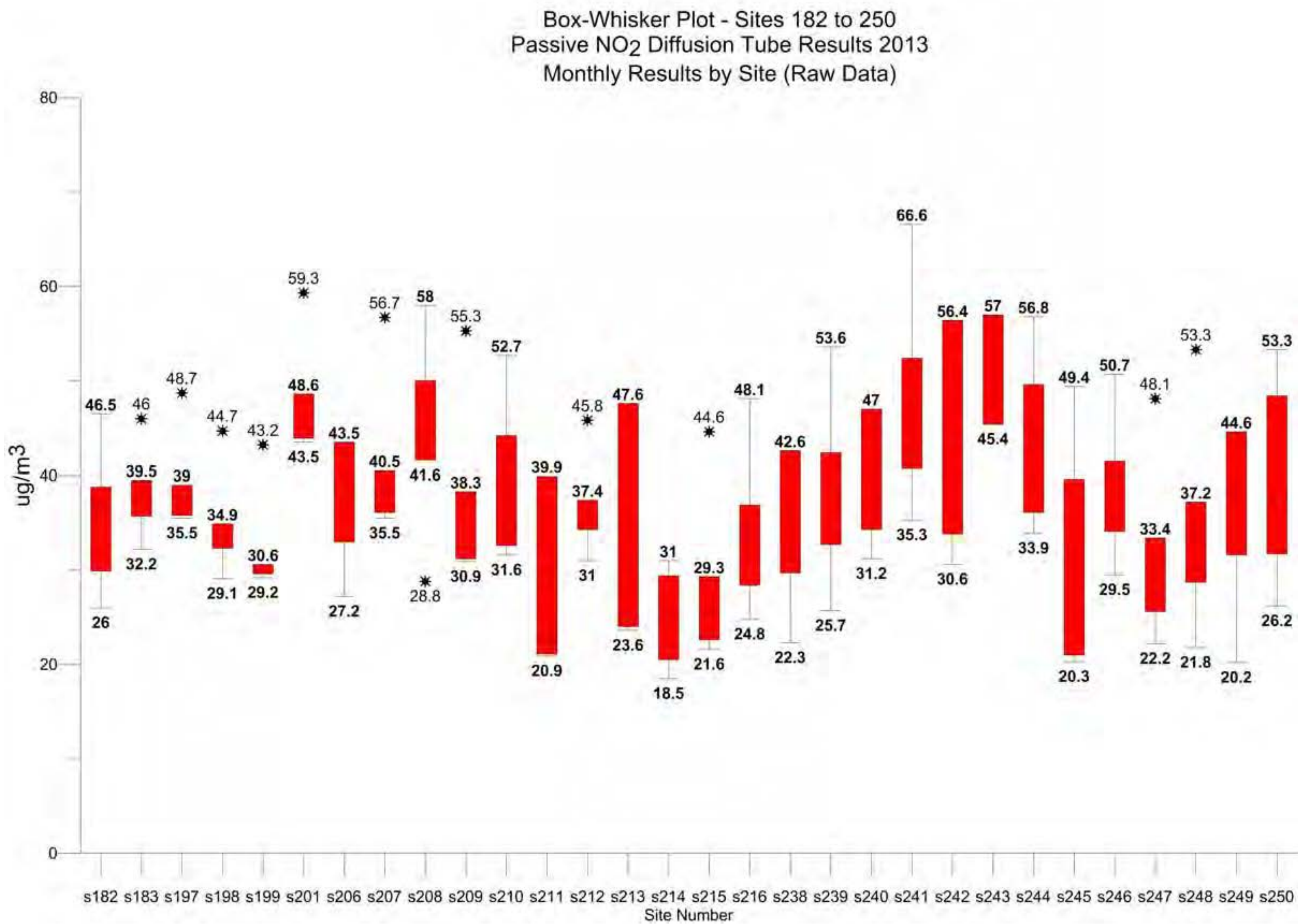
Box-Whisker Plot - Sites 61 to 90
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
0
20
40
60
80
55.9
26
28.2
19.4
46
65.4
40.8
42.7
19.3
52.7
37.5
21.5
75.3
46.7
26.6
54.4
41
36.8
65
34.8
46.5
21
48.7
33.5
46.1
31.7
18.1
41.5
24.9
35.6
30.6
23.9
52.4
36.3
44.5
21.2
47.8
22.4
41.5
20.7
47.6
26.6
41.6
32.8
53.4
36.4
44.5
21.4
40
25.9
17.4
56.1
25.6
31.3
15.9
44.8
36.5
34.5
29.5
s61 s63 s64 s65 s66 s67 s68 s69 s70 s71 s72 s73 s74 s75 s76 s78 s79 s83 s84 s85 s86 s87 s88 s89 s90
Site Number

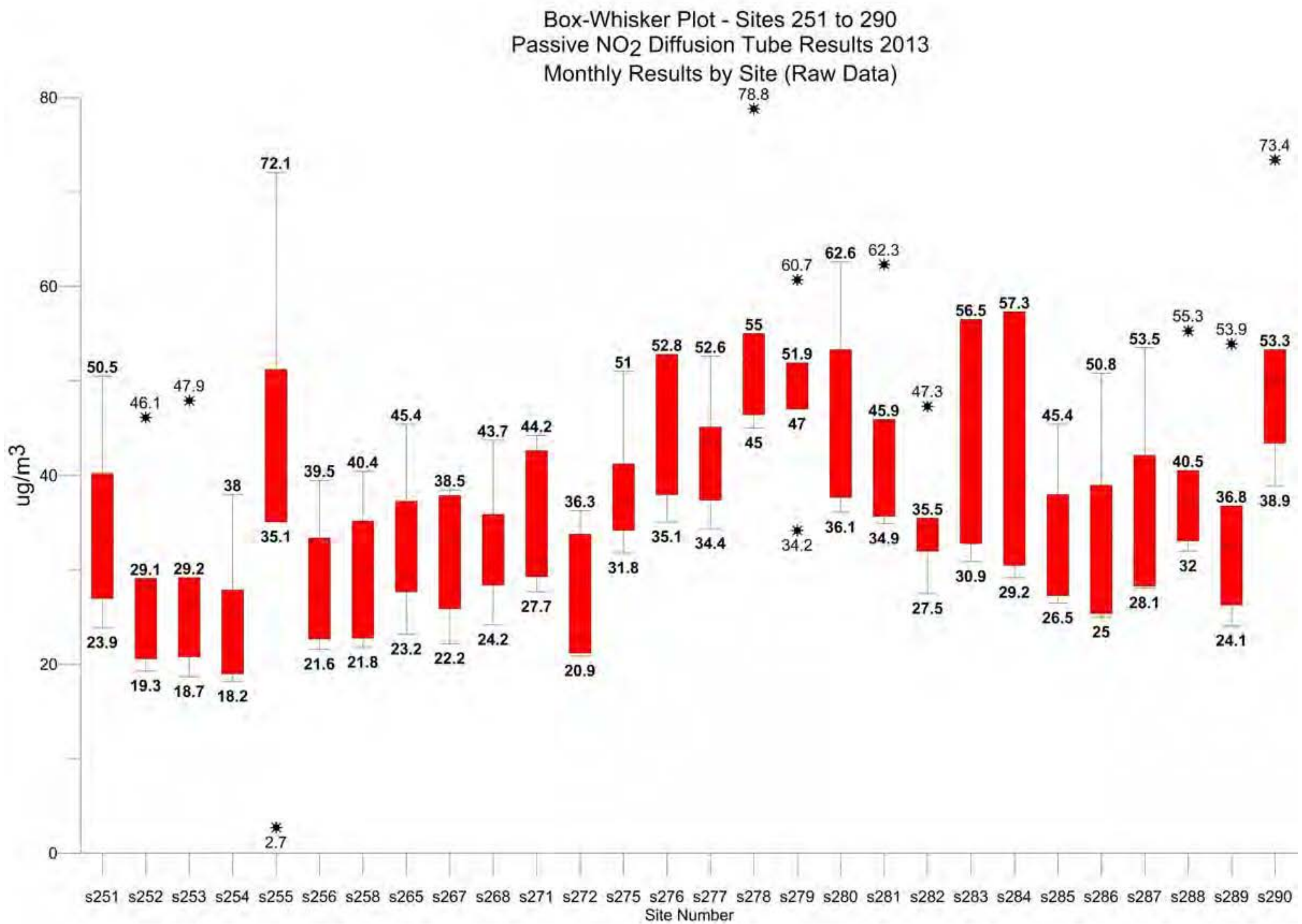

Box-Whisker Plot - Sites91 to 120
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s91 s92 s93 s94 s95 s96 s97 s98 s99 s100 s101 s102 s103 s104 s105 s106 s107 s108 s109 s110 s111 s112 s113 s114 s115 s116 s117 s118 s119 s120

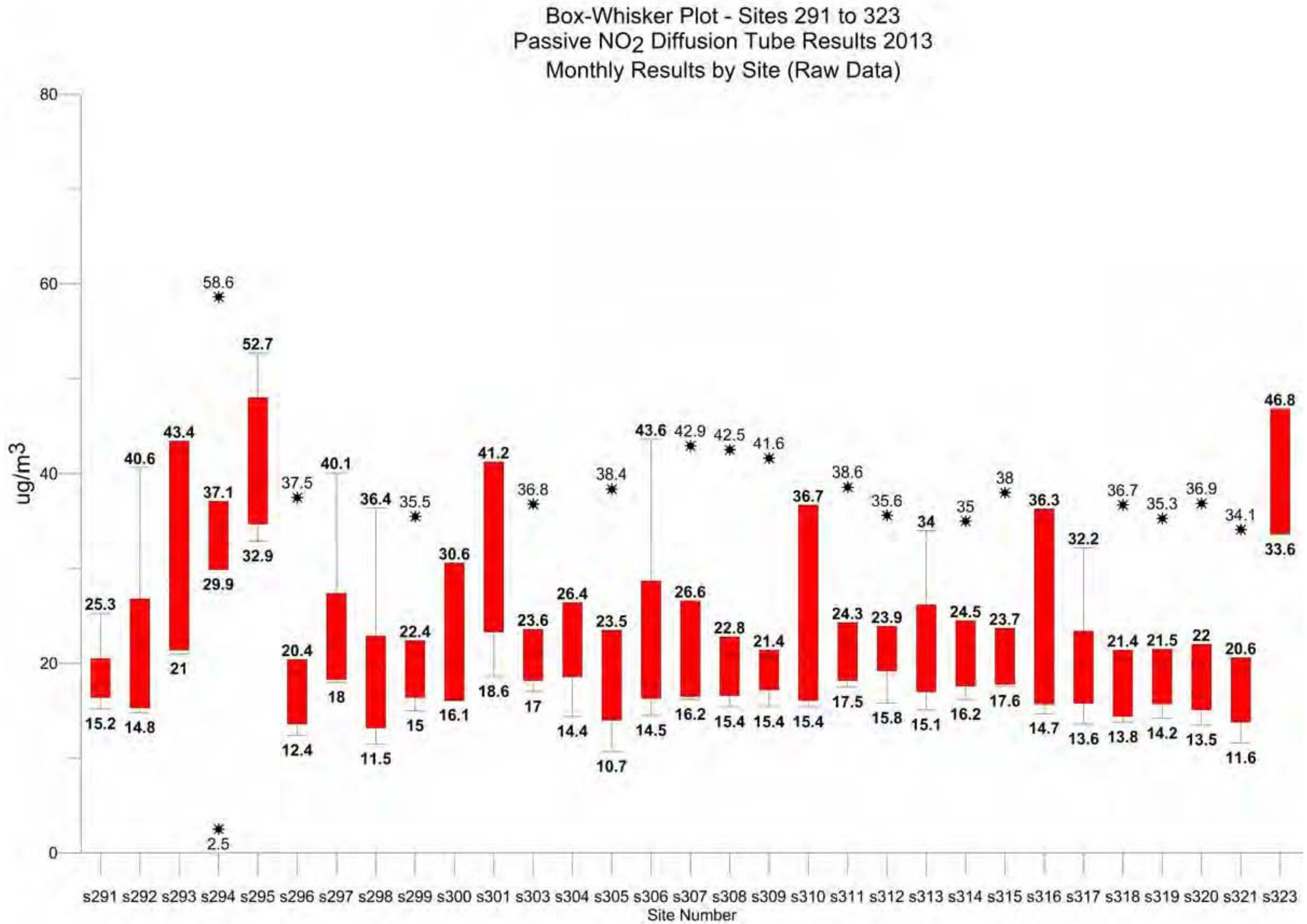

Box-Whisker Plot - Sites 121 to 150
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s121 s122 s123 s124 s125 s126 s127 s128 s129 s130 s131 s132 s133 s134 s135 s136 s137 s138 s139 s140 s141 s142 s143 s144 s145 s146 s147 s148 s149 s150



Box-Whisker Plot - Sites 151 to 180
Passive NO_2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
0
20
40
60
80
43.2
25.1
39.6
25.6
52.4
21.9
40.9
25.4
49.9
30.6
46.3
21.4
44.5
18.4
54.3
34.6
22.1
27.1
18.8
45.3
29.1
19.2
44
15.9
41.8
16.3
35.4
16.6
27.3
12
36
20.5
35.3
26.5
25
34.2
21.3
13.1
31.2
18.1
26.4
12.2
41.7
9.3
24
9.3
23.4
7.9
56.8
24.5
45.6
24.5
s151 s155 s156 s158 s159 s160 s162 s163 s164 s165 s166 s167 s168 s169 s170 s171 s172 s173 s174 s175 s176 s177 s178 s180
Site Number


Box-Whisker Plot - Sites 182 to 250
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s182 s183 s197 s198 s199 s201 s206 s207 s208 s209 s210 s211 s212 s213 s214 s215 s216 s238 s239 s240 s241 s242 s243 s244 s245 s246 s247 s248 s249 s250


Box-Whisker Plot - Sites 251 to 290
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s251 s252 s253 s254 s255 s256 s258 s265 s267 s268 s271 s272 s275 s276 s277 s278 s279 s280 s281 s282 s283 s284 s285 s286 s287 s288 s289 s290


Box-Whisker Plot - Sites 291 to 323
Passive NO2 Diffusion Tube Results 2013
Monthly Results by Site (Raw Data)
ug/m3
Site Number
s291 s292 s293 s294 s295 s296 s297 s298 s299 s300 s301 s303 s304 s305 s306 s307 s308 s309 s310 s311 s312 s313 s314 s315 s316 s317 s318 s319 s320 s321 s323

Appendix 6

AIRBORNE PARTICLES IN SWANSEA, UK: THEIR COLLECTION AND CHARACTERISATION

AIRBORNE PARTICLES IN SWANSEA, UK: THEIR COLLECTION AND CHARACTERISATION

Heather Price[1], Robert Arthur[3], Keith Sexton[2], Clive Gregory[3], Bastiaan Hoogendoorn[3], Ian Matthews[3], Tim Jones [1], Kelly BéruBé[2]

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[2]School of Biosciences, Cardiff University, Museum Avenue, Cardiff, CF10 3US, Wales, UK
[3]Centre for Health and Environment Research, Department of Primary Care and Public Health, Neuadd Meirionydd, 4th Floor, Heath Park, Cardiff, CF14 4YS, Wales, UK

Abstract

Urban air particulate matter has previously been associated with a variety of adverse health effects. It is now the smallest particles, ultrafine or nanoparticles, which are linked to the greatest health effects. The physicochemistry of these particles is likely to provide information regarding their toxicity. Therefore, the aim of this study was to further the understanding of the heterogeneous and changing particle concentrations in urban air, in conjunction with gaining an understanding of the physicochemistry of the particles.

A Dekati™ Electrical Low Pressure Impactor was used to collect the particles and real-time data in a busy traffic corridor in Swansea, Wales over a period of ten non-consecutive weeks. Particle concentrations in the street canyon were analysed and particle physicochemistries investigated using a variety of techniques.

Particle number concentrations were found to vary both diurnally and from day to day in the traffic corridor. Of all particles, the nano–fine size fraction was consistently identified in the highest concentrations (maximum: 140,000 particles cm^{-3}). Particle physicochemistry was found to vary as a function of size, with larger particles exhibiting a greater variety of morphologies (and consequently particle types) and associated metals.

Background

Air pollution is not a new problem. Pollution episodes have been noted since Roman times, with evidence of small-scale scientific atmospheric pollutant investigations as early as the seventeenth century (Kretzschmar, 2007). However it took one-off events such as the Meuse Valley fog in Belgium, 1930 (Nemery et al., 2001) and the Great London smog of 1952 (Whittaker et al., 2004; Davis et al., 2002; Elsom, 1987) to incontrovertibly link airborne particle matter to adverse health effects. These events served as a wake-up call, leading to technological improvements, funding and research (Donaldson, 2003). It is now the smallest particles, nano- or ultrafine particles, generally defined as particles with at least one dimension below 100nm (Donaldson et al., 2001; Oberdörster et al., 2005), that are being linked with the greatest health effects in epidemiology studies, in vitro studies and to a large extent, in vivo studies (Donaldson et al., 2001; Brown et al., 2001, Oberdörster et al., 2005). Whilst this association is now well established, the actual causes of adverse health effects continue to be debated, and are not well understood.

Over the range of particle sizes, it is nanoparticles that have consistently been found in the highest concentrations in urban air (Tuch et al., 2003; Ketzel et al., 2004; Mejìa et al., 2007). Concentrations in urban air have repeatedly been found to reach levels of 104-5 particles cm-3 (Kittelson et al., 2004) during peak traffic flow periods. This causes concern that at these high particle levels the human body clearance mechanisms cannot work efficiently at removing particles (Oberdörster, 1995); leading to particles remaining in contact with cell surfaces for longer periods of time. This persistent contact or "particle overload" has been highlighted as a potential contributing factor when assessing the toxicity of airborne particles.

The issue is complicated by the variety of particles that populations are exposed to on a daily basis. Urban air particles are a complicated and heterogeneous mix (e.g. Donaldson et al., 2005), combining a wide range of particle characteristics such as size, morphology, surface reactivity, biopersistence and chemistry in every sample. This emphasises the importance of fully characterising particulates in all investigations (e.g. Harrison and Yin, 2000).

This study used an interdisciplinary approach to investigate particle physicochemistry within a traffic canyon. Particles were collected using a DekatiTM Electrical Low Pressure Impactor (ELPI) into twelve size fractions. The collection was completed at two locations; an urban air traffic canyon and a rural background location. Due to the small masses in each of the collected size fractions, they were then combined into three analysable size fractions (7-615nm, 616-2.39µm, 2.4µm- 10µm). The three size fractions were physicochemically evaluated using tools including Field Emission- Scanning Electron Microscopy (FE-SEM) and Inductively Coupled Plasma- Mass Spectrometry (ICP-MS).
Methods

Site details

Particle collection was completed at two localities; an urban air site, and a rural control site. Neath Road in Swansea, Wales, UK was the urban collection site. Neath Road is a main commuter traffic route into Swansea City, and a recognised traffic hotspot (Figure 1). The area has been designated an Air Quality Management Area (AQMA) based upon its pollutant concentrations. Traffic levels are high (~18,000 per day) due to the road forming a main commuter zone between Swansea and Neath. Swansea is also an old industrial port city, which has been undergoing a process of urban renewal for a number of years. The locality was therefore expected to consist of a cocktail of particle types that were contributed by the main sources; urban, industrial and marine. Sampling was completed over a period of ten non-consecutive weeks during one season (therefore reducing the impact of seasonal- related meteorological differences) between 05/12/07 and 28/02/08, resulting in both particle collections and real-time particle data.
The traffic corridor is orientated NNE- SSW, with the predominant wind direction in a similar trajectory (NE-SW). Small-scale industrial sites are located city-wide; however the predominant wind direction (blowing straight from the sea and onto the site) reduces the impact of local industry. Port Talbot to the south east represents the most substantial industrial area in the vicinity, potentially contributing particles dependent upon the wind direction.

Brecon, the rural control site is located approximately 42km north-east of Swansea. Sampling lasted for a period of three weeks; producing only a one week usable sample due to an atypical dust storm (correlated to an event originating from the Sahara), and a neighbour's bonfire. While achieving the one week usable particulate sample, a local mains power failure resulted in no real-time data collection.

Instrumentation

Particles were collected using a DekatiTM Electrical Low Pressure Impactor (ELPI). The ELPI is an inertial-based cascade impactor, which accumulates both real-time particle data and particle collections onto substrates. It divides particle data into 12 size fractions, from 7nm to 10µm, 3 of which are within the ‘nano’ size range, and particle collections from 30nm to 10µm. ELPI cut-off diameters (Keskinen et al., 1992) and particle concentration profiles (Zervas and Dorlhène., 2006) have been confirmed in previous studies. A flow rate of 30 l/min was maintained using a Sogevac Leybold vacuum pump. The ELPI stages were loaded with 25mm aluminium foil substrates. Substrates were weighed using a microbalance (Sartorius Micro SC-2) pre- and post-sampling to determine the particulate mass. Substrates were not coated with grease (as recommended by the manufacturers) in order to reduce contamination during subsequent ICP-MS analyses (Fujitani et al., 2006). The equipment set-up on-site included the collection head, teflon tubing, ELPI, pump, and laptop for equipment control and data collection.
Statistical testing
Graphing and statistical testing was completed using Microsoft Excel, with SPSS (version 16) used for non-parametric particle analysis and Spearman’s Rank Correlation Coefficient.

Particle characterisation

Analytical electron microscopy
In preparation for Field Emission- Scanning Electron Microscopy (FE-SEM), the aluminium foil substrates were cut into sections. Approximately one-eighth of each collection foil was used for analysis. Epoxy resin (AralditeTM) was used to attach the foil substrate sections to 12.5mm aluminium SEM stubs (Agar Scientific). Samples were then coated with gold using a sputter coater (Bio-Rad SC500). Samples were imaged using a Philips XL30 FE-SEM. A range of working conditions in secondary electron mode were utilised to maximise image quality, including a working distance of 5mm- 10mm, accelerating voltages 5- 20kV, spot size 4 and a gold foil aperture.

Particle extraction
Particles were removed from the foil substrates for further physicochemical analysis using a novel freeze-drying technique.
Onto each aluminium foil, 900µl of molecular biology grade water was pipetted. The foil and water were then frozen. Once fully frozen, the ice discs were peeled from the foils using ceramic tweezers. Samples were freeze-dried at -40oC (Model: Edwards Pirani 10) until no ice remained in the samples, a process taking varying lengths of time from overnight, to periods of two or

three days depending upon sample size. Samples were combined into three size fractions (30nm- 615nm, 616nm- 2.39µm, 2.4µm- 10µm) in order to provide samples large enough for analysis, representing 'nano-fine', 'fine' and 'fine-coarse' particle size fractions. The accuracy of the particle removal technique has been assessed (Figure 2). Figure 2 compares the particle recovery efficiencies between the three size fractions. Percentage particle recovery is ascertained by weighing substrates before/ after sampling to find total particle mass, and after extraction to find the particle mass that has been removed from the substrate. Particle percentage recovery therefore represents the mass percentage removed from the substrate using the extraction, in comparison with the original particle mass.

Particle removal using this technique is proven to be efficient (up to 98% particle recovery), removing the majority of the particle mass from the collection substrates. These removal efficiencies are comparable (or more efficient than) than those from other studies. Hartz et al. (2005) obtained a 60- 85% mass recovery using a solvent- based extraction process. Jones et al. (2006) recovered 80% of particles with an initial wash of particles collected onto Polyurethane Foam (PUF) substrate. Further washing provides recoveries of up to 95%, comparable with this study.

Due to the high removal rates, particles removed using this methodology are considered to be representative of the particle sample as a whole. It is shown that particle removal is most effective in the middle size fraction, a factor likely to be closely related to a larger initial mass and volume in this size fraction, combined with similar substrate adherence areas to the smallest and largest size fractions, reducing the relative percentage of particles in contact with the substrate.

ICP-MS analysis

Samples were digested for ICP-MS analysis using a CEM MDS-200 microwave system. Particle samples (n=2) were washed into teflon-coated composite vessels using 5ml 70% nitric acid. The samples were digested using an existing programme developed for refractory carbon-based particulate matter (Jones et al., 2006). The microwave programme consists of a stepped increase in pressure to 80psi for a period of 20minutes, with a corresponding temperature rise to 180oC. The programme lasts for approximately 2.5 hours, including warm up and cool down periods. Samples were then diluted to a level of 10µg/ml (dependent upon their original weight) using deionised (>18ΩM) H2O. Raw data was corrected for blanks and controls accordingly.

Results

Real-time particle data

After processing the raw data using ELPIvi software, it is seen that throughout the daily cycle, on both weekdays (Figure 3 [a- c]) and Sundays (Figure 3 [d- f]), particle number concentrations are consistently highest in the smallest size fraction (D50% 7nm). In this size fraction, particle number concentration peaks at 140,000 particles cm-3.

During the weekday averages, there is a consistent daily concentration profile which is replicated in all three analysed size fractions. The profile is characterised by a steep rise in particle numbers during the morning rush hour. Interestingly, whilst all three size fractions show this

trend, particle numbers in the coarse size fraction (2.4μm- 10μm; Figure 3c) do not begin to increase until 08:30am, compared to a 06:00am increase identified in the two smaller size fractions. Similarly, the evening rush hour signal identified in the two smaller size fractions (7nm- 2.39μm) which begins at 15:00pm, does not begin in the coarse size fraction until 17:00pm. During weekdays, the "night-time" particle concentrations (18:30- 06:30) are significantly lower (95% conf.) than "daytime" particle concentrations (06:30- 18:30) in the two smaller particle size fractions (7nm- 2.39μm). When considering the coarse size fraction (2.4μm- 10μm), this statistical difference (95% conf.) is not identifiable.
In contrast to the weekday data, Sunday particle number concentrations peak at 38,000 particles cm-3 at 20:30pm. The smallest (7nm- 615nm) and largest (2.4μm- 10μm) measured size fractions do not show a significant difference in particle number concentrations between "daytime" and "night-time" hours (95% conf.). In contrast, the middle size fraction does indicate number concentration variation between day and night-time hours (95% conf.).

Averaged data across the week (Monday- Sunday; Figure 4) illustrates the daily particle concentration profile differences at Neath Road, Swansea. Outputs for Monday- Thursday are consistent in terms of profile shape and magnitude in the smallest size fraction (7nm- 615nm). This profile pattern begins to break down on Friday and Saturday, and by Sunday, the original number concentration profile has broken down completely, with smaller magnitudes and a different profile shape, with a particle concentration low during the morning replacing the number concentration high identified in the weekday data.
Fine (616nm- 2.39μm) and Coarse (2.4μm- 10μm) particles do not have a similar weekly concentration distribution to the smallest size fraction. The consistency of the number concentration profile (Monday- Thursday) identified in the smallest size fraction is not repeated in these size fractions. Instead, concentration profiles are generally more poorly defined, with occasional time periods appearing to be synchronised with the finest size fraction. In both larger size fractions, particle concentrations are higher from 12:00pm Saturday to 00:00am Sunday than on the Wednesday and Thursday, which contain some extreme particle concentration lows, for example Thursday (14:30pm), potentially a product of meteorological conditions.Physicochemistry of collected particles

FE-SEM

As shown in Figure 5, particle morphology, and consequently type, increased in variability as particle size increased. Particles in the smallest size fraction (30- 615nm) have a consistent morphology of spherical to sub-spherical particles. In the middle size fraction, a combination of agglomerated spherical/ sub-spherical particles and more sheet-like platy grains dominate. The largest size fraction (2.4μm - 10μm) exhibits much greater particle variability, with a range of particle morphologies visible (Figure 5e, f), agglomerated spherical/ sub-spherical particles, platy grains, cubic morphologies, larger spherical particles and large near-spherical particles with nodules.

ICP-MS

The ICP-MS elemental analysis confirmed that iron, zinc and magnesium were the most abundant elements in the particles (Figure 6). Element concentrations were found to vary with respect to particle size, but differently between elements, for example, iron and magnesium were found to increase in concentration with increasing particle size, compared to nickel and lead, which had the highest elemental concentrations in the smallest size fraction.

In terms of average PM10 concentration, elements were identified in the descending concentration order Fe> Zn> Mg> Ni> Cu> Cr> Ba> Mo> Pb> Mn> Ti> V> Zr> Co> Cd. Associations were identified between a number of elements using Spearman's rank correlation coefficient including Fe and Cu, Fe and Ba, Fe and Mn, Mg and Co, Ni and Ba, Cu and Ba, Cu and Mn, Ba and Mn to a 0.01 confidence level.

Discussion

Particle data analysis

Throughout the 24-hour sampling period shown in Figure 3, the highest particle concentrations are found in the smallest particle size fraction, particles 7nm- 615nm. These findings reinforce work completed by others, for example in Brisbane (Mejìa et al., 2007) where peak particle concentrations were below 30nm (82- 90% of particles). A study in two German cities, Erfurt and Leipzig (Tuch et al., 2003), found the highest particle concentrations in the 10nm- 20nm size range; whilst an urban air study focussed upon Copenhagen (Ketzel et al., 2004) and lasting several years placed the particle concentration maximum between 20nm- 30nm. This particle concentration maximum is attributed to the traffic contribution at these urban sites (Mejìa et al., 2007; Ketzel et al., 2004; Shi et al., 1999). The findings within the Swansea traffic corridor are therefore comparable with those found in other locations, and the concentration maximum, combined with what is known about the street canyon can confirm that whilst the input of particles from other sources (for example industrial and marine) will contribute to the particle totals, vehicles are the dominant sources of particles at Neath Road in Swansea.

Particle concentrations throughout the day in the traffic corridor are high (mean: 52,000 particles cm-3) when compared against some urban areas sampled in similar studies. The German two city study (Tuch et al., 2003) found a particle concentration maximum of 40,000 particles cm-3, whilst the Copenhagen study (Ketzel et al., 2004) found an average of only 7,700 particles cm-3 during a three month investigation period. A study completed in Rouen, France (Gouriou et al., 2004) using an ELPI found average particle concentrations below 50,000 particles cm-3; if particular external factors were combined, concentrations in the range of 106 particles cm-3 were sometimes obtained. This distribution is similar to the situation in the Swansea traffic corridor. Whilst the mean averages at 52,000 particles cm-3, specific events happening over timescales as short as seconds are influencing and dramatically increasing the particle concentrations observed in the traffic corridor at particular times, leading to concentration peaks of up to 140,000 particles cm-3 in the nano-fine size fraction. A Three European City study (Ruuskanen et al., 2001) obtained similar results, with an Erfurt peak at 188,000 particles cm-3 during the morning rush hour.

On weekdays, days dominated by traffic, all size fractions are identified as having a traffic-responsive profile. That is, it is possible to identify a morning and afternoon rush hour signal. The coarse size fraction was found to have a later rush hour peak (both morning and afternoon). This finding could be explained by the rapid sensitivity of nanoparticles to vehicle exhaust particles, as previously identified by Rodriguez et al. (2007), in a study carried out in Milan, Barcelona and London. Nanoparticles were found to vary extremely quickly and significantly in response to traffic, a finding reinforced in a study of urban air particle concentrations in Helsinki (Buzorius et al., 1998), where individual vehicles were found to affect the observed particle concentrations.

A number of studies have found that particle concentrations are higher during the day, and are linked to the vehicular particle source and its predominance during daytime hours (Buzorius et al., 1998; Laasko et al., 2003); as seen in the Swansea traffic corridor. Some studies (for example Rodríguez et al., 2007) have investigated further to find that the difference between daytime and night-time concentrations is much more pronounced in the nano-fine range; a result also found in this study on weekdays. On days not dominated by traffic sources (Sunday), this nanoparticle day-night variation was not significant, reinforcing traffic as a source of the smallest particles. This continuity between day and night-time particle number concentrations on Sundays could also be contributed to by the lack of industry and other related sources of particles on the weekend.

The morning rush hour peak has been identified in this study, a finding also seen in a study at Marylebone Road (Harrison and Jones, 2005). A daily pattern, with nanoparticle peaks between 8am and 9am, and 4pm and 5pm identified in the German Two City study (Tuch et al., 2003) correlates with the nanoparticle morning and afternoon rush hour peaks identified in Swansea on weekdays. A link between nanoparticle concentrations and solar radiation has previously been identified (Shi et al., 2001); perhaps explaining the sustained nanoparticle numbers observed at Neath Road between morning and afternoon rush hour peaks.

The difference in particle concentrations and distributions identified at the Neath Road collection site between weekdays and weekends has also been identified in other studies (Buzorius et al., 1998), and is attributable to a reduction in commuter traffic and to an extent, industrial processes during the weekends. This result has not been consistent for all studies (Mejìa et al., 2007), perhaps due to a reduced importance of commuter traffic-sourced particles in the study, and the dominance of other sources.

Identifiable in the Neath Road data is reduced particle number concentrations in the fine and coarse size fractions during Wednesday and Thursday, and increased particle number concentrations on Saturday and Sunday. If the smallest size fraction (7nm- 615nm) is taken to be representative of the particle number profile predominantly as a result of traffic, this finding reinforces that particles in the middle and largest size fractions are contributed to by a variety of sources other than traffic exhaust, perhaps road dust, marine particles and industrial particles (Moreno et al., 2004).

The week-long study at Neath Road traffic corridor identified variability in particle concentration signals for different days of the week, especially emphasised in the smallest size fraction, particles between 7 and 615nm. Different particle signals were also identified in a study carried out in Milan, Barcelona and London (Rodríguez et al., 2007), a finding explained by the importance of semi-volatile compound condensation in urban areas. In contrast, a study at three sites within Birmingham, England (Shi et al., 1999) found that despite variable weather conditions, particle concentrations and distributions measured varied only negligibly. Day to day particle concentration and distribution variances at Neath Road can be assumed to be dependent upon traffic compositional, volume changes or meteorological differences. Further work is required to elucidate the relative contribution of each component.

Physicochemistry of collected particles

Carbonaceous material was found to be dominant in all size fractions; as identified from the FESEM imaging (nano-sized spherical to sub-spherical particles found singularly or in aggregates; Figure 5). Results from a characterisation analysis of particulate matter collected on the coast of Sicily (Rinaldi et al., 2007) agree with this finding, especially in the size range 50-140nm. In this study, the smallest measured size fraction (30nm- 615nm) was also found to have the highest carbonaceous material of all the measured size fractions. These study findings are in agreement with others including those completed in Pasadena, California (Hughes et al., 1998), Milwaukee, Wisconsin (Lough et al., 2005), Belfast (urban), London (urban) and Harwell (rural) in the UK (Jones and Harrison, 2005). The large contribution of carbonaceous soot nanoparticles to the samples, whether as individual particles (or small groupings of particles) in the smallest size fraction, or larger agglomerates in the middle and largest size fraction reaffirms traffic exhaust particles as the main particle source in the street canyon. The large contribution of traffic exhaust particles to total particle concentrations in urban settings is well documented (e.g. BéruBé et al., 2008).

Particles of cubic morphology, as recognised using FESEM imaging (Figure 5), can be identified as marine-derived halite crystals (Jones and BéruBé, 2007), due to the proximity of the sampling site to the sea and the predominant wind direction (Figure 1). Those particles with perfect cubic morphology are likely to have grown in situ on the collection substrate, whilst more damaged particles are likely to have origins of either marine processes or road salting (Moreno et al., 2004). The combined factors of proximity to the sea and comparatively stable weather conditions suggests a predominance of marine-derived halite crystals.

Large (coarse size fraction) spherical particles with nodules covering the surface are attributed to biogenic processes, confirmed by their behaviour beneath the FESEM beam (BéruBé et al., 2008).

FESEM imaging identified sheet-like particles in the largest size fraction. These particles (2.4-10μm) are identified as mineralogical particles, perhaps derived from local or more distant areas of exposed crust and soil (BéruBé et al., 2008).

Due to the naturally variable wind directions encountered during a sampling period, the origin of industrial- generated perfect spherical particles may be local (within Swansea) or wind-blown from a distance (for example Port Talbot to the south- east). Spherical particles are common in both urban and industrial air (Moreno et al., 2004).

The metals identified in the particle samples (ICP-MS analysis) were found to increase in variety with increasing particle size, as found also in the Milwaukee study (Lough et al., 2005). PM10 was found to contain more metals than PM2.5, perhaps due to the greater variety of contributing sources to the larger size fractions; including crustal, traffic, biological and technogenic-type sources. In another study, investigation of analytical SEM images identified that particles under 1μm predominantly consist of traffic-derived soot (Baulig et al., 2004). Other studies have found a more bimodal distribution of elements within particulate samples, for example a peak in the nano-size fraction, and a peak in the particle size range 3.2- 5.6μm as found in a study conducted in southern Taiwan (Lin et al., 2005).

Iron was found to be the most abundant metal in the particles in agreement with results from other physicochemical analysis studies (Hughes et al., 1998; Lough et al., 2005; Baulig et al., 2004).

Some elements identified by ICP-MS analysis can be identified as partly arising from diesel emissions, for example Fe, Ca, Si, Mg and Mn (Wang et al., 2003) a number of these elements are also associated with crustal components, for example Fe, Ca, Si, Mg (Lough et al., 2005). This highlights the fact that source apportionment is extremely complicated, with different studies identifying different tracers for the same source, and different sources for the same tracer or combination of tracers.

The elemental concentrations identified in this study (ICP-MS analysis; Figure 6) are much lower than in London 1950s particulate samples (Whittaker et al., 2004). Comparisons include 157ppm Fe concentration at Neath road and 19,294μg g-1 London 1955 sample, and 1.3ppm Mn concentration at Neath Road and 508 μg g-1 from the London 1955 samples. Additionally, in a paper by Shao et al. (2007), outdoor Beijing particulate matter was collected and analysed by ICP-MS. Levels of 17ppm Mn in the Beijing air can be compared with 39ppb (Neath Road). Therefore total metal concentrations of particulate matter from urban Swansea air are lower than concentrations identified in historic studies (Whittaker at al., 2004) and in rapidly developing countries (Shao et al., 2007). This finding is to be expected (Donaldson, 2003) due to improved legislation and current British technological requirements, and more local factors including meteorological conditions, road usages and the prevalence of local polluting industries.

Metal concentration ordering at the Neath Road collection site (Fe> Zn> Mg> Ni> Cu> Cr> Ba> Mo> Pb> Mn> Ti> V> Zr> Co> Cd) can be compared to those in the literature for urban locations (Whittaker et al., 2004 (Fe> Pb> Cu> Mn> V> As> Co); Chandra Mouli et al., 2006 (Fe> Mn> Ni> Cu> Pb> Co); da Silva et al., 2008 (Cu> Pb> Ni. Sb> Ce)). The difference between the concentration orders of metals at different sites highlights the importance of local factors; including geography, meteorology and variability of sources and source compositions. Correlations were identified between some of the metals analysed by ICP-MS ($p>0.01$). These correlations may indicate the same or similar elemental sources, for example correlation between Ba and Ni may be associated with road exhaust emissions (Dongarrà et al., 2007).

Summary and Conclusions

Particulate matter within the Neath Road street canyon, Swansea, Wales was studied for particle concentration variations and particle physicochemical properties. The particle concentrations within the traffic corridor were found to be consistently highest in the smallest size fraction, with particle concentrations and daily patterns comparable to previous studies in this field. Evening and weekend concentrations of particles were significantly lower than daytime particles, highlighting the role of traffic exhausts as a primary and influential provider of the smallest (and most abundant) particles.

Generally, with increasing particle size, particle morphology and type increased in variability, with particles in the nanoparticle-range being dominated by traffic exhaust particles. The associated metal content increased in both amount and variety of types with increasing particle size. The ICP-MS analyses generally added to and reinforced results from the FESEM and were useful in providing bulk elemental analysis.

Figures

Figure 1. Location map showing the Neath Road, Swansea sampling site (black circle) in relation to surrounding feature

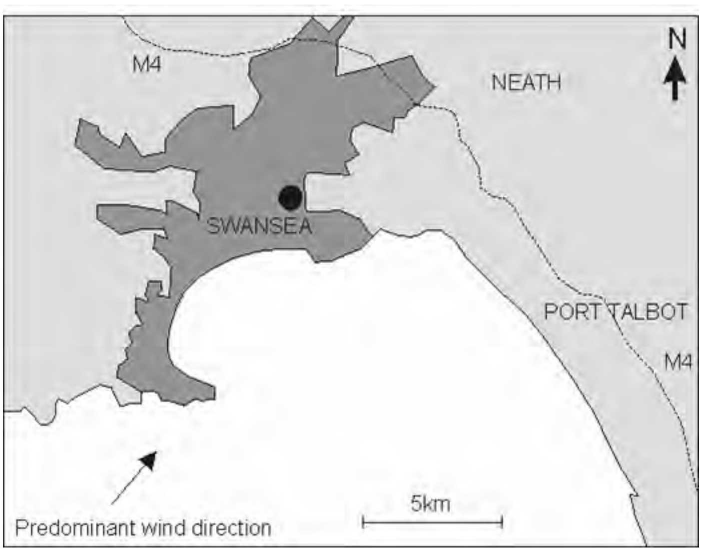
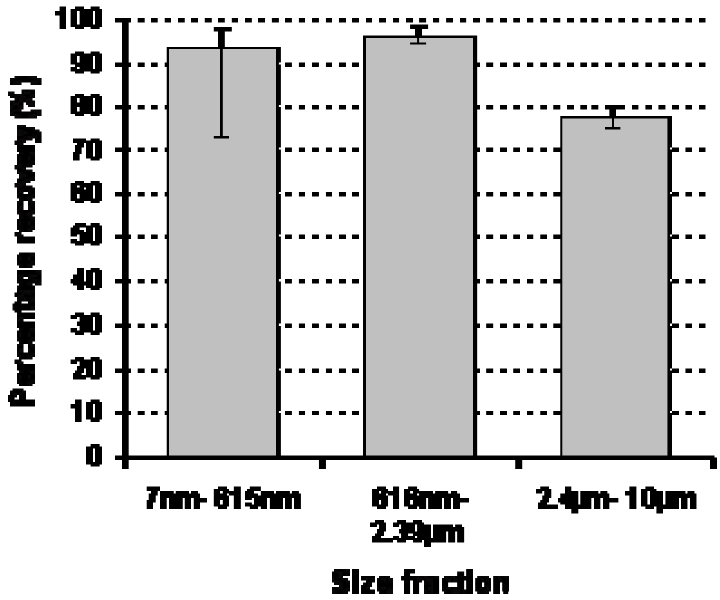


Figure 2. Particle mass extraction efficiency for the three analysed size fractions (30nm- 615nm, 616nm- 2.39μm, 2.4μm- 10μm). Error bars indicate the range of recovery efficiencies measure



100
90
80
70
60
50
40
30
20
10
0
Percentage recovery (%)
7nm- 615nm
616nm-
2.39µm
2.4µm- 10µm
Size fraction

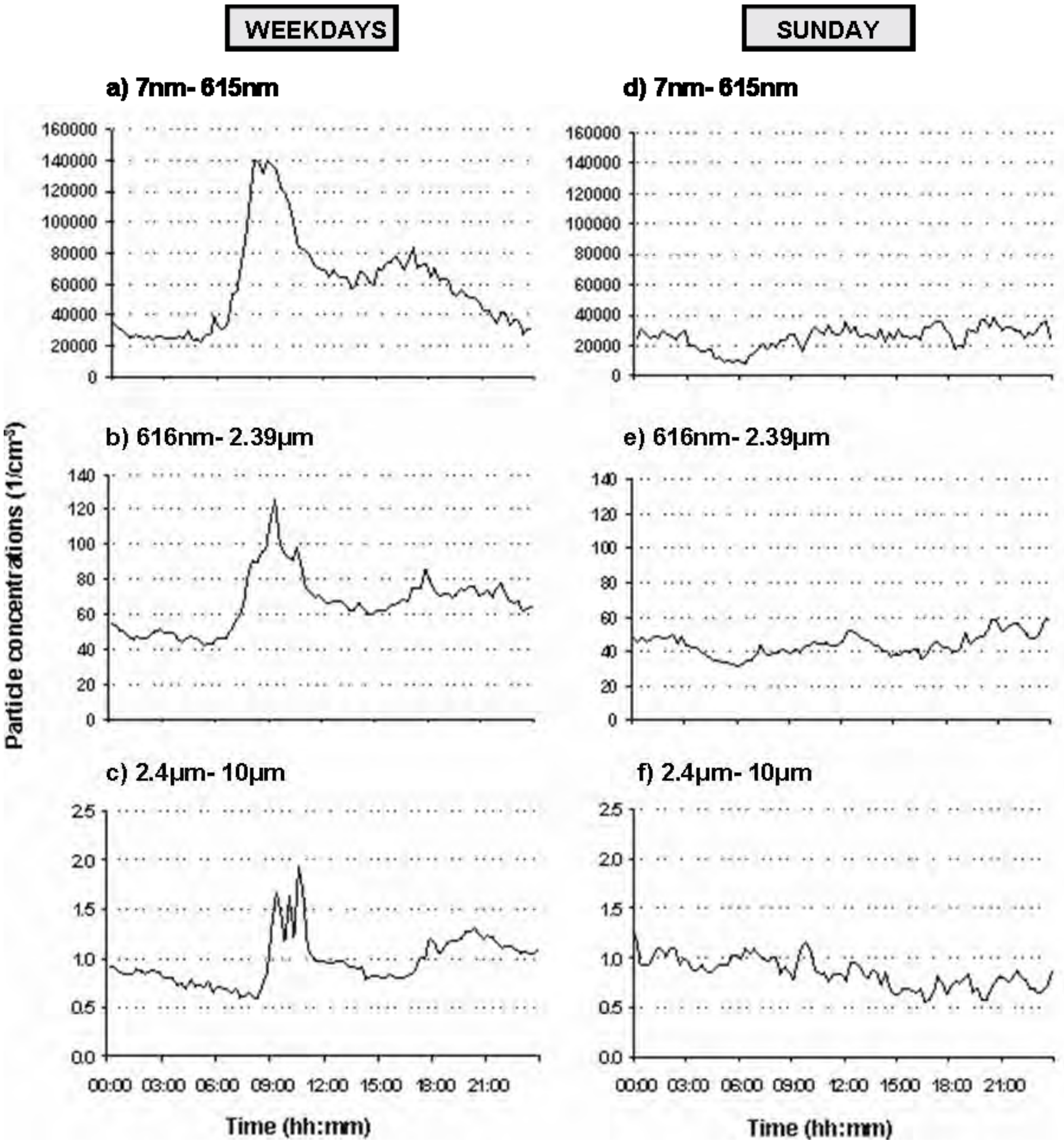


Figure 3. Average daily particle concentration profile in Neath Road traffic corridor for (1) weekdays and (2) Sundays in three size fractions (a) 7nm- 615nm, (b) 616nm- 2.39µm, (c) 2.4µm- 10µm

Figure 4. Average weekly particle concentration profile for Neath Road, Swansea

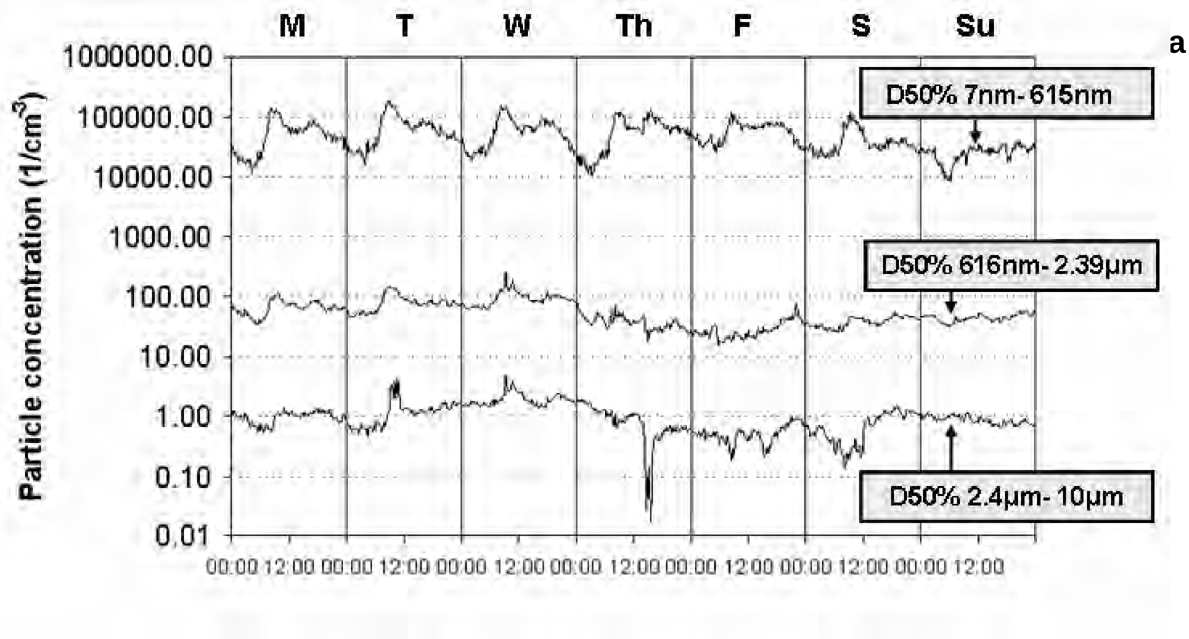


Figure 5. FE-SEM images of particles in the three measured size fractions collected in Neath Road, Swansea

(a) Particles in the 30- 615nm size range. (b) Close-up view of the 30- 615nm particle size range. (c) Particles in the middle size fraction (616nm- 2.39µm), at a large-scale view. (d) Closer view of particles in the middle size fraction. (e) Particles in the largest size fraction (2.4µm- 10µm). (f) Closer view largest size fraction

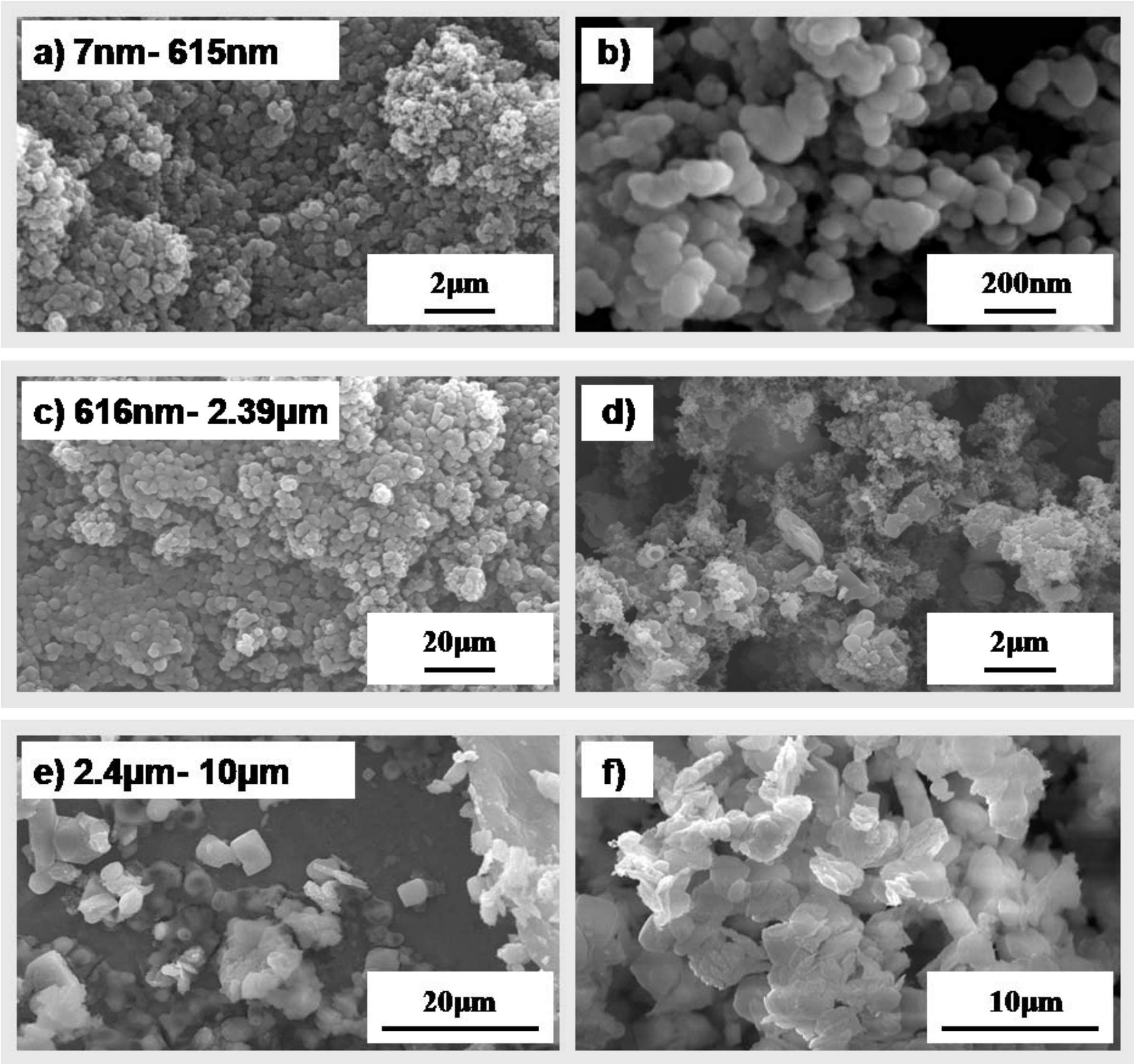
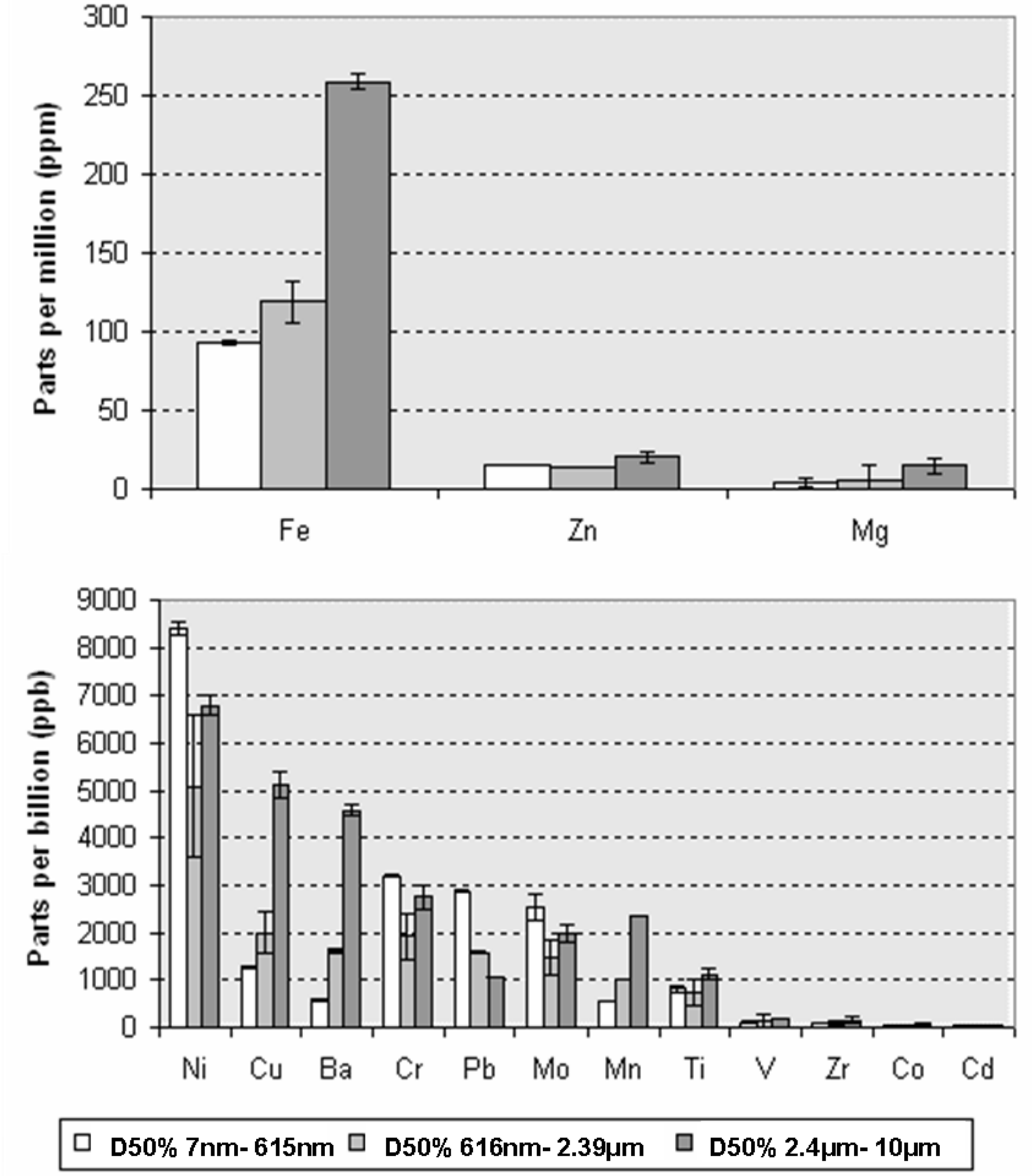


Figure 6. ICP-MS elemental analysis of the three analysed size fractions



Bars represent the three different analysed size fractions (white= D50% 30nm- 615nm; light grey= D50% 616nm- 2.39µm; dark grey= D50% 2.4µm- 10µm), top graph showing elements in parts per million (ppm) concentrations and bottom graph showing elements in parts per billion (ppb) concentrations. Error bars represent one standard deviation either side of the mean.

Acknowledgements

This research was funded by the National Environment Research Council (NERC).

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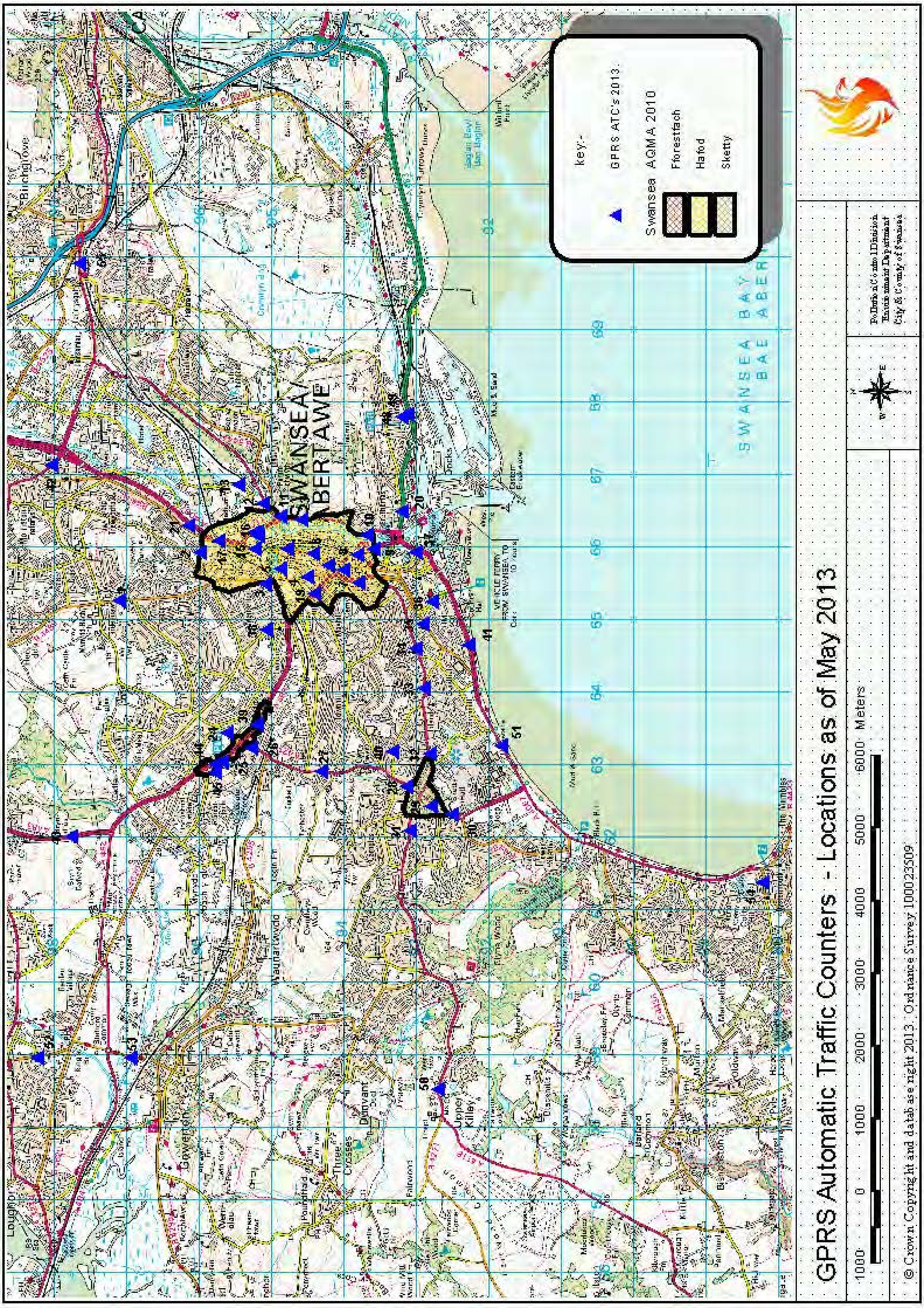
Appendix 7

Automatic Traffic Counter Locations


GPRS Automatic Traffic Counters - Locations as of May 2013
key:-
GPRS ATC's 2013
Swansea AQMA 2010
Fforestfach
Hafod
Sketty
SWANSEA BAY
BAE ABERTAWE
SWANSEA/ABERTAWE
1000 0 1000 2000 3000 4000 5000 6000 Meters
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Appendix 8

SWWITCH Progress Report 2013

REGIONAL TRANSPORT PLAN FOR SOUTH WEST WALES 2010 - 2015

CONSORTIWM CLUDIANT INTEGREDIG DE-ORLLEWIN CYMRU
SOUTH-WEST WALES INTEGRATED TRANSPORT CONSORTIUM

SWWITCH

ANNUAL PROGRESS REPORT 2012/13

CONTENTS

Front Page Photographs

Top left: Access to Kenfig project
Top right: Clydach Connect 2 cycle/pedestrian bridge Bottom left: Cross Hands Economic Link Road – Phase 1a Bottom right: Bike Mobility scheme users in Haverfordwest

FOREWORD

The South West Wales Integrated Transport Consortium (SWWITCH) is pleased to produce the third Annual Progress Report (APR) on the Regional Transport Plan (RTP). It is required by the Welsh Government to explain the uses and benefits of the Regional Transport Consortium Grant (RTCG) and it is also important for stakeholders, to provide an update on changes made and progress achieved during the 2012/13 financial year.

This APR has been prepared in accordance with guidance issued by the Welsh Government.

SWWITCH wants the document to be easy to follow and so, as far as is possible, background material and detail is included separately in appendices. The Appendices will be available on the website and in hard copy on request. SWWITCH welcomes any comments on this report or the appendices, which can be forwarded to the SWWITCH Co-ordinator using the contact details shown on the SWWITCH website: www.swwitch.net

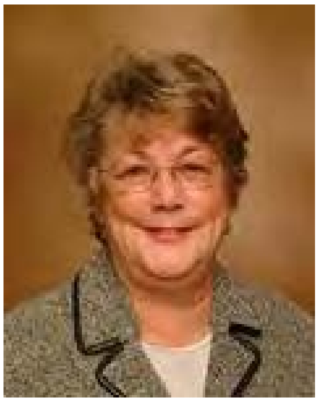
The APR does not re-write the RTP or change the main emphasis of the Plan. It is intended to provide a summary of:

- Changes relevant to the plan and updates on policy or programme developments
- Confirm how capital and revenue grant funding have been used and what differences the funding has made
- Look ahead to 2014/15, the last year of the current RTP

SWWITCH Joint Committee Voting Members

Councillor Colin Evans
SWWITCH Chair 2013/14

Councillor June Burtonshaw



Councillor Sandra Miller

Councillor Rob Lewis

E1.0 EXECUTIVE SUMMARY

E1.1 Transport Policy and Planning Context

Since the 2011/12 Annual Progress Report (APR) was submitted in September 2012 there have been a number of internal and external changes as follows:

- The Collaboration agenda
- Bus funding review
- The emergence of proposals to establish a City Region
- The evolution of the Active Travel Bill
- Continued financial pressures and the impact on Council resources

E1.2 The RTP remains fundamentally unchanged and still provides the strategic framework for improving access in South West Wales. The RTP link to and synergy with national strategies and plans for transport and with each Council's strategic planning process remains.

E1.3 RTP Progress in 2012/13

Plan One on Page Seven shows the RTP delivery in 2012/13 and Table E.1 provides a summary of RTP spend. There were some changes to actual schemes and project values in comparison with the original Delivery Plan submission and some additional funding was allocated in year. All changes were agreed with Welsh Government through the SWWITCH Programme Management Group (PMG) and full details of the changes are included in Appendix One.

Table E.1 – Summary of RTP spend 2012/13

Project	Original allocation (£k)	Final spend (£k)	Match funding (£k)	RAG status
Amman Valley Cycleway	200	303		
Carms Walking and Cycling linkages	150	240		
Boulevard project	200	455	1,260 – ERDF, RA	
Completion of National Cycle Network	10	10		
Haverfordwest Sustainable Towns Concept	20	20		
Carmarthen to Swansea Bus Corridor	100	106		
Ammanford to Cross Hands Bus Corridor	150	379		
Haverfordwest to Tenby via Narberth corridor	170	218		
Port Talbot to Swansea Bus Corridor	450	102		
Carmarthenshire Rural Interchanges	200	155		
Port Talbot Central Interchange	200	4		
Swansea City Bus Station	384	384		
Community Transport Capital Grant	50	39		
Fabian Way Bus corridor	50	42		
Pembroke Dock Interchange	50	65		
Milford Haven Interchange	100	99		
Llanelli Railway Station	50	49		
Waterston and Blackbridge	700	656		
Cross Hands Economic Link Road	250	265	750 - ERDF	
Wind St. Tir y Dial Lane junction	150	14		
Morfa Road	250	750		
Glasfryn Rd Improvements, St. David's	20	20		
Programme Management and Monitoring	110	121		
Fishguard & Goodwick Stn	0	74		
Access to Kenfig	0	840		

Project	Original allocation (£k)	Final spend (£k)	Match funding (£k)	RAG status
Connect 2 cycle scheme	0	20	566 – EU/ Big lottery	
Afan Connect 2 Signing	0	30		
Route Enhancements	0	100		
TOTAL	**4,014**	**5,560**		

Where RAG status indicates

RED	AMBER	GREEN
Project did not progress as set out in the delivery plan and funding was moved to other projects	Project was delivered/progressed but with changes or significant cost increases	Project was delivered as set out in the delivery plan and at or near budget

E1.4 For RTP projects commenced, progressed and/or delivered in 2012/13 headlines are as follows:

- Completion and opening of the Access to Kenfig Scheme
- Completion of the Fishguard & Goodwick station project
- Opening of the refurbished Ammanford Bus Station
- Phase 1a of the Cross Hands Economic Link Road completed
- Opening of the Clydach Connect 2 cycle link in Swansea

E 1.5 Plan Two on Page Eight shows Road Safety Capital delivery on 2012/13 and Table E.2 provides a summary of Road Safety (RS) capital spend. There were few changes to actual schemes and project values in comparison with the Delivery Plan submission. However, some additional funding was allocated in year on the basis of particular priorities identified by the Welsh Government.

Table E.2 – Summary of Road Safety capital spend 2012/13

Projects	Original Allocation (£k)	Final spend (£k)	RAG status
Carms CC			
Pedestrian safety schemes	40	40	
Road Safety Measures outside schools	90	90	
Speed Management	9	9	
Route Treatment	145	145	
20mph limit Llanelli	0	48	
NPT CBC			
Route Treatment	146	146	
Speed Management	7	7	
20mph limit Aberavon	0	48	
Pembs CC			
Route Treatment	107	112	
Pedestrian Safety Schemes	15	16	
Speed Management	39	31	
Signage	5	7	
C & C of Swansea			
Pedestrian Safety Schemes	15	4	
Road Safety Measures outside schools	20	16	
Route Treatment	230	263	
Speed Management & cameras	32	22	
Signage	34	37	
20mph limit St. Thomas	0	38	
TOTAL	**934**	**1,079**	

Where RAG status is on the same basis as for Table E.1

E1.6 Table E.3 below provides a summary of Road Safety (RS) revenue spend in

2012/13. There were some changes to actual schemes and project values in comparison with the Delivery Plan submission. These were discussed with relevant Welsh Government Officers and approved by SWWITCH PMG prior to changes being made. In additions a small sum of extra funding was allocated in year on the basis of priorities identified by the Welsh Government.

Table E.3 – Summary of Road Safety revenue spend 2012/13

Projects	Original Allocation (£k)	Final spend (£k)	RAG status
Education	170	172	
Training	154	177	
Publicity	67	88	
Staff costs	193	155	
TOTAL	**584**	**592**	

Where RAG status is on the same basis as for Table E.1

E1.7 Table E.4 below provides a summary of RTP revenue spend for 2012/13.

Table E.4 – Summary of RTP revenue spend 2012/13

SWWITCH Core Team support	Allocation (£k)	Spend (£k)	RAG status	SWWITCH STC revenue support	Allocation (£k)	Spend (£k)	RAG status
Staff costs	101	102		Staff costs	62.3	65.8	
IT	1	1.7		IT	5.5	1	
Operational costs	10.5	3.6		Operational costs	5.2	5	
Commissions	12.5	17					
TOTAL	**125**	**124.3**		**TOTAL**	**73**	**71.8**	

Where RAG status is on the same basis as for Table E.1

E1.8 During 2012/13 the SWWITCH Travel Plan Co-ordinator continued to work directly for the Welsh Government for two days per week and this was reflected in additional funding to employ a Travel Plan officer to "backfill" the co- ordinator's work.

E1.9 Key outputs and benefits – The RTP spend during 2012/13 has allowed progress on delivering the RTP to continue. Capital spending has supported the development and delivery of a range of schemes aimed at improving access for residents, visitors and businesses, to, from and within the region. The improved access helps to facilitate economic regeneration and development in South West Wales and supports increasing social inclusion as vulnerable groups can more easily access services and facilities which support productive and fulfilling lives.

E1.10 Revenue spend has supported the:

- continuing development of transport strategy and policy and facilitated the management of the capital programme
- work with private and public sector bodies on behavioural change and sustainable transport options to work and training
- work with a broad range of vulnerable road users to stimulate awareness of the potential road safety issues and to encourage more responsible use of roads by all modes

E1.11 A summary of key outputs from 2012/13 is:

- Active Travel schemes – new sections of pedestrian/cycle routes opened at Amman Valley, Pembrey Canal, Carmarthen Riverside, Clydach connect 2

- Bus schemes – improved passenger waiting facilities provided on the following bus strategic corridors; Haverfordwest to Tenby, Carmarthen to Swansea, Ammanford to Cross Hands
- Integration – Schemes to improve the integration between modes were implemented including Carmarthenshire Rural Interchanges and the Boulevard project in Swansea
- Rail – Final Completion of Fishguard & Goodwick station, preparations for future rail station improvements were undertaken at Pembroke Dock, Milford Haven and Llanelli
- Highways – the Access to Kenfig scheme was completed facilitating access by Heavy Goods Vehicles to Kenfig Industrial Estate, Phase 1a of Cross Hands Economic Link road was completed and early stage preparations for the Waterston/Blackbridge and Morfa Road Schemes were undertaken
- Road Safety – a range of engineering interventions outside schools, at locations with a high rate of collisions and casualties and to reduce inappropriate vehicle speed and education, training and publicity schemes with a range of vulnerable users

E1.12 The outputs from the SWWITCH capital and revenue spend are helping to deliver the South West Wales contribution to the National Transport Plan and also supporting the Programme for Government aims, especially in terms of economic regeneration and reducing social exclusion.

E1.13 Monitoring – SWWITCH has continued to monitor progress and outputs in accordance with the RTP revised monitoring action plan. There was insufficient funding in 2012/13 to undertake a SWWITCH Travel Pattern Survey and so some of the more detailed information which supports the measurement and evaluation of outcomes of the investment cannot be updated for 2012/13.

E1.14 However, part of the 2013/14 capital spend will include a Travel Pattern Survey and this will provide an in depth picture of the modes that people use for what purposes they travel, what alternatives they had and users opinions on a range of transport options.

E1.15 Key monitoring facts are as follows:

- 21 out of the 30 indicators cannot be updated for this APR as there are no published or available data sources at this time (the SWWITCH Travel Pattern Research is essential to update some indicators)
- 9 indicators have been successfully updated with new data, 6 indicators have improved, 1 is neutral and 2 have declined (still waiting others)

E1.16 Extensive scheme data has been collated and analysed and is included in Appendices to the RTP. There is a strong correlation between RTP and Strategic Environmental Assessment (SEA) monitoring and to avoid duplication the SEA monitoring has been incorporated into the reporting on RTP monitoring

E1.17 Scheme level monitoring has also been carried on appropriate schemes.

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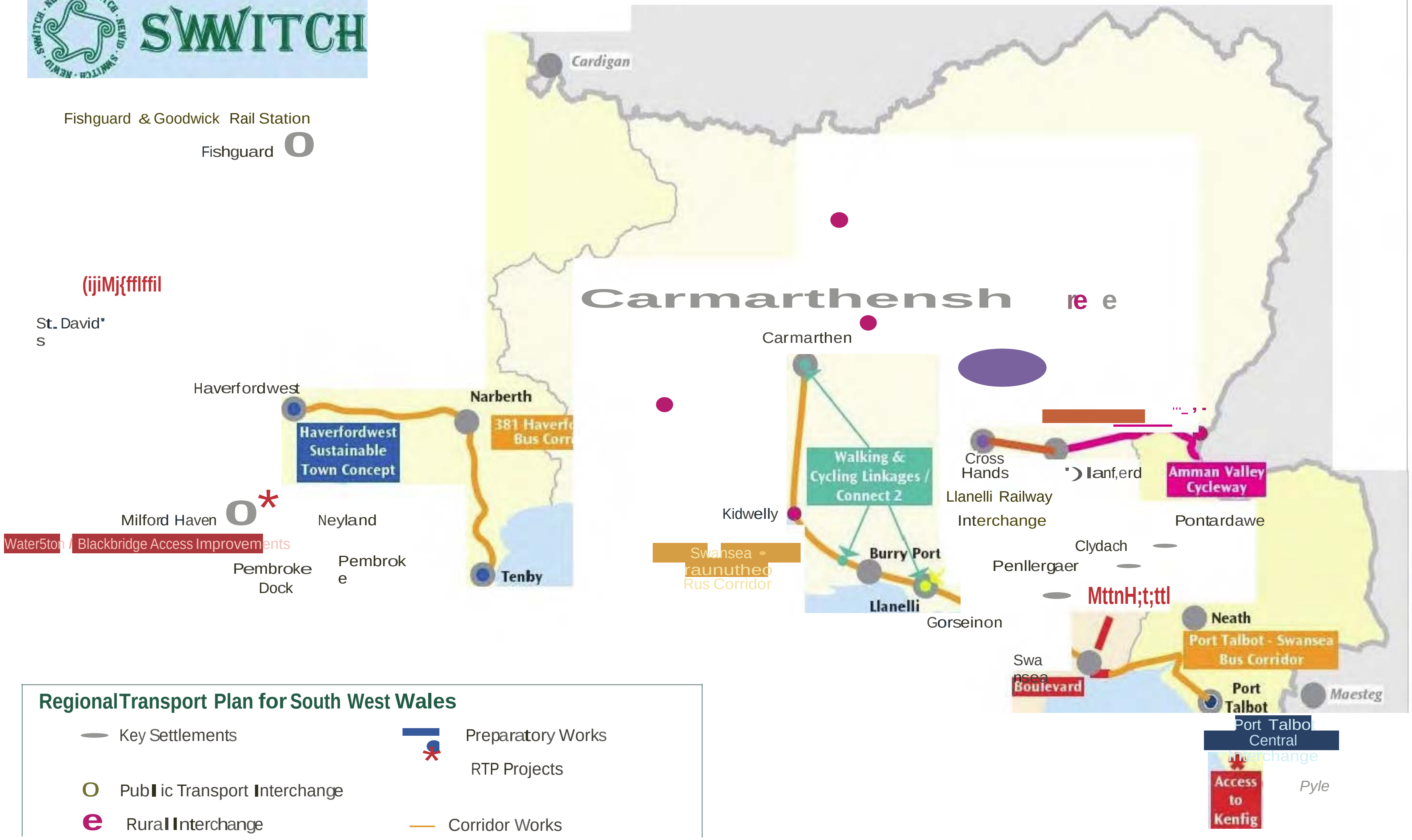
SWWITCH

SWWITCH 2012/13 ANNUAL PROGRESS REPORT PLAN ONE



RTP Annual Progress Report- Scheme Location Map

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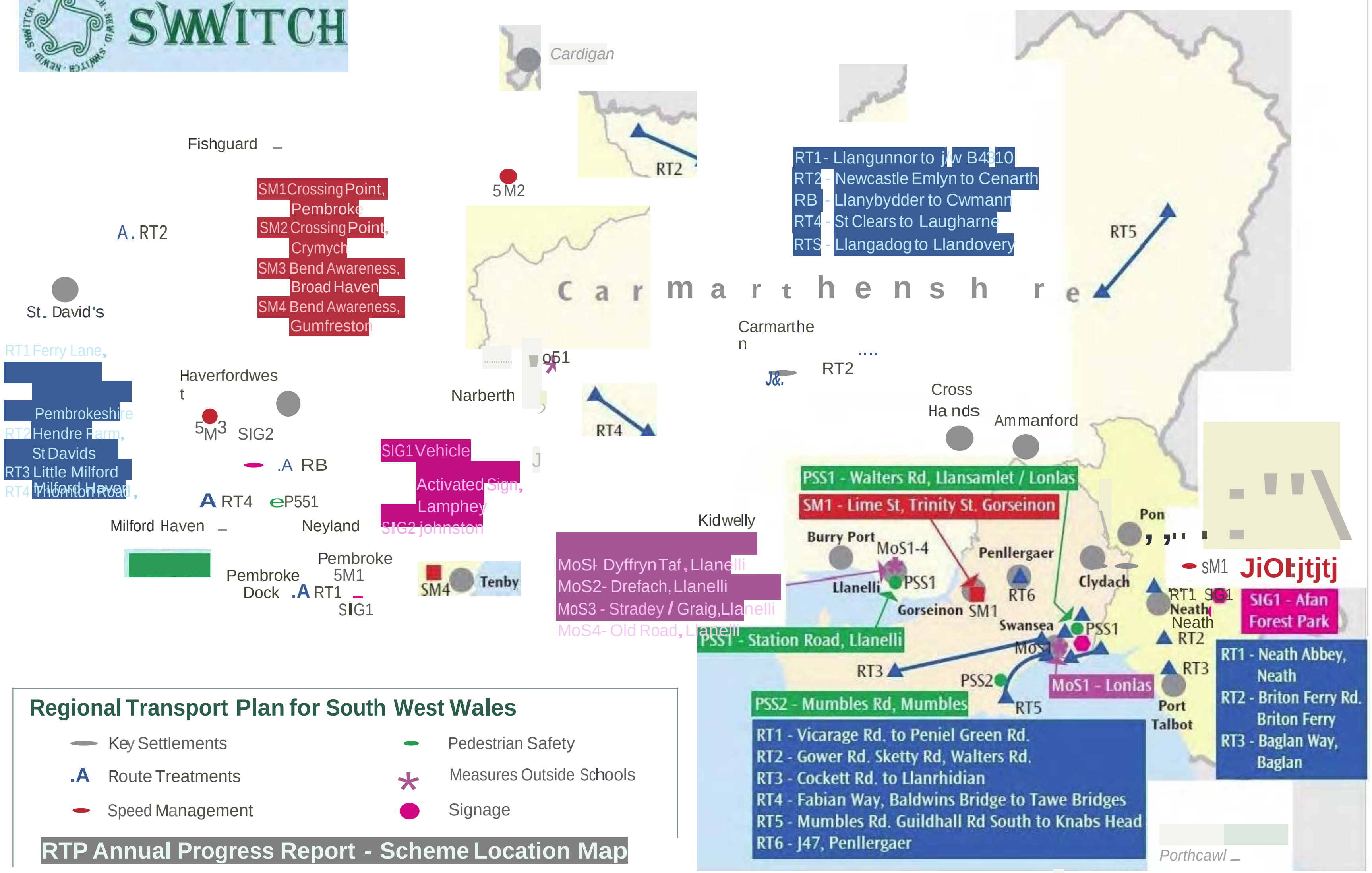
SWWITCH 2012/13 ANNUAL PROGRESS REPORT PLAN TWO



1.0 TRANSPORT POLICY AND PLANNING CONTEXT

1.1 **Introduction**

The Regional Transport Plan (RTP) for South West Wales was prepared between 2006 and 2009, in accordance with guidance issue by the Welsh Government. It was intended to support the Welsh Transport Strategy and National Transport Plan for Wales and also to align with other strategic plans at a national and regional level. The synergy between the RTP and National and Regional Strategies and plans is shown in Appendix Two.

1.2 The RTP was developed through extensive and prolonged engagement with a broad range of stakeholders. Following the adoption (by SWWITCH Councils) and approval (by Welsh Government) of the RTP, stakeholders have continued to play a key part in the delivery of the plan through participation at Joint Committee and through more informal contact and engagement.

1.3 Delivery of RTP projects began in April 2010, with the introduction of the new Regional Transport Grant (now Regional Transport Consortia Grant - RTCG). Each year SWWITCH submits a Delivery Plan to the Welsh Government, in line with guidance issued, to allow a range of projects to be delivered. The project delivery alongside strategy and policy development are the focus of the Annual Progress Report (APR) process.

1.4 This is the third SWWITCH APR and it relates to the 2012/13 financial year.

Photographs 1& 2: Language and play and Junior road Safety Club –two Road Safety Revenue projects

1.5 **Changes in the last year**

Since the last APR was submitted there have been a number of changes as follows:

- The Collaboration agenda
- Bus funding review
- The emergence of proposals to establish a City Region in South West Wales
- The evolution of the Active Travel Bill
- Continued financial pressures and the impact on Council resources, including staff and funding

1.6 In the 2011/12 APR SWWITCH reported on the development of even more collaboration in the region and across Wales as a result of the “Simpson

Compact". This work continued apace throughout 2012/13 with a strong focus on working across democratic boundaries and tiers of governance to identify problems with current working arrangements and suggest a strategic framework and governance model within which a step change in collaborative working could come to fruition.

1.7 During the 2012/13 a bus funding review began, driven by the Welsh Government working with the public sector and bus and community transport operators and user organisations. The review was started in recognition that public sector funding for public transport was going to reduce and there was a need to ensure that funding provided would help to drive up the quality of services available and encourage more fare paying passengers in the longer term.

1.8 SWWITCH was fully engaged in the bus funding review process and further details are included in Appendix Three

Photographs 3 &4: Progress on the Amman Valley Cycleway – new sections of route opened

1.9 In late 2011, the Welsh Government established a group, chaired by Dr Elizabeth Heywood to look at the options for a City Region approach in Wales. The Group's recommendations were submitted to the Minister in July 2012 and the key recommendation for SWWITCH was that a City Region should be established in the Swansea Bay area.

1.10 This recommendation coincided with the commissioning by the four SWWITCH Councils of a regional Economic Regeneration Strategy and SWWITCH was involved in stakeholders events associated with the stages of developing the strategy.

1.11 It was originally proposed that the Swansea Bay City Region would include the Councils of Swansea and Neath Port Talbot and the more urban areas of Carmarthenshire. However, in view of the maturity of the joint working already established in the region and the appropriateness of including the Haven Enterprise Zone (the only Enterprise Zone in South West Wales), it has subsequently been agreed that the City Region boundary will be the same as the SWWITCH boundary. Further detail on the Regional Economic Strategy and the City Regions report are included in Appendix Four.

1.12 The Welsh Government launched a White Paper on an Active Travel Bill for Wales in May 2012. This was intended to increase the numbers of people walking and cycling (with the resulting health and well-being benefits) by placing duties on Local Councils. These duties involve mapping out existing walking and cycling routes and then working with stakeholders to map out more and improved routes to be developed over a period of time.

1.13 During the rest of the 2012/13 financial year, SWWITCH was actively engaged in various consultation events on the Active Travel Bill, as part of key stakeholders groups which helped to shape the Bill and supporting guidance and also in responding to various consultations that have arisen.

1.14 Ongoing financial pressures – are a national and global issue and they have continued to impact on the RTP delivery over the last year in a number of ways:

- The overall budget available from the Welsh Government for transport across Wales has been significantly lower than for the 5 years preceding the introduction of regional funding. This means that expectations for even the "do minimum" level of the SWWITCH RTP delivery have not been achieved and understandably outputs and outcomes are less than predicted
- Local Councils have also had a squeeze on funding and many competing demands around Education and Social Care. Funding from Councils for both capital and revenue support for transport has been reducing year on year
- Local Councils have also reduced staffing levels, both through encouraging voluntary redundancies and by not replacing staff who retire or move to other posts. This has had a real impact on the capability and capacity of Local Councils to progress policies and proposals to deliver improved access
- A slow reduction in the commercial bus service network has continued and this was mirrored at the end of the 2012/13 year by a reduction in public sector subsidised services following reductions in Welsh Government funding

1.15 **Other current issues**

Traffic levels in South West Wales (and indeed Wales as a whole) continue to show a slight decline as shown in Table One below. This is not equal across SWWITCH.

Table One – SWWITCH Traffic Levels 2009 – 2012

Billion vehicle Kilometres travelled

Area	2009	2010	2011	2012
Carmarthenshire	1.89	1.86	1.84	1.83
Neath Port Talbot	1.32	1.27	1.30	1.29
Pembrokeshire	1.08	1.06	1.05	1.04
Swansea	1.66	1.63	1.63	1.62
Wales	27.49	26.98	26.93	26.76

1.16 Despite lower traffic levels, transport related air quality problems remain an issue as set out in Appendix Five.

1.17 Community Transport Capital Enhancement Grant (CEG) – As for 2011/12 SWWITCH allocated a small sum of capital funding (£50k) for Community Transport Operators. There was a formal bidding process and SWWITCH worked with the Community Transport Association (CTA) to assess submissions and propose recommendations.

1.18 Community Transport organisations bid for and spent £38k in 2012/13. That funding has made a difference to the capabilities of organisations over the last year and this has meant more and happier users of the services. Full details of the SWWITCH CEG for 2012/13 are included in Appendix Six

Photographs 5 & 6: Community Transport vehicles supported by SWWITCH Capital Enhancement Grant in 2012/13.

1.19 Linkages with Strategic Planning – Whilst the timescales for the adoption of Local Development Plans (LDPs), differs widely across the region, SWWITCH has been actively engaged in the various development process to ensure good synergy with the RTP and the programme pool projects. More information on the evolving LDPs and other relevant plans/strategies is set out in Appendix Seven.

1.20 Summary – There have been significant changes since the RTP was prepared and submitted and the pace of change will increase as the public and private sector strive to deliver more with less. However, the RTP vision, objectives and long term strategy still provide a strong foundation for the region by facilitating the development of a vibrant and more equal economy and improving access to a wide range of life enhancing facilities and services.

1.21 Figure One on Page 13 shows the link between the 2012/13 RTCG spend and the RTP vision and objectives.

Figure One – Link between the 2012/13 Programme Delivery and RTP vision and objectives

Our Vision for South West Wales is to improve transport and access within and beyond the region to facilitate economic development and the development and use of more sustainable and healthier modes of transport

Project	RTP Objectives supported
Amman Valley Cycleway	1/2/5/6/7
Walking and Cycling linkages	1/2/5/6/7
Boulevard	1/2/3/4/5/6/7
Completion of National Cycle Network	1/2/3/5/6/7
Haverfordwest Sustainable Towns Concept	1/2/3/5/6/7
Carmarthen to Swansea Bus Corridor	1/2/3/4/5/6
Ammanford to Cross Hands Bus Corridor	1/2/3/4/5/6
Haverfordwest to Tenby via Narberth corridor	1/2/3/4/5/6
Port Talbot to Swansea Bus Corridor	1/2/3/4/5/6
Carmarthenshire Rural Interchanges	1/2/3/4/5/6/7
Port Talbot Central Interchange	1/2/3/4/5/6/7
Swansea City Bus Station	1/2/3/4/5/6/7
Community Transport Capital Grant	1/2/4
Fabian Way Bus corridor	1/2/3/4/5/6
Pembroke Dock Interchange	1/2/3/4
Milford Haven Interchange	1/2/3/4
Llanelli Railway Station	1/2/3/4
Waterston and Blackbridge	1/3/7
Cross Hands Economic Link Road	1/3/7
Wind St. Tir y Dial Lane junction	1/3/7
Morfa Road	1/3/7
Glasfryn Rd Improvements, St. David's	1/3/7
Fishguard & Goodwick Stn	1/2/3/4
Access to Kenfig	1/3/7
Road Safety Capital	
Route treatments	1/3/5/7
Pedestrian safety schemes	1/3/5/7
Speed Management & Cameras	1/3/5/7
Signage	1/7
Measures outside schools	1/3/5/7

1. To improve access for all to a wide range of services and facilities including employment and business, education and training, health care, tourism and leisure activities
2. To improve the sustainability of transport by improving the range and quality of, and awareness about, transport options, including those which improve health and well being
3. To improve the efficiency and reliability of the movement of people and freight within and beyond South West Wales to support the regional economy
4. To improve integration between policies, service provision and modes of transport in South West Wales
5. To implement measures which make a positive contribution to improving air quality and reducing the adverse impact of transport on health and climate change, including reducing carbon emissions
6. To implement measures which help to reduce the negative impact of transport across the region on the natural and built environment including biodiversity
7. To improve road safety and personal security in South West Wales

Table Two – 2012/13 RTP Delivery – Allocation and spend by project and link to 2013/14 programme

Project	Project status	2012/13 original allocation (£k)	2012/13 Final allocation (£k)	Match funding (£k) (additional to RTP spend)	2013/14 Allocation (£k)
Amman Valley Cycleway	PD/W	200	303		390
Carms Walking and Cycling linkages	W	150	240		500(various routes)
Boulevard	W	200	455	1,260 – ERDF, RA	170
Completion of NCN PCC	PW	10	10		55
Haverfordwest Sustainable Towns Concept (phase2)	PW	20	20		80
Carmarthen to Swansea Bus Corridor	W	100	106		125
Ammanford to Cross Hands Bus Corridor	W	150	379		50
Haverfordwest to Tenby via Narberth corridor	PD/W	170	218		585
Port Talbot to Swansea Bus Corridor	PD/W	450	102		830
Carmarthenshire Rural Interchanges	W	200	155		70
Port Talbot Central Interchange	PD	200	4		-
Swansea City Bus Station	W	384	384		-
Community Transport Capital Grant	W	50	39		65
Fabian Way Bus corridor	PW	50	42		160 (C&W not bus)
Pembroke Dock Interchange	W	50	65		50
Milford Haven Interchange	PD	100	99		92
Llanelli Railway Station	PW	50	49		50
Waterston and Blackbridge	PD	700	656		-
Cross Hands Economic Link Road	W	250	265	750 - ERDF	150
Wind St. Tir y Dial Lane junction	W	150	14		50
Morfa Road	PW/PD/W	250	750		580
Glasfryn Rd Improvements, St. David's	PW	20	20		27
Programme Management & Monitoring	N/A	110	121		210
Fishguard & Goodwick Stn	W	0	74		-
Access to Kenfig	W	0	840		-
Connect 2 cycle scheme	W	0	20	566 – Big Lottery	-
Afan connect 2 Signing	W	0	30		-
Route enhancements	W	0	100		-
	TOTAL	**4,014**	**5,560**	**2,576**	

2.0 CAPITAL SPEND 2012/13

2.1 RTP – SWWITCH was allocated £4.014m in 2012/13. This funding was fully spent and an additional £1.546m was made available by Welsh Government towards the end of the financial year, bring the overall total spend to £5.560m.

2.2 Within that total there were a number of changes to project proposals and spend in comparison to what was set out in the Delivery Plan. Plan One on Page Seven shows the location of the 2012/13 RTP projects and Table Two on Page 14 shows the original and final allocations by project. This also shows where match funding was available.

2.3 Further details on individual projects, explanations for changes to allocation, photographs and plans where applicable are included in Appendix One.

2.4 RS Capital – SWWITCH was allocated £0.934m in 2012/13. This funding was fully spent and an additional £0.145m was made available by the Welsh Government towards the end of the financial year, bringing the total spend to £1.079m.

Photographs 7&8: Schemes in Pembrokeshire and Swansea funded through the SWWITCH Road Safety capital allocation

2.5 Further details are included in Appendix One. A wide range of engineering techniques were used to address road safety issues including:

- Vehicle Activated signs
- Traffic islands
- Carriageway markings
- Anti-skid treatment and Signing and lining

2.6 Synergy between the Capital Programme and Strategic Priorities is demonstrated on Figure Two on Page Sixteen. There is a clear link between national and regional aspirations and priorities as the RTP and the National Transport Plan were developed alongside each other and both seek to deliver the Wales Transport Strategy.

2.7 Transport Improvements which are not RTP funded – some transport projects in the RTP programme were developed in 2012/13 without RTCG. This includes Sustainable Travel Centres in Haverfordwest and Carmarthen Town, Bulford Road Link, Port Talbot Parkway Station redevelopment and Harbour Way.

Figure Two – Link between NTP/RTP priorities and the 2012/13 Capital Programme

Integrated Transport projects
Boulevard
Carmarthen to Swansea Bus corridor
Ammanford to Cross Hands Bus corridor
Haverfordwest to Tenby Bus corridor
Port Talbot to Swansea Bus corridor
Haverfordwest Sustainable Towns Concept
Carmarthenshire rural interchanges
Port Talbot Central interchange
Swansea Bus Station
Community Transport Capital grant

NTP 1/2/3/4/6/10/11
RTP 3/4/5/6/7

Walking & cycling projects
Amman Valley Cycleway
Carms Walking & Cycling Linkages
Completion of NCN network Pembs
Fabian Way corridor
Connect 2 cycle scheme
Afan Connect 2 signing

NTP 1/2/3/6/8/11
RTP 1/4/5/7

Rail projects
Pembroke Dock Interchange
Milford Haven Interchange
Llanelli Station
Fishguard & Goodwick station

NTP 2/ 3/4/5/6/8/11
RTP 2/3/4/5/6/7

Highways projects
Waterston & Blackbridge
Cross Hands Economic Link Road
Wind St, Tir Y Dial Lane Junction
Morfa Road
Glasfryn Road Improvements
Access to Kenfig

NTP 6/7/8/10/11
RTP 2/3/7/8

Road Safety projects
Route treatment
Speed management
Signage
Measures outside schools
Speed cameras

NTP 6/7/8/10
RTP 5/7/8

National Transport Plan Priorities

1. Sustainable Travel Centres
2 Transport Planning improvements
3 Increasing healthy and sustainable travel choices
4. Improving local bus services
5. Improving rail services
6. Improving access to key sites and services
7. Managing road infrastructure
8 Improving safety of the road network
9. Improving sustainability of freight transport
10. Improving the sustainability of transport infrastructure and reducing environmental effects
11. Strategic road, rail, bus, interchange and walking & cycling projects

RTP Strategy

1. Improving land use and transportation planning
2. Improving strategic east west road and rail links
3. Improving strategic bus corridors
4. Promoting integration
5. Improving safety in transport
6. Providing more and better information
7. Improving linkages between key settlements and strategic employment sites
8. Improving the efficiency of the highway network

2.8 These projects are an integral part of the SWWITCH vision and objectives for improved transport in the region and support both the strategic east west movement of people and freight and the drive towards more sustainable travel in our town centres.

2.9 In addition SWWITCH (via Swansea as host financial Authority) bid for NSIP+ funding in 2011 to improve access to smaller stations in south west Wales. The bid was successful and the main body of work and improvements really began in 2012/13. The total value of the NSIP+ bid is £896k and the stations are mainly in Carmarthenshire and Pembrokeshire with some improvements at "Swanline" stations in Neath Port Talbot.

2.10 Preparatory Works projects – From 2012/13 onwards preparatory works projects have been dealt with in a different way to previous years. Instead of identifying and recording preparatory works separately, they are an integral part of the programme. All project have been classified into three categories as follows:

- Preparatory works (PW) where projects at an early stage can be developed further through surveys, outline design and consultation, development of costs and risk registers etc
- Pre Delivery (PD) where detailed designs are prepared and land and statutory undertaker issues are resolved and planning permission (where required) is achieved
- Works (W) where construction is ready to begin as soon as funding is secured and contracts are awarded

2.11 In practice, as many projects in the 2012/13 programme were relatively small scale, there were a number of projects which included at least two and sometimes three of these stages within the year. The status of projects is shown on column two in Table Two on Page Fourteen.

2.12 This Table also shows the clear link between the 2012/13 programme and the current year delivery with a number of projects continuing to develop through various stages towards final completion and delivery as and when funds allow.


Photographs 9 &10: Bus stop improvements in Pembrokeshire funded through RTCG

2.13 Managing RTP Project progress – Table Three on Page Eighteen shows the progress of 2012/13 RTP projects in through the key stages and gateways. Progress has been slower than SWWITCH hoped, mainly due to the level of funding available. This inevitably means that even relatively simple projects are delivered in stages over a few years rather in one year. Notwithstanding this, clear progress is being made every year.

The Key Stages are as follows:

Key Stage 1	Identification of problem, WelTAG stage 1 and coarse options
Key Stage 2	Detailed options appraisal and further WelTAG development
Key Stage 3	Develop detailed design of project
Key Stage 4	Statutory processes
Key Stage 5	Contractor selection
Key Stage 6	Award of contract
Key Stage 7	Opening and handover
Key Stage 8	Project completion

Table Three – Progress of 2012/13 projects through Key Stages and Gateways

Project	KS 1	KS 2	Entry into RTP programme	KS 3	KS 4	Gateway 1 & 2	KS 5	KS 6	Gateway 3	KS 7	Gateway 4	KS 8	Gateway 5
Amman Valley Cycleway				P	P		P	P		P		P	
Carms Walking and Cycling linkages							P	P		P		P	
Boulevard													
Completion of NCN PCC													
Haverfordwest Sustainable Towns Concept													
Carmarthen to Swansea Bus Corridor					P		P	P		P		P	
Ammanford to Cross Hands Bus Corridor								P		P		P	
Haverfordwest to Tenby via corridor													
Port Talbot to Swansea Bus Corridor				P									
Carmarthenshire Rural Interchanges				P	P		P	P		P		P	
Port Talbot Central Interchange													
Swansea City Bus Station													
Fabian Way Bus corridor													
Pembroke Dock Interchange							P						
Milford Haven Interchange													
Llanelli Railway Station													
Waterston and Blackbridge													
Cross Hands Economic Link Road				P	P		P	P		P		P	
Wind St. Tir y Dial Lane junction													
Morfa Road													
Glasfryn Rd Improvements, St. David's													
Fishguard & Goodwick Stn													
Access to Kenfig													
Connect 2 cycle scheme													

Where P denotes a project which has several elements, not all of which have achieved the KSA or gateway

3.0 REVENUE SPEND 2012/13

3.1 Revenue spend in 2012/13 included:

- £584 Road Safety funding
- £125k for core consortia funding
- £75k for supporting the development of Travel Plans and sustainable transport options

3.2 Road Safety Revenue funding
A number of Road Safety Education projects have been developed and managed collaboratively across the region since 2011/12 and in 2012/13 more than 50% of the allocation was managed in this way.

3.3 An additional sum of £7.5k was made available at the end of the 2012/13 financial year and this was used to support the National Cycle Standards training.

3.4 Full details of Road Safety revenue spend and the benefits of working collaboratively are set out in Appendix Eight. Key areas of activity were:

- Children's Traffic Club and Junior Road Safety Officers
- National Standards Cycle Training
- Theatre in Education, Publicity campaigns and Radio Advertising
- Pass Plus Cymru and Drive for Life
- Bike Safe, Dragon rider and First Bike on Scene
- Staffing

3.5 SWWITCH Revenue Funding
The revenue allocation in 2012/13 was £198k, comprising:

- £125k for SWWITCH core funding
- £73k for the SWWITCH Travel Plan team (which was allocated as part of Sustainable Travel centres funding)

Table Four below shows the original and actual budget spend for both the above elements.

3.6 As for the previous year, the Travel Plan funding supported not only the Travel Plan Co-ordinator, but a Travel Plan Officer in recognition of the fact that the SWWITCH Travel Plan Co-ordinator was working at least two days per week at an All wales level.

3.7 Core and Travel Plan revenue funding continued to be an important part of planning and delivering RTP and other transport improvements in 2012/13.

Table Four – SWWITCH Revenue budgets (Core and Travel Plan) 2012/13

SWWITCH Core Team support	Allocation (£k)	Spend (£k)	SWWITCH STC revenue support	Allocation (£k)	Spend (£k)
Staff costs	101	102	Staff costs	62.3	65.8
IT	1	1.7	IT	5.5	1
Operational costs	10.5	3.6	Operational costs	5.2	5
Commissions	12.5	17			
TOTAL	**125**	**124.3**	**TOTAL**	**73**	**71.8**

3.8 The SWWITCH core funding also supports the overall RTP programme management with the SWWITCH Co-ordinator and Liaison Officer dedicating approximately 40% and 30%respecitively on programme management.

3.9 Table Five on Page Twenty One shows the link between all the SWWITCH revenue funding (Core, Travel Plan and Road Safety) and the strategic priorities of the RTP and the NTP. This demonstrates the value for money achieved for a small revenue fund.

3.10 SWWITCH core funding is not used to programme manage individual RTP projects. That is carried out by experienced Local Council officers who project manage schemes wholly within their Council boundaries and work collaboratively across Council boundaries to deliver strategic schemes.

3.11 It is inevitable that some RTP capital schemes delivered in 2012/13 have ongoing revenue implications, generally (but not always) related to maintenance. Each Council has taken on these commitments as part of accepting the capital grant.

4.0 MONITORING UPDATE

4.1 The (revised) SWWITCH Monitoring Plan is still valid for 2012/13, albeit there are still uncertainties (common across Wales) about some environmental monitoring and indicators. These may not be practical to measure over the 5 year lifetime of the current RTP.

4.2 In addition, there was insufficient funding in 2012/13 to undertake a Travel Pattern survey. This means that a number of the Monitoring Plan indicators could not be directly measured. There are a few proxies that are available, but it does leave a significant gap in the SWWITCH monitoring update.

4.3 The full details of the RTP monitoring are set out in Appendix Nine and “headline” outputs are as follows:

- 9 out of 30 indicators have been successfully updated with new data
- 21 out of 30 indicators cannot be updated as there are no published or available data sources (3 of these require a methodology to be finalised)

4.4 There is crossover between a number of the SEA indicators and the RTP indicators. The former have been incorporated into the Monitoring Plan accordingly to avoid duplication. Where indicators have been successfully updated, their performance against the baseline has been considered and results are summarised below.

4.5 Improved indicators:

- 3B – Percentage of rail services which operate within 10 minutes of schedule - Network rail data indicates little or no change in the reliability of services when considering average network performance over the year but a positive change in respect of the public performance measure
- 5C – Greenhouse emissions from transport - CO_2 emissions have decreased for all transport types in all four local authorities
- 7A – Number of fatal collisions - There has been a reduction from 32 fatal casualties in the 2009 baseline year to 20 in 2012
- 7C – Number of children killed or seriously injured - There has been a reduction from 38 children killed or seriously injured in the 2009 baseline year to 14 in 2012

Table Five– Link between transport priorities and functions supported by revenue funding

NTP and RTP priorities	Function supported by revenue funding							
	Transport planning	Funding applications	Management, administration	Scheme development	Programme management	Financial Management	Collaboration	External partnerships
Improving land use and transportation planning								
Sustainable Travel Centres, increasing healthy and sustainable travel choices								
Promote integration								
Provide more and better information								
Improving rail services								
Improving strategic bus corridors and local bus services								
Improving access to key sites and services including strategic employment sites								
Improving the sustainability of freight transport								
Improving the sustainability of transport infrastructure and reducing environmental effects								
Improving the efficiency of the highway network and managing the road infrastructure								
Improving safety in transport and the safety of the road network								
Strategic road, rail, bus, interchange and walking and cycling projects								

- 7D – Combined rate of death and seriously injured for pedestrians and cyclists per distance travelled - There has been a 9.5% increase in miles walked per pedestrian KSI casualty and a 24% increase in miles cycled per cyclist KSI casualty
- 7G – Number of crimes per 100,000 rail passenger journeys - Statistics indicate a general decrease in the level of crime occurring on the railways and at stations

4.6 Neutral Indicators:

- 2E – Percentage of people aged 60+ issued with a bus pass as a proportion of the 60+ population - There has been a very slight reduction against the baseline year of 2009/10 from 87.8% to 87.3%
- 6A – Proportion of transport schemes having a positive impact on the natural and built environment - The WelTAG assessments indicate that 62% of RTP schemes will have an overall positive impact on the natural and built environment (new baseline)
- 7B – Number of serious collisions - There has been a negligible increase in the number of serious collisions from 224 in 2009 to 225 in 2012

Photographs 11 & 12: Pembs CC electric vehicle charging point and the SWWITCH Travel Plan awards 2013

4.7 Indicators for which no update can be provided in 2012/13:

- 1A-1D – Dependence on a repeat regional level accessibility assessment (note a national level assessment has been reported in Monitoring the National Transport Plan, Update 2012 (September 2013)
- 1E, 1F – Dependent on update of connectivity indices. These have not been updated in 2012/13
- 2A, 2B, 2C, 2D. 2F. 2G – Dependence on the SWWITCH Household Survey which is due to be undertaken in FY2013/14
- 3A – Dependence upon Welsh Bus Passenger Surveys which have not been repeated since 2010
- 4A, 4B, 4C – Dependence on the SWWITCH Household Survey which is due to be undertaken in FY2013/14
- 5A and 5B – Dependence on updated AQMA information to be provided by the local authorities and reported by Defra
- 7E – Dependence on the SWWITCH Household Survey which is due to be undertaken in FY2013/14
- 7F – Dependence upon Welsh Bus Passenger Surveys which have not been repeated since 2010

- 7D – Combined rate of death and seriously injured for pedestrians and
- 7H – Reliance on police forces to provide crime data for buses

4.8 Monitoring remains a key element of what SWWITCH does, ensuring that individual scheme and the RTP as a whole is delivering the outputs and outcomes that are sought. However, the level of RTP monitoring is clearly related to the investment made and as this has been significantly less than that envisaged as the RTP was prepared, expectation in terms of outputs and outcomes need to be similarly reduced.

4.9 Scheme level monitoring is also important and details of 2012/13 monitoring are included in Appendix Nine. The headlines are as follows:

Bus passenger surveys undertaken on routes 381 and 412 in November 2012 show:

- Overall decline in user satisfaction levels across the 10 criteria
- Levels of satisfaction in respect of service frequency have increased for both routes since the October 2011 baseline surveys
- Over 70% of respondents to both surveys were satisfied or very satisfied overall in 2012

Journey Time Reliability surveys - undertaken in Swansea during the AM and PM peaks in October 2012 have enabled an evaluation against the 2011 baseline for the Tawe Bridges phase of the Boulevard Project. The findings are positive:

- Reduction in average journey times n/bound and s/bound during peaks
- Reduction in average journey times eastbound and westbound in am peak
- Reduction in average journey time eastbound in pm peak
- Slight increase in average journey time westbound in pm peak

Cycle Count data - covering strategic sites across the regional cycle network has been used to inform progress on the Boulevard Project (Tawe Bridges) and the Pembrokeshire Trail, shows that the average daily number of cyclists has increased at indicative sites associated with both schemes

4.10 Traffic Management compliance – All SWWITCH Councils were fully compliant with the Traffic Management Act in 2012/13. In addition all four SWWITCH Councils have Civil Parking Enforcement powers and their 2012/13 reports are included in Appendix Ten

5.0 SUPORTING INFORMATION

5.1 Partnership approach

The RTP was developed collaboratively by the four SWWITCH area Councils and with a wide range of stakeholders. The RTP is also the result of other partnerships, between some or all of the constituent Councils and Councils from other consortia areas. This is a priority for SWWITCH moving forwards to improve access and transport. Full details on collaborative working are included in Appendix Eleven

5.2 SWWITCH Decision making processes

Details of the structures and decision making processes which support the RTP delivery process are included in Appendix Twelve.