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Hafod-yr-ynys Air Quality Action Plan – Draft (2017).

Report for Caerphilly County Borough Council

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Contact:

Nigel Jenkins
Ricardo Energy & Environment
Gemini Building, Harwell, Didcot, OX11 0QR,
United Kingdom

t: +44 (0) 1235 753 107
e: nigel.jenkins@ricardo.com

Ricardo-AEA Ltd is certificated to ISO9001 and ISO14001

Author:

Ellis Marshall-Padkin

Approved By:

Nigel Jenkins

Date:

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Report Structure

This report constitutes the Hafod-yr-ynys Air Quality Action Plan. The Action Plan Report is set-out as follows:

- Chapter 1. Introduction
- Chapter 2. Development of an Action Plan
- Chapter 3. Legislative framework and existing policy within Caerphilly which impact on air quality.
- Chapter 4. LAQM work undertaken in Hafod-yr-ynys and monitoring undertaken.
- Chapter 5. Assessment of the options considered for inclusion in the AQAP.
- Chapter 6. Modelling assessment of the shortlisted measures to predict their likely impact on air quality concentrations.
- Chapter 7. Assessment of the shortlisted measures including social, environmental and economic impacts.
- Chapter 8. Outlines the draft AQAP

Appendix 1: Hafod-yr-ynys Air Quality Action Plan (Formatted for Welsh Government submission)

Appendix 2: AQAP list of measures

Appendix 3: Model Methodology and Verification

This report is prepared for:

Local Authority Officer	Maria Godfrey
	Caerphilly County Borough Council | Cyngor Bwrdeistref Sirol Caerffili
Department	Team Leader Pollution Control & Emergency Planning
Address	Penallta House, Tredomen Park, Ystrad Mynach, CF82 7PG
Telephone	01443 811346
e-mail	godfrm@caerphilly.gov.uk
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Executive summary

This report has been prepared to evaluate and present options that Caerphilly County Borough Council can consider and take forward as a AQAP for the Hafod-yr-ynys AQMA. The Hafod-yr-ynys draft AQAP will be set-out in a format similar to an Air Quality Action Plan as required the Welsh Government, in fulfilment of Part IV of the Environment Act 1995 - Local Air Quality Management.

This document will be used to provide an overview of Action Plan measures and options that may be considered by Caerphilly County Borough Council for engagement with stakeholders, communities and Welsh Government.

The Action Plan process is set-out below and follows the Action Plan requirements set-out in the interim Welsh Government policy guidance.

The following steps were taken during the development of the Action Plan:

- Step 1. Review of LAQM PG (16) Wales to understand the LAQM requirements
- Step 2. Review current local policies, air quality and recent assessments
- Step 3. Creation of long list of action plan measures that could be considered
- Step 4. Review of the short list of measures to be adopted within the plan
- Step 5. Assess the impact of measures
- Step 6. Draft Action Plan Report for consultation and engagement
- Step 7. Deliver final AQAP

This report will provide information for steps 1 – 6, thereafter the council will engage and consult with stakeholders. The next step toward finalising the AQAP will involve a review of feed-back, further implementation costing and viability analysis before publishing the final AQAP.

As required by Local air quality management interim policy guidance for Wales (March 2016) the Air Quality Action Plan has been developed in recognition of the legal requirement on the local authority to work towards air quality objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part.'

This is a draft AQAP outline document and could be subject to change following public consultation.

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1 Introduction

This document is the draft Air Quality Action Plan (AQAP) which aims to address the exceedances of the air quality objectives identified along the A472 at Woodside Terrace, Hafod-yr-ynys. Caerphilly County Borough Council declared Hafod-yr-ynys as an Air Quality Management Area (AQMA) in November 2013. Following the declaration of the AQMA it is the statutory duty of the County Borough Council to develop an AQAP to address the air quality issues locally.

The draft AQAP provides information on the current air quality concentrations within the Hafod-yr-ynys AQMA and presents potential measures for consideration by the Council and consultation with key stakeholders. Following the stakeholder engagements and review by the Council, a final AQAP will be produced for the Welsh Government and Caerphilly County Borough Council.

The Hafod-yr-ynys AQMA was declared for exceedances of the annual average national objective for nitrogen dioxide (NO_2) set at 40 $\mu g.m^{-3}$. The annual exceedance of the limit has been attributed to emissions from a combination of sources but mainly those from road traffic. Monitoring has indicated that the hourly concentrations of NO_2 measured as a result of traffic emissions result in exceedences of the annual NO_2 objective at the automatic monitoring site. The AQMA was declared on exceedences measured at residential properties along the A472 at Woodside Terrace and as a result the AQAP will focus on measures to reduce the exposure of residents and reduce or improve emissions from the associated traffic on the A472 at Woodside Terrace.

This action plan has been developed in accordance with the legal requirements placed on the local authority to work towards air quality objectives and improve local air quality under Part IV of the Environment Act 1995 and relevant regulations under that part.

1.1 Background

The County Borough of Caerphilly was created in 1996 as part of the reorganisation of local government. It occupies approximately 28,000 hectares of the South Wales Valleys with a population of around 170,000. It stretches over 40km between the Urban Centres of Cardiff and Newport in the South and the Brecon Beacons to the North taking in all parts of the valleys of the rivers Rhymney, Sirhowy and Ebbw. It contains some 50 distinct towns and villages, many (particularly in the North) are linear settlements located on the valley floors. Hafod-yr-ynys lies to the North-West of Newport, between Crumlin and Pontypool.

Historically the County Borough of Caerphilly was a major source of heavy industry and coal mining. The main sources of air pollution today arise from heavy traffic flow in and around the town centres, particularly in the Caerphilly and Hafod-yr-ynys areas, where there is frequent queuing and congestion. As a result of local congestion Woodside Terrace, Hafod-yr-ynys has been declared an Air Quality Management Area (AQMA).

1.2 Hafod-yr-ynys Air Quality Management Area

The Hafod-yr-ynys AQMA is situated on the A472 which is a main trunk road connecting Pontypool to the north- south A467. The A472 passes through the Woodside Terrace section from Pontypool as it approaches the A467 (Newbridge – Llanhilleth section). The A472 is a heavily traffic main route which carries 21,400 vehicles per day, dominated by cars and LGVs at 81.3% and 14.3% respectively. However previous emissions source apportionment studies have shown that although Heavy Diesel Vehicles (HGVs and buses) only represent 3.7% of the fleet on this road, their NOx emissions contribution was significantly higher at 35%.

The Woodside Terrace section of the A472 leads into a junction at the A467 and is a single carriage section of road with a speed limit of 30mph. The A472 approaching Woodside Terrace from Pontypool has vehicles decelerating/braking as they approach the AQMA. Inversely vehicles accelerate uphill to join a two-lane section of the A472 as they leave the AQMA.

The A472 section at Woodside Terrace is set in a valley, running NE – SW with a downward slope gradient of approx. 1 – 2% (E- W). The road is set in a semi-canyonised environment with 2 storey residential cottages boarding the road along the southern boundary of the AQMA and an upward sloping valley wall to the northern boundary of the road. The A472 passes directly in front of and within 2-5m of many of the residential properties to the south of the road, with some additional residential properties located within 5-10m of the road situated north of the road toward the latter SW section of the AQMA.

The Air Quality Management Area consists of the area surrounding the A472 where relevant exposure is present. Figure 1 shows the Hafod-yr-ynys AQMA and includes the current automatic monitoring site measuring NO_2. The close proximity of houses to the road where traffic is accelerating/decelerating has resulted in the declaration of the AQMA. There are a number of factors which can contribute to the exceedences of the NO_2 objective limit in this location including:

- the proximity of residential properties to the road;
- restricted circulation and dispersion of pollutants due to the local topography;
- the incline of the road which can effect acceleration/deceleration loading on engines and resultant emissions;
- the change in speed limits and management of speed on the approach to the AQMA from the dual carriage-way;
- the volume and vehicle types travelling on the A472; and
- congestion and queuing at various peak traffic times.

These contributing factors have been considered in the approach and the recommended measures to be proposed in the Air Quality Action.

Figure 1: Hafod-yr-ynys AQMA with monitoring site (green box)

The AQMA boundary is presented in Figure 2.

Figure 2: AQMA Boundary

2 Development of the Action Plan

The development of the Hafod-yr-ynys AQAP needs to consider a number of key objectives as well as setting out the measures the Council is to develop to improve air quality within the AQMA and wider area.

2.1 Key objectives the AQAP is required to address

The AQAP addresses the key areas of concern for public health and the environment:

- Air quality and health
  - Action plan measures target local pollutant concentration reduction and exposure reduction for residents within Caerphilly.
- Air quality and the natural environment
  - Action plan measures targets reductions in emissions to air of gaseous and particulate pollutants which effect local fauna and flora.
- Air quality and traffic noise
  - Action plan measures targets reduced traffic volumes within the AQMA to reduce traffic noise.
- Air quality and climate change
  - Action plan measures targets cleaner fleets and smoother flow of traffic to reduce emissions of CO_2.
- Well-being of Future Generations (Wales) Act 2015
  - Action plan measures targets those areas where air quality is failing the national air quality objectives and recommends a list of actions to work towards bringing the levels of NO_2 back to within acceptable levels
  - Reference to the Action Plan will also figure in the Public Services Board's local well-being plan so that any decisions made are done so with areas of poor air quality in mind.

2.2 Action Plan requirements

Following "local air quality management interim policy guidance for Wales (March 2016)" an air quality action plan must include the following:

- quantification of the source contributions to the predicted exceedences of the relevant objectives, where possible. This will allow the action plan measures to be effectively targeted;
- evidence that all available options have been considered on the grounds of cost-effectiveness and feasibility. Cost-beneficial measures should be given priority, but there will be times when cost-effective measures are required to work towards objectives;
- how the local authority will use its powers and also work in conjunction with other organisations in pursuit of the air quality objectives;
- clear timescales in which the authority and other organisations and agencies propose to implement the measures within the plan;
- where possible, quantification of the expected impacts of the proposed measures and an indication as to whether the measures will be sufficient to meet the air quality objectives. Where feasible, data on emissions should be included as well as data on concentrations; and
- how the local authority intends to monitor and evaluate the effectiveness of the plan.

2.2.1 Actions outside a local authority's control

Some of the actions needed to improve air quality may be outside the local authority's direct control. If a source over which an authority has little control is responsible for a significant percentage of local emissions, an authority should not demand disproportionate emissions reductions from other sources in pursuit of the objectives. Instead it should note in its action plan that it has done all that it reasonably can to bring about reasonable and proportionate emissions reductions from those sources over which it has influence.

Local authorities should make clear any limitations in their action plans and show the extent to which they rely on actions by others, such as NRW and the Welsh and UK Governments, to work towards meeting the objectives. The plan should show how other bodies have been involved in its development.

Local authorities have a duty to keep their action plans up to date. Section 84(4) of the 1995 Act states that an authority may from time to time revise an action plan. Whenever an action plan is revised, local authorities must consult the Welsh Ministers and other statutory consultees (see Schedule 11(1)(c) of the 1995 Act).

2.2.2 Action Plan progress monitoring

In order to ensure that local authorities implement the measures within an action plan by the timescales indicated within that plan, the Welsh Government expects authorities to submit annual progress reports once the final action plan has been implemented. These progress reports list the measures within the action plan, include the timescales by which they are/were due to be implemented and give an update on progress in terms of implementation.

2.3 Leading the Air Quality Action Plan

The development of the Action Plan involves leadership and close engagement with the relevant departments within Caerphilly County Borough Council. Local authority departments should be constructively engaged in agreeing measures to improve air quality and meet the legal requirement to work towards air quality objectives.

Caerphilly Council has set up a steering group to take forward the development and implementation of the Action Plan for Hafod-yr-ynys. The members of the steering group consist of residents, representatives from various department of the Council including Highways, Planning and Environmental Health along with Local Ward Members. In addition, external stakeholders such as Environmental Health representatives from neighbouring authorities and Public Health Wales also participate in the work of the group.

The draft Action Plan will go out to public consultation in May 2017 following the local election period. The Action plan will be available on the Council's website and members of the public will have an opportunity to provide their views on the Plan and the options being put forward for implementation.

2.4 Air Quality Action Plan Steering Group

Establishing an Action Plan steering group helps develop and lead the implementation of Action Plans. These groups should include all the relevant stakeholders involved in carrying out the measures detailed in the plan. The steering group can also play a key role in formulating the annual action plan progress report.

The steering group should engage with other local authority departments- Transport planners, land use planers, environmental protection, Public health, Economic development/regeneration, corporate policy and education departments.

2.5 Action Plan Development Process

The Action Plan process is set-out below and follows the action Plan requirements set-out in the interim policy guidance.

The following steps were taken during the formation of the Action Plan:

- Step 1. Review of LAQM PG (16) Wales to understand the LAQM requirements
- Step 2. Review current local policies, air quality and recent assessments
- Step 3. Creation of long list of action plan measures that could be considered
- Step 4. Review of the short list of measures to be adopted within the plan
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- Step 6. Draft Action Plan Report for consultation and engagement
- Step 7. Deliver final AQAP

This report will provide information for steps 1 – 6, thereafter the council will engage and consult with stakeholders before a further review and finalisation of the final AQAP.

3 Legislative Framework for Air Quality

3.1 Local Air Quality Management

The Environment Act 1995 gives local authorities responsibilities and duties for air quality at a local level. This includes the responsibility to review and assess key pollutants.

The Local Air Quality Management (LAQM) framework requires local authorities to annually review and assess air quality. It is a statutory duty of the County Borough Council to declare an Air Quality Management Area (AQMA) where exceedances of the air quality objectives are identified. The County Borough Council is then required to produce an AQAP to address the air quality within the area to reduce pollutant concentrations.

This action plan has been developed in recognition of the legal requirement on the local authority to work towards air quality objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part. The Wales LAQM PG (16) outlines the requirements of an AQAP, they must focus on effective and quantifiable measures that improve air quality. Measures which cannot be quantified but will still lead to improved air quality should still be considered such as community engagement and active travel plans.

The Council has prepared this Action Plan to demonstrate that they are working towards the air quality objectives set out under the legislation. LAQM PG (16) sets out the minimum requirements of an AQAP, this includes:

- Provide detailed background on the Local authority's duties under Part IV of the 1995 Act.
- Reference previous review and assessment reports.
- Quantification of the sources contributing to the exceedance identified.
- Detail measures to improve air quality
- Evidence that all available options have been considered on the ground of cost effectiveness and feasibility.
- Details on how the local authority will use its powers and also work in conjunction with other organisations in the pursuit of the air quality objectives.
- Clear timescales in which the authority and other organisations propose to implement the measures within the plan.
- Where possible quantification of the expected impacts of the proposed measures and an indication whether the proposed measures will be sufficient to meet the air quality objectives.
- How the local authority intends to monitor and evaluate the effectiveness of the plan?

3.2 Air Quality Objectives

The air quality objectives applicable to LAQM in Wales are set out in the Air Quality (Wales) Regulations 2010 and are shown in Table 1. This table shows the objectives in units of micrograms per cubic metre ($\mu g.m^{-3}$) with the number of exceedances in each year that are permitted (where applicable).

Table 1: Air Quality Objectives

Pollutant	Air Quality Objective Concentration	Measured as
Nitrogen Dioxide	200 $\mu g.m^{-3}$ not to be exceeded more than 18 times a year	1 hour mean
	40 $\mu g.m^{-3}$	Annual Mean
Particulate Matter (PM_{10})	50 $\mu g.m^{-3}$ not to be exceeded more than 35 times a year	24 hour mean
	40 $\mu g.m^{-3}$	Annual mean

The locations where the air quality objectives apply are defined as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed over the relevant averaging period of the objectives. Typically, these include residential properties, hospitals and schools for the longer averaging periods (i.e. annual mean) and the above locations plus workplaces, shopping areas etc. for short-term (i.e. 1-hour and 24-hour) pollutant objectives

Table 2: Locations Where Objectives Apply

Averaging Period	Objectives should *apply* at…	Objectives should generally *not* apply at…
Annual Mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade) or any other locations where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside Sites (for example, pavements of busy shopping streets.) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expect to spend 1 hour or longer.	
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes.	

3.3 Health effects of poor air pollution

In the UK air pollution currently has an estimated equivalent health cost of up to £20 billion each year. Air pollution on average reduces the life expectancy of every person by 7-8 months. Air pollution not only impacts on human health it also impacts on ecosystems and vegetation.

In the UK there are various sources of air pollution, these include transport, industrial process, energy production and natural sources. The Government has identified eight key pollutants for which health based limit values/objectives have been set. These objectives are defined in the National Air Quality Strategy (NAQS).

- Nitrogen Dioxide (NO_2)
- Particulate Matter (PM_{10})
- Particulate Matter ($PM_{2.5}$)
- Benzene
- 1,3 Butadiene
- Lead
- Sulphur Dioxide (SO_2)
- Carbon Monoxide (CO)
- Ozone (O_3)

Additionally, as more evidence has established the detrimental health effects of fine particulate matter, those particles less than 2.5 microns in size ($PM_{2.5}$), the national government is also targeting UK-wide reductions in $PM_{2.5}$. As well as national government actions on $PM_{2.5}$, local authorities also have a role to play and are also expected to work towards reducing emissions and concentrations of $PM_{2.5}$ in their local area.

Whilst this AQAP is predominately focused on reducing NO_2 concentrations, the measures set out will have a positive effect on the reduction of the other air pollutants, especially Particulate Matter.

3.4 Existing Strategies and Policies relevant to Air Quality in Caerphilly County Borough.

3.4.1 Caerphilly Town Centre AQAP

The Caerphilly Town Centre AQAP sets out a work programme to improve air quality in and around the Caerphilly AQMA, which was declared in 2008 for exceedances of the NAQS objectives for nitrogen dioxide (NO_2). Modelling identified that the likely dominant source of NO_2 in the town centre AQMA is road transport. Both queuing and moving heavy duty vehicles (HDV), light goods vehicles (LGV) and cars contribute approximately equally to the high NO_2 concentrations recorded in Caerphilly town centre

The Plan reports that more than a 20% reduction in traffic emissions of oxides of nitrogen (or NO_X, which is a precursor to NO_2) would be necessary to achieve the annual mean air quality objective for NO_2, based upon 2008 figures. The AQAP considers a suite of options to improve air quality and recommends some of these for implementation following the activities and recommendations of a CCBC steering group, which are aimed at reducing levels of air pollution within the AQMA in Caerphilly town centre.

The Plan also sets actions being progressed by other organisations, for which the actions will be monitored and progress reported annually. It is important that the AQAP for Hafod-yr-ynys compliments the measures set out within the Caerphilly Action Plan and they work towards improved air quality within the Caerphilly area.

3.4.2 Noise Action Planning Priority Area (NAPPA)

Action Plans should also make further consideration to the effects of traffic noise as required under Wales LAQM.PG(16). Special consideration should be given to noise action planning priority areas and any other areas where a local authority considers traffic noise to be a matter of concern, where these may be subject to changes in traffic noise levels as a result of air quality management measures. The Welsh Government "*A noise action plan for Wales 2013–2018*"[1] sets out the vision for Wales and links to Noise Action Area maps[2].

Hafod-yr-ynys has been designated as a Noise Action Planning Priority Area as part of the work being taken forward under the Environmental Noise Directive.

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[1] http://gov.wales/docs/desh/publications/131217noise-action-plan-for-wales-en.pdf
[2] http://data.wales.gov.uk/apps/noise/#lat=52.4493&lon=-3.7408&zoom=8&time=den&theme=road

3.4.3 Local Development Plan

Strategy Policy 19 (SP19) in the LDP seeks to implement improvements to the existing transport infrastructure that;

- Address social exclusion by increasing accessibility to employment, services and facilities throughout the County Borough
- Assist in regenerating the Heads of the Valley Regeneration Area through creating and improving transport links to the settlements in the Northern and Southern Connections Corridors, and / or
- Reinforce the role and function of settlements, and/or
- Reduce the level of traffic movements and / or congestion, within any identified air quality management area, and/or
- Promote the most efficient use of the transport network.

3.4.4 South East Wales Valleys Local Transport Plan

The South East Wales Valleys Local Transport Plan (LTP)[3], which has been jointly produced by Blaenau Gwent, Caerphilly, Merthyr Tydfil, Rhondda Cynon Taf and Torfaen County Borough Councils, sets out the local authorities' priorities for transport schemes in the five-year period 2015 to 2020, and their medium and longer term aspirations up to 2030.

Local Transport Plans across Wales have replaced Regional Transport Plans, which expired on 31 March 2015. The South East Wales Valleys Local Transport Plan was published in January 2015.

The plan outlines the intention to make best use of the existing regional road network with the aim of improving journey time, reducing congestion and improving air quality. It recognised air quality monitoring data as an indicator of the outcome of transport schemes within the area.

The LTP links with other existing strategies and polices and makes reference to Air Quality Action Plans due to the emissions from road traffic being the highest contribution to local air quality problems within the area. The plan also makes reference to the link between air quality and health. The LTP links with local public health objectives which includes the adverse health impacts of noise and pollution.

3.4.5 Wellbeing of Future Generations Act (Wales) 2015

The Wellbeing of Future Generations Act, is an Act of the National Assembly for Wales to make provision requiring public bodies to do things in pursuit of the economic, social, environmental and cultural well-being of Wales in a way that accords with the sustainable development principle.

The Act sets out wellbeing goals for Wales, these include:

- A resilient Wales- A nation which maintains and enhances the natural environment.
- A healthier Wales- A society in which people's physical and mental wellbeing is maximised.

3.4.6 Air Quality Regulations (Wales) Regulations 2010

The Air Quality Standards (Wales) Regulations 2010 incorporate the CAFÉ Directive and the Fourth Daughter Directive into Welsh law, and replaced the Air Quality Standards (Wales) Regulations 2007. The Regulations came into force on 11 June 2010.

The regulations set out the limit values for Air Quality as set out by the European Union (EU).

3.4.7 Caerphilly Single Integrated Plan – Caerphilly Delivers

The Public Service Board provides the overarching strategic leadership, direction and management for the development of the health, social care and well-being within Caerphilly county borough. The Caerphilly Single Integrated Plan sets out the vison for Caerphilly as a place where "people live longer and healthier lives" The objectives set within the Plan to work towards include:

[3] http://www.caerphilly.gov.uk/Services/Transport-and-parking/Local-Transport-Plan

- Address the inequities in the rate of low birth weight babies across the borough.
- Improve lifestyles of the population in the county borough so that people recognise and take responsibility for their own health and well-being, and make use of the opportunities and support available to them.
- Reduce the variation in healthy life expectancy in the county borough so that the health and well-being of individuals experiencing disadvantage improves to the levels found among the advantaged.
- Improve the education, information, early intervention, prevention and harm reduction in relation to Substance Misuse in the borough.
- Ensure people are supported to live in their own communities to lead safe, fulfilled and independent lives.

3.4.8 Climate Change Strategy

The Climate Change Strategy for Caerphilly County Borough was produced by the Living Environment Partnership, one of the four partnerships of the Community Strategy. This group was predominantly made up of environmental organisations but on climate change issues it linked to a number of partners including Aneurin Bevan Local Health Board, Caerphilly Community Safety Partnership, Health Challenge Caerphilly, National Farmers Union, Sustrans, CADW, Groundwork Caerphilly and Welsh Government, to name but a few.

The aims of the Strategy were:

- To bring together organisations from all sectors and coordinate a joined up response to the challenge of climate change, using the expertise and experience of partners and sharing good practice.
- To establish baseline information about the contribution that Caerphilly County Borough makes to global climate change, in terms of greenhouse gas emissions from all sectors.
- To promote ownership of the responsibility for greenhouse gas mitigation within the County Borough, amongst all sectors.
- To encourage and facilitate greenhouse gas mitigation through providing advice and guidance to all sectors.
- To anticipate the possible effects that global climate change may have on Caerphilly County Borough and to begin planning the adaptation measures required to minimise the potentially harmful consequences of climate change on our residents and the local environment.
- To fully appreciate both the potential risks but also the potentially beneficial effects of climate change and to identify a range of opportunities that could arise from the environmental changes presented.

The Climate Change Strategy has since been replaced by the Caerphilly Single Integrated Plan (SIP), with environmental issues within the SIP being part of “Greener Caerphilly”. The 3 priorities within a ‘Greener Caerphilly’ aims to;

- Reduce the causes and adapt to the effects of Climate Change
- Reduce the causes and adapt to the effects of climate change
- Maximise the use of the environment for health benefits

Work on this is reported to the Greener Caerphilly Leadership Group and on to the Public Service Board.

Within Caerphilly County Borough Council, strategies and actions have been put in place for us to play our part in combating climate change

3.4.9 Carbon Reduction Strategy

The Authority, working with the Carbon Trust, developed a long-term carbon reduction strategy in 2009. The ambitious but achievable target of a 45% reduction in CO_2 emissions by 2019 was agreed. It is anticipated that this target will be met by a mixture of:

- good housekeeping (10%)
- invest to save energy efficiency projects (20%)
- good design and asset management (10%)
- renewable energy (5%)

3.4.10 Housing

Housing accounts for 27% of the UK's carbon emissions. The rising cost of energy has resulted in an increase in Caerphilly residents being driven in to fuel poverty. Work is ongoing with Housing Services, housing associations and residents to address energy issues.

The Authority's Housing Services have an ongoing programme involving improving the energy efficiency of homes, including innovative measures such as external wall insulation and renewable technologies such as solar panels and heat pumps. They also have a programme replacing old boilers with new condensing boilers.

3.4.11 Adaptation Plan for Caerphilly County Borough Council

Caerphilly County Borough Council is preparing a Climate Adaptation Plan for the borough, and has been engaging with all Council Service areas. This is following the methodology set out in the guidance accompanying the Climate Change Act 2008. A Local Climate Impact Profile (LCLIP) has been completed and approved by the Authority's Corporate Management Team in July 2015. The LCLIP identified 128 impacts, of which 32 were rated as high priority.

4 Local Air Quality Management and previous Assessments of Air Quality

4.1 Local Air Quality Management

The 2010 Progress Report first identified Woodside Terrace, Hafod-yr-ynys as an area of concern in relation to the NO_2 annual mean objective. Further monitoring was to be conducted within the area to confirm if a Detailed Assessment would be required for the area.

The 2011 Progress Report confirmed exceedance of the NO_2 annual mean at Woodside Terrace, Hafod-yr-ynys and Caerphilly County Borough Council were required to proceed to a Detailed Assessment for the area.

An automatic monitoring site at Woodside Terrace was installed in November 2011. The Council monitors NO_2 at several locations throughout the Council area using both automatic and passive sampling methods. The Council has an **Automatic** Air Quality Station (AQMS) which is affiliated to the UK Automatic Urban and Rural Network (AURN) and data can also be access via the Welsh Air Quality Forum website[4]. The Council also deploys nitrogen dioxide (NO_2) diffusion tubes identified with the prefix **CCBC**. Monitoring locations within the Hafod-yr-ynys AQMA are presented in Figure 3.

Figure 3: Monitoring locations in Hafod-yr-ynys AQMA

4.1.1 Air Quality Concentrations in Hafod-yr-ynys

The automatic monitoring station in Hafod-yr-ynys is not representative of an exposure location, due to its close proximity to the road.

[4] http://www.welshairquality.co.uk

Monitoring of NO_2 has showed that there has been exceedances of both the annual and 1-hour nitrogen dioxide objectives within the Hafod-yr-ynys Air Quality Management Area. The annual mean concentrations measured within Hafod-yr-ynys are presented in Table 3.

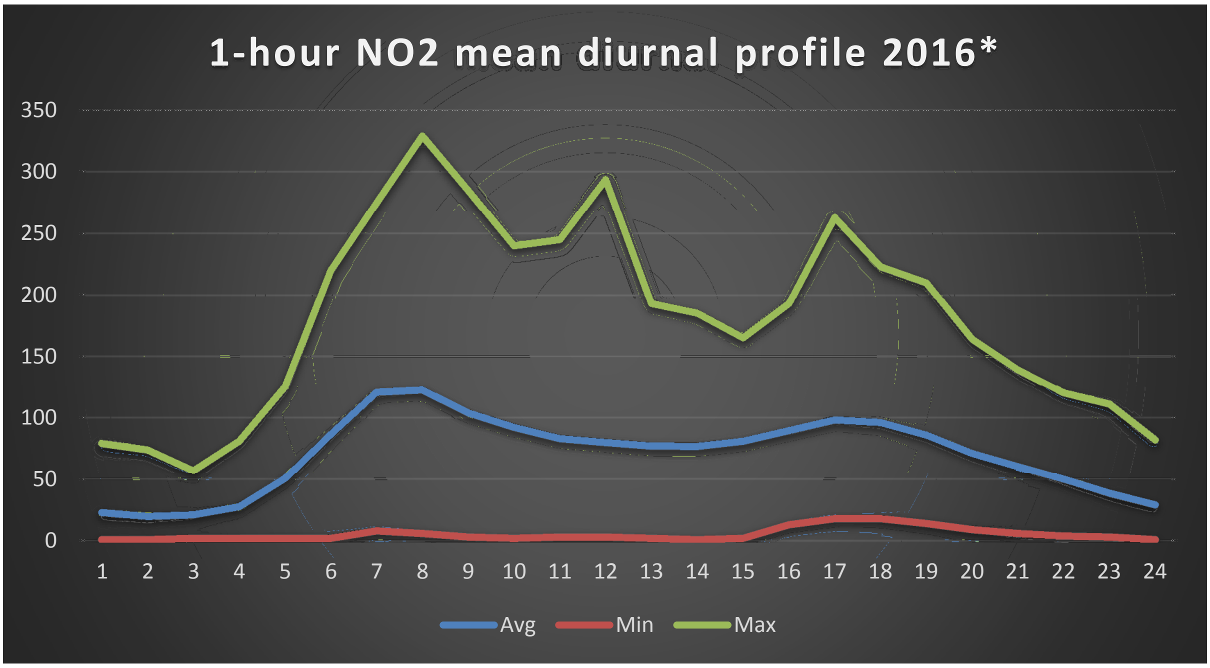
Table 3: Results of Automatic and Non-Automatic Monitoring (Annual Mean Concentrations)

Site ID	Site Name	Site Type	Annual Mean Concentration $\mu g/m^3$						
			2010	2011	2012	2013	2014	2015	2016*
	Automatic Monitoring Station								
CAE6	Hafod-yr-ynys Roadside	Kerbside	-	-	**70.9**	**68.3**	**67.7**	**68**	**70**
	Non-Automatic Monitoring								
CCBC 48	1 Woodside Tce, Hafodrynys	Roadside	**43**	**41**	**45**	**48**	**46**	**42**	**40**
CCBC 50	Just past Woodside Tce, on hill	Kerbside	**43**	**55**	**46**	**50**	**47**	**47**	**47**
CCBC 60	3 New Houses, opp. 5, Woodside Terrace	Roadside		**49**	**41**	**41**	39	32	36

**Full 2016 dataset has not been fully QA/QC at this time, therefore data should be treated as provisional.*

The diurnal profile of NO_2 over the year is presented in Figure 4. This identifies peak-time traffic flows during rush hours as well as the incidents of high (max) concentrations experienced at the kerbside automatic monitoring station.

Figure 4: 1-Hour mean NO2 concertation diurnal for 2016



**Full 2016 dataset has not been fully QA/QC at this time, therefore data should be treated as provisional.*

The hourly mean concentrations measured within Hafod-yr-ynys AQMA are presented in Table 4 (Hourly Mean AQS objective for NO_2, not to be exceeded for more than 18 hours > 200 µg/m³)

Table 4: Results of Automatic monitoring station (1-hour mean concentrations)

Site ID	Site Name	Site Type	Number of exceedances of 200 Concentration µg/m³						
			2010	2011*	2012	2013	2014	2015	2016**
	Automatic Monitoring Station								
CAE6	Hafod-yr-ynys Roadside	Kerbside	-	63	**137**	**85**	**75**	**108**	**129**

** Monitoring started in October 2011*
***Full 2016 dataset has not been fully QA/QC at this time, therefore data should be treated as provisional.*

4.2 Required reductions within the AQMA

Current monitoring of NO_2 identified continued exceedences of the annual average objective at the façade of the properties (exposure location) CCBC 48 - 1 Woodside Terrace, Hafod-yr-ynys. This measurement location is on the façade of a property and is therefore a relevant location of exposure as opposed to the continuous monitoring station at the kerbside.

This location is at the objective level of 40µg/m³, however it is this location that has exceeded the objective level between 0 – 8µg/m³ over the last 4 years. The current required in concentrations reduction target, therefore should be at least 4µg/m³ NO_2, to ensure compliance.

4.3 Previous Detailed Assessment (2013)

The Detailed Assessment was conducted in 2013 by Ricardo AEA on behalf of Caerphilly County Borough Council to assess the potential scale and extent of exceedances of the Air Quality Objectives within the study area. The Detailed Assessment focused on Woodside Terrace (A472, Hafod-yr-ynys. It was identified that the exceedance area encompasses all the house on the South side of A472 at Woodside Terrace as well as the houses to the North side of the A472 directly opposite Woodside Terrace. This equates to about 78 people being exposed to exceedances of the annual mean objective for NO_2.

In addition to the annual mean NO_2 objective, automatic monitoring for 2012 concluded that the NO_2 hourly mean objective was also breached in addition to the annual mean NO_2 objective. In light of the Detailed Assessment results it was concluded that CCBC should declare an AQMA encompassing all receptors identified within the study area with an exceedance of the NO_2 objective.

In light of the findings of the Detailed Assessment an AQMA was declared within Hafod-yr-ynys in November 2013.

4.4 Further Assessment (2013/14)

The Detailed Assessment identified exceedances of the NO_2 annual mean and 1 hour objectives in Hafod-yr-ynys. A Further Assessment was conducted to revisit the results of the Detailed Assessment and to carry out a source apportionment and scenario modelling in the study area based on 2013 monitoring results.

The results of the Further Assessment indicated that the NO_2 annual mean and 1-hour mean objectives were exceeded during 2013 and 2014 in the AQMA. The study confirmed the results of the Detailed Assessment and the area of exceedance remained unchanged.

It was estimated that NOx reductions in the AQMA of between 4% and 60% are required in order to achieve compliance with the annual mean NO_2 objective.

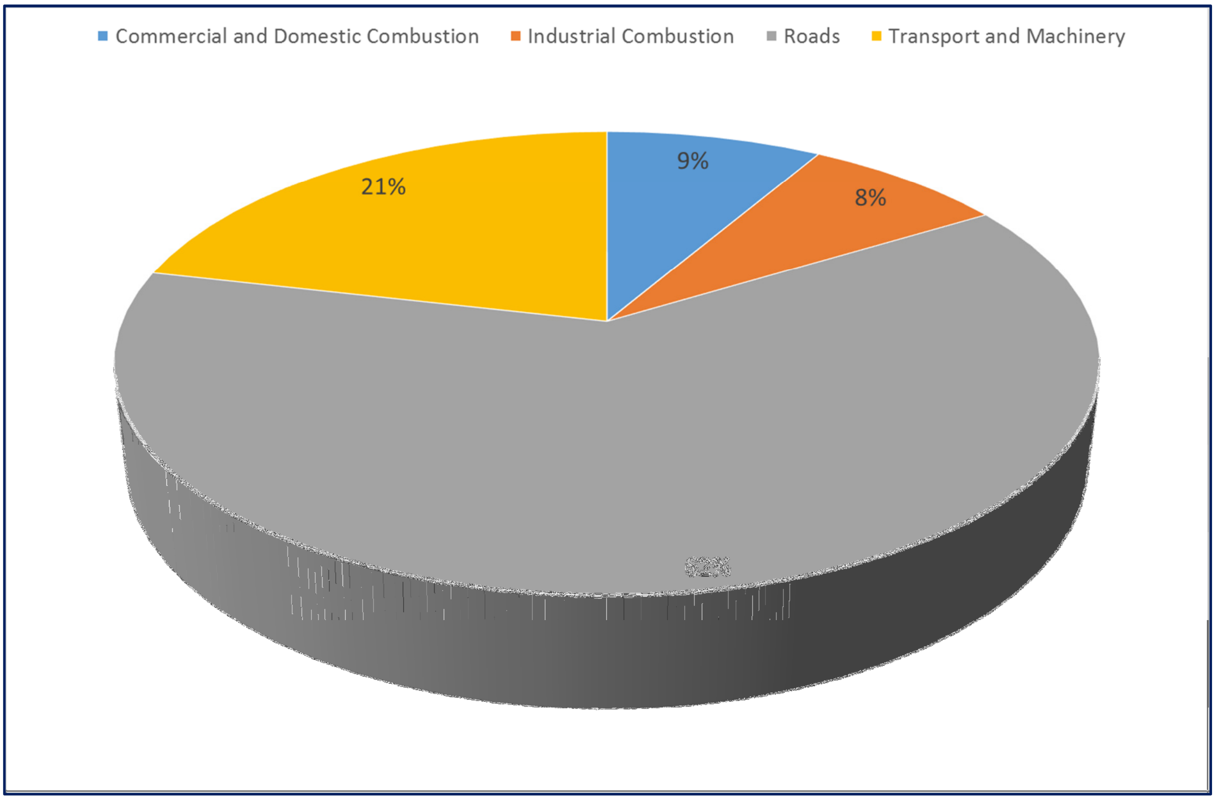
An emission inventory of NOx emissions within the 1 km^2 grid square around the AQMA was compiled. Analysis of the results of the emission inventory indicated that 62% of NOx emissions were due to road transport emissions. Further source apportionment analysis of NOx emissions at a number of locations within the AQMA have also been carried out and the results of this will feed into the Council's developing Action Plan. On further analysis of the road traffic component it indicates that emissions from HDVs and from queuing of all vehicle classes contribute the largest proportions. A reduction in both the volume of HGV traffic and queuing traffic within the AQMA would result in a decrease in NO_2 concentrations.

Modelling of the mitigation scenarios agreed with the Council indicated that an integrated package of interventions would provide the best NOx reductions. Measures that reduce queuing and reduce HGV numbers will reduce road NOx significantly. These measures are however very challenging (both financially and technically) to implement.

The background NO_x emission sources are compiled in the National Atmospheric Emissions Inventory (NAEI) for the entire UK. The components of the background emissions can be produced from local, regional and trans-boundary sources. The make-up of the sources can be varied from location to location and can include emissions from: industrial processes, commercial and domestic properties, roads, agriculture, shipping, aircraft, non-mobile road machinery (NRMM) or mining.

The total atmospheric NO_x emissions from the 1km grid squares covering the Hafod-yr-ynys AQMA in 2013 are presented in Figure 5.

Figure 5: Breakdown of total background NO_x emissions by source



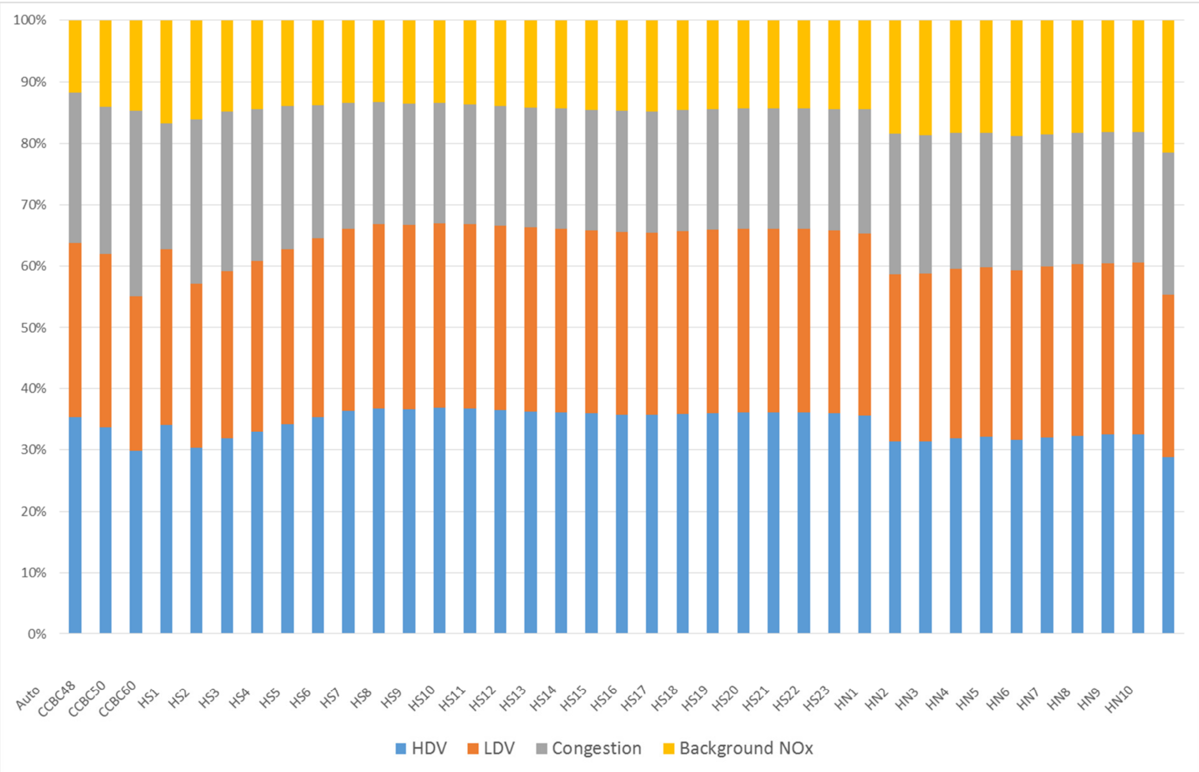
4.5 Source Apportionment

A local source apportionment study was undertaken in order to investigate which emission sources make the highest contribution to predicted pollutant concentrations in the AQMA. Different groups were set up within the model to include different sources and the model then predicted pollutant concentrations as a result of emissions from each group. From the emission inventory the highest contributor in the AQMA is from road traffic. Therefore the source apportionment analysis focussed on the road contribution where a further model run was undertaken with the following groups included:

- Queues (congestion);
- LDV emissions; and
- HDV emissions.

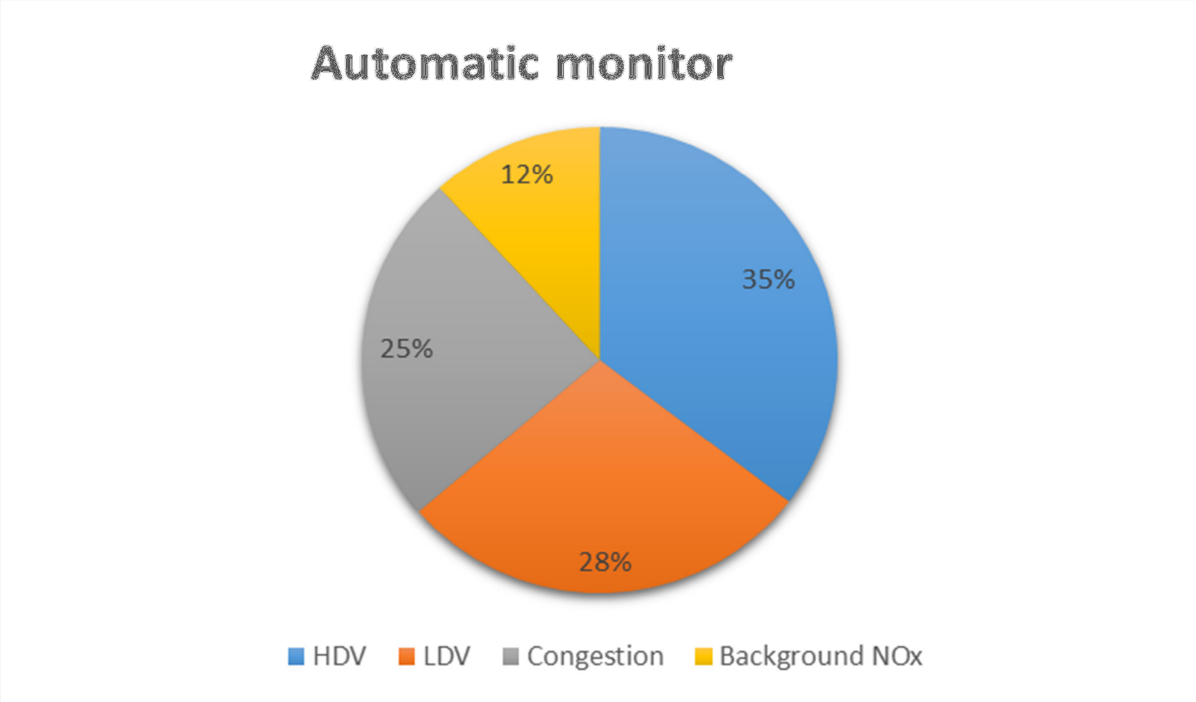
NOx concentrations were calculated at specified points only. The results of the source apportionment are presented in Figure 6.

Figure 6: Road Traffic NOx Emissions



The source apportionment analysis indicated that the greatest contribution of road traffic NOx emissions at most locations are due to emissions from HDV vehicles. This category includes buses, rigid and artic HGV. Therefore, any action plan measures focussed on reducing HDV should have a positive impact on pollutant concentrations at these locations. At the automatic analyser 35% of total NOx emissions are due to HDV vehicles and 25% of total NOx emissions are due to emissions from queuing vehicles as presented in Figure 7.

Figure 7: Source Apportionment at Automatic Monitoring Location



4.6 Modelled Scenarios

The findings of the Further Assessment provide additional justification for the development of mitigation measures.

A number of mitigation scenarios were agreed with the Council in the Further Assessment in order to assess the level of intervention that would be required to meet the objectives. These were modelled in ADMS-Roads using the same methodology but with updated traffic data to reflect the potential effect of the proposed intervention. The effect on ambient concentrations of NO_2 of three scenarios were modelled at all of the monitoring locations used throughout the Further Assessment.

In order to compare the future scenarios with an appropriate baseline model, the 2013 base year model was updated to a 2014 do nothing scenario. This allowed for direct comparison with the future mitigation scenarios. The scenarios tested within the Further assessment were:

- Scenario 1: Junction Improvements
- Scenario 2 & 3: 10% and 20% HDV reduction

4.6.1 Future Scenario 1: Junction Improvements

In 2013 the Council undertook a traffic modelling assessment of proposed junction improvements at the A472 junction. An option appraisal road traffic assessment was undertaken by Parsons Brinckerhoff (PB). This identified a number of possible junction designs to improve the traffic flow at the heavily congested junction. Option 7 was identified in the assessment as being the preferred option. Option 7 was a combination of two options:

- Option1 Additional Capacity A472 Hafod-yr-ynys Road to A467; and
- Option2 Additional Capacity A467 to A472 Hafod- yr-ynys Road

PB provided the following data for the 2014 with option 7 scenario:

- AM and PM Peak Hour traffic speed for both eastbound and westbound traffic;
- AM and PM peak hour traffic flow by vehicle class for both eastbound and west bound traffic; and
- AM and PM queue length for westbound traffic only.

A summary of the traffic data are provided in Table 5.

Table 5: PB Traffic Data 2014 with Junction Improvements

	AM peak				PM peak			
	LDV/hr	HDV/hr	Min speed (kmh^{-1})	Maximum Queue Length (m)	LDV/hr	HDV/hr	Min speed	Maximum Queue Length (m)
Eastbound	1039	59	42	No queue	795	32	42	No Queue
Westbound	787	43	50	65	788	31	51	143

The traffic model assessment indicated that the proposed junction improvements may result in a reduction in queue length such that there will no longer be queuing traffic adjacent to Woodside Terrace.

In order for direct comparison with the traffic model a future baseline year of 2014 which represents a do nothing scenario was used to compare with 2014 with junction improvements. At the time of writing the assessment the junction improvements work had just begun. Results of this scenario are presented in Table 6.

Table 6: Predicted Annual Mean Concentrations

Specified Receptor	2014 do nothing		2014 with junction improvements		Change in Annual mean NO_2 µg m^{-3}
	Predicted Annual Mean NO_2 µg m^{-3}	Predicted Exceedences of 1 hour mean NO_2 µg m^{-3}	Predicted Annual Mean NO_2 µg m^{-3}	Predicted Exceedences of 1 hour mean NO_2 µg m^{-3}	
Auto	**64.2**	71	**41.1**	0	-23.1
CCBC48	**51.5**	37	35.7	0	-15.8
CCBC50	**48.7**	43	39.5	0	-9.2
CCBC60	39.6	15	27.7	0	-11.9

The results indicated that, based on the traffic model results, the junction improvements should result in the 1 hour mean no longer being exceeded and a reduction in annual mean concentrations of 23 µg.m^{-3} at the automatic analyser.

4.6.2 Future Scenario 2 & 3: 10% and 20% HDV reduction

From the source apportionment analysis of the base year the contribution from HDV was responsible for the largest contribution. Therefore, any measures aimed at reduction of the flow of HDVs should result in a decrease in pollutant concentrations.

Two scenarios were modelled which considered the impacts from a 10% and a 20% reduction in HDV vehicle movements within the AQMA. As the junction improvements discussed in scenario 1 is a committed development and work is ongoing the model has considered the reduction in HDV flow following completion of the junction improvements. The results of these scenarios are presented in Table 7 and Table 8 respectively.

Table 7: Annual mean Concentrations 10% reduction

Specified Receptor	Predicted Annual mean NO_2 µg m^{-3} (2014 with junction improvements)	Predicted Annual mean NO_2 µg m^{-3} (10% reduction in HGV movements)	Change in Annual mean NO_2 µg m^{-3}
Auto	**41.1**	**40.5**	-0.6
CCBC48	35.7	35.2	-0.5
CCBC50	39.5	38.3	-1.2
CCBC60	27.7	27.4	-0.3

Table 8: Annual mean Concentrations 20% reduction

Specified Receptor	Predicted Annual mean NO_2 µg m^{-3} (2014 with junction improvements)	Predicted Annual mean NO_2 µg m^{-3} (20% reduction in HGV movements)	Change in Annual mean NO_2 µg m^{-3}
Auto	**41.1**	37.1	-4.0
CCBC48	35.7	34.0	-1.7
CCBC50	39.5	37.6	-2.1
CCBC60	27.7	25.6	-2.2

The results indicated that a 20% reduction in HGV flow would be required to reduce annual mean NO_2 concentrations to below the objective at all locations.

Following the implementation of the proposed junction improvements, monitoring results have continued to measure about the AQS annual mean objective for NO_2, with high hourly concentrations. This would indicate that the predicted results of 'no queueing' in the modelling hasn't been achieved and that queuing traffic still occurs at the junction. The modelling undertaken was subject to limitations as traffic data used was based on the available traffic model for the area rather than local measured traffic data.

5 Action Plan options assessment

This chapter provides more information on the action plan measures considered and being adopted within the plan. The Action plan is presented in a separate report as a stand-alone report.

5.1 Initial Assessment of Options

This section outlines the work undertaken to assess the range of options available to Caerphilly Borough Council to reduce air pollutant concentrations within the designated AQMA in Hafod-yr-ynys.

5.1.1 Range of options considered

A range of options have been considered by Caerphilly Borough Council, however following the previous Further Assessment and more recent modelling studies undertaken (Chapter 6) it is apparent that radical measures will be required in order to reduce pollutant concentrations to within the Air Quality Objectives. A number of measures have been proposed that are seen as cost effective in addition to more radical measures that would have large costs associated.

The measures have been categorised into the following categories:

- Strategic
- Short term infrastructure

- Long term infrastructure
- Smarter choices
- Development Control
- Awareness
- Fleet operators
- Bus Emissions
- Cycling/Walking
- Improve and reduce CCBC emissions
- Monitoring

In line with the categories above the following measures are being taken forward as outlined in Table 9.

Table 9: Action plan measures overview

Measures selected for inclusion in the Hafod-yr-ynys AQAP
1. Strategic Measures
Develop local policies in line with air quality
Integrate with local well-being plans
Provision of Local Air Quality Strategy for Caerphilly
2. Short Term Infrastructure
Localised traffic management
3. Long Term Infrastructure
Investigate the feasibility of a bypass for traffic-bypass AQMA
Speed and flow management
Investigate the feasibility of demolition of Woodside Terrace housing
4. Smarter Choices
Encourage Green Travel Plans for businesses, schools and CCBC
5. Development Control
Use planning system to secure air quality improvements
Traffic and low emission assessment for any proposed development that is likely to increase local traffic and add to congestion
6. Awareness
Publicise alternative transport available locally
Work with the Policy Team to add air quality awareness to promotional and education packages
Electronic "pollutant signage" within AQMA and local area
Signs and banners for approved variable message sign in AQMA
7. Fleet Operators
Travel Plans for local HGV fleet operators (ECOstars)
8. Bus Emissions
Low emission buses within the AQMA
9. Walking/Cycling
Improve walking routes to and from school
Improvements in cycling network and routes and signage/publicity of cycling network

Measures selected for inclusion in the Hafod-yr-ynys AQAP
Green travel Plans for schools and local businesses
10. Improve and reduce CCBC emissions
Improvements to CCBC Fleet
Encourage car sharing /car club for CCBC staff in the area
11. Air Quality Monitoring
Continue monitoring NO_2 increase diffusion tube network for evidence base Façade monitoring with automatic analysers to include particulate matter.
12. Traffic and emissions monitoring (AQMA)
Improved local traffic monitoring to provide detailed traffic classifications, age, speed, volumes in real-time (ANPR)
Roadside remote emissions monitoring to identify profile of real-time emissions from vehicles passing through AQMA and identify gross polluters, vehicle classification, link to ANPR and AQ monitoring measurements

5.1.2 Non Feasible Options

From the initial long list of measures, some measures have been discounted from further inclusion in the AQAP as they have not been deemed suitable for Hafod-yr-ynys. These measures are detailed below:

Re-routing of HGVs around AQMA was considered but discounted due to:

- A472 is a designated primary route for HGVs
- Alternate routes for HGVs would involve 30 – 50 mile diversion for operators and would increase pollutant and carbon emissions, fuel consumption and likely congestion on other routes.
- Potential to create additional areas of higher air pollution resulting in AQMAs elsewhere within Caerphilly County Borough Council.

HGV access restrictions were considered but discounted due to:

- A472 is a designated strategic route and re-routing likely to cause additional pressures on road network, as well as similar points mentioned above.
- Enforcement and infrastructure costs disproportionately high for small area.

Prohibit right turning onto Gladstone Road was considered but discounted due to:

- there is only one means of access into the street.
- People travelling along the A472 from the east would effectively have to drive into Crumlin Road to turn around.
- The left turn into Gladstone Street is also very acute and not appropriate for large vehicles.

Prohibiting of parking outside Woodside Terrace was considered but discounted due to:

- This section of road is already subject to an 8am-6pm restriction.
- Prohibiting parking all together would not be socially accepted by residents as they have to park somewhere and no other parking is available.
- This is not going to reduce the overall amount of traffic on the road.

Gating Traffic Outside of street canyon environment was considered but discounted due to:

- Believed that bottling the traffic is also likely to increase overall levels of pollution and create other problems elsewhere.
- Traffic held at top of hill achieved through signalising the Swffryd junction could cause delays going up the hill which would increase pollutant concentrations within the AQMA.

5.2 Development of Proposed Measures

5.2.1 Strategic Measures

Integrating with local policies to compliment air quality measures, including the local transport plan, procurement plans and the Local Development Plan. This will ensure that future transportation and development decisions consider the impact on local air quality within the Borough.

5.2.1.1 Develop Local Policies in line with air quality

Measure	Title
M 1.	Integrate with local policies in line with air quality
Definition	Key Intervention
a. Local Development Plan b. Local Transport Plan c. AQ & Equipment contracts in place with Procurement	Development of policies that will work towards reducing pollutant levels and ensure future decisions within the area do not have an adverse effect on air quality
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.1.2 Integrate with local well-being plans

Measure	Title
M 2.	5.2.1.3 Integrate with local well-being plans
Definition	Key Intervention
a. Integrate and raise awareness of air quality and the health issues attributable to poor air quality within the Caerphilly Assessment of Local Well-being so that air quality is recognised and forms part of the Public Services Board decision making process.	Local well-being plans to reference air quality and link air quality and well-being.
Responsible authority and other partners	Powers to be used
Public Services Board	Voluntary

5.2.1.3 Provision of local air quality strategy

Measure	Title
M 3.	Provision of local air quality strategy
Definition	Key Intervention
a. Link Caerphilly and Hafod-yr-ynys AQAPs to produce an integrated AQ strategy for Caerphilly CBC..	Revise Caerphilly AQAP and consider other areas within the Borough which are likely to exceed the air quality objectives
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.2 Long Term Infrastructure

5.2.2.1 Investigate the feasibility of a bypass for traffic to remove from AQMA

Measure	Title	
M 4.	Investigate the feasibility of a bypass for traffic	
Definition		Key Intervention
a. One-way rerouting for south-bound vehicles (A472 traffic toward A467(south)). b. Two-way re-routing for southbound (A472 traffic) and east-bound (A467 traffic coming from south)		Building a by-pass which diverts 12.5% traffic Building a by-pass which diverts 25% traffic.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.2.2 Speed and Flow Management

Implement speed management to encourage the smoothing of traffic flow to reduce excessive acceleration and deceleration of vehicles through the AQMA. The existing gradient and change from dual to single carriageways (to East) – These may have added safety and noise benefit.

Measure	Title	
M 5.	Speed and Flow Management	
Definition		Key Intervention
a. Lower speed limit - zoning b. Safety camera		To encourage smooth flow of traffic and discourage harsh breaking/accelerating within the AQMA.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.2.3 Investigate the feasibility of the demolition of Woodside Terrace Housing

Measure	Title	
M 6.	Investigate the feasibility of the demolition of Woodside Terrace Housing	
Definition		Key Intervention
a. Remove all affected properties		Remove receptors and reduce canyon effect of air pollutants by allowing greater dispersion.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary /compulsory purchase

5.2.3 Smarter Choices

Smarter choices are measures which encourage smarter travelling choices for local businesses schools and CCBC whose daily journey involves traveling through the AQMA.

5.2.3.1 Encourage Green Travel Plans for businesses, Schools and CCBC

Measure	Title
M 7.	Encourage Green Travel Plans for businesses, Schools and CCBC
Definition	Key Intervention
a. To encourage more efficient travel within the AQMA	Working with businesses, schools and CCBC within wider strategic AQAP.
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.4 Development Control

5.2.4.1 Use of planning system, to secure air quality improvements

Measure	Title
M 8.	Use of planning system, to secure air quality improvements
Definition	Key Intervention
a. Planning system to contribute to improved air quality by not permitting developments which have a detrimental effect on air quality.	To use planning as a control on developments which could have an adverse impact on air quality.
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.4.2 Require an air quality impact assessment for any proposed development likely to increase local traffic

Measure	Title
M 9.	Require an air quality impact assessment for any proposed development likely to increase local traffic
Definition	Key Intervention
a. Air Quality impact Assessment for any development likely to increase local traffic to demonstrate that air pollution concentrations will not increase.	To ensure that there is no adverse impact of air quality from proposed developments.
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.5 Awareness

5.2.5.1 Publicise alternative transport available locally

Measure	Title
M 10.	Publicise alternative transport available locally
Definition	Key Intervention
a. Publicise alternative transport available locally through promotion of travel information	To encourage use of alternative transport to reduce traffic and congestion
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.5.2 Work with the Policy Team / Education to add air quality awareness to promotional and educational packages

Measure	Title	
M 11.	Work with the Policy Team and Education to add air quality awareness to promotional and educational packages	
Definition		Key Intervention
a. Work with the Policy Team and Education to add air quality awareness to promotional and educational packages		Work with Healthy Schools / Eco schools to raise awareness of the harmful effects of Air pollution and the ways in which the public can make smarter choices to reduce the burden of air pollution.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.5.3 Electronic pollutant signage within AQMA and local area

Measure	Title	
M 12.	Electronic pollutant signage within AQMA and local area	
Definition		Key Intervention
a. Electronic "pollutant signage within AQMA and local area"		Signage encourages drivers to switch off their engines in standing traffic queues, linked to signalling.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.5.4 Signs and banners for engine idling

Measure	Title	
M 13.	Signs and banners for engine idling	
Definition		Key Intervention
a. Signs and banners for approved variable message signs b. Switch-off stickers on taxis / public transport		Signage at key intersections, near junctions and on public transport / taxis encouraging people to switch off engines when traffic comes to a stop.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.6 Fleet Operators

5.2.6.1 Travel Plans for local HGV fleet operators

Measure	Title	
M 14.	Travel Plans for local HGV fleet operators	
Definition		Key Intervention

a. Travel Plans for Local HGV operators b. Identify alternative routes for local HGV traffic c. ECOstars programme	To reroute HGV traffic away from AQMA as far as practicable to reduce HGV traffic. Implement ECOstars programme to support local hauliers to save fuel, costs and emissions through training and education.
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.7 Bus Emissions

5.2.7.1 Low emission buses within AQMA

Measure	Title	
M 15.	Low emission buses within AQMA	
Definition		Key Intervention
a. Work with local fleet operators to introduce low emission buses within AQMA route.		To reduce emissions from bus services traveling within the AQMA
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.8 Cycling/Walking

5.2.8.1 Improve walking routes to and from school

Measure	Title	
M 16.	Improve walking routes to and from school	
Definition		Key Intervention
a. Improve walking routes to and from school		To encourage local residents to uptake active forms of transport
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.8.2 Improvements in cycling network and routes

Measure	Title	
M 17.	Improvements in cycling network and routes	
Definition		Key Intervention
a. Improvements in cycling network and routes b. Signage/publicity of cycling network		To encourage use of existing network and improve and expand on network
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.8.3 Green Travel Plans for schools and local businesses

Measure	Title	
M 18.	Green Travel Plans for schools and local businesses	
Definition		Key Intervention

a. Green Travel Plans for schools and local businesses	To encourage change in behaviour for traveling to and from school and work, encourage use of active travel for those living locally
Responsible authority and other partners	Powers to be used
Caerphilly County Borough Council	Voluntary

5.2.9 Caerphilly County Borough Council Emissions

5.2.9.1 Improvements CCBC Fleet

Measure	Title	
M 19.	Improvements CCBC Fleet	
Definition		Key Intervention
a. Improvements CCBC Fleet b. Newer and more fuel efficient fleet		Integrate air quality work with fleet management contracts. Trial electric vehicles within the CCBC fleet and install charging points at key locations – lead the way.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.9.2 Encourage Car sharing for CCBC Staff

Measure	Title	
M 20.	Encourage Car sharing for CCBC Staff	
Definition		Key Intervention
a. Encourage Car sharing for CCBC Staff		Raise awareness of the problems of poor air quality among CCBC staff. Incentives for car share – designated parking areas within Council buildings, financial incentives for staff (extra mileage allowance for car share).
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.10 Monitoring

5.2.10.1 Continue Monitoring NO_2 and increase monitoring network

Measure	Title	
M 21.	Continue Monitoring NO_2 and increase monitoring network	
Definition		Key Intervention
a. Increase diffusion tube network to widen evidence base for measuring impact b. Installation of additional automatic monitoring station at façade of houses (true exposure location)		To enhance monitoring network to gather greater understanding of concentrations within AQMA
Responsible authority and other partners		Powers to be used

Caerphilly County Borough Council	Voluntary

5.2.11 Traffic and Emissions Monitoring

5.2.11.1 Traffic monitoring

Measure	Title	
M 22.	Install traffic monitoring	
Definition		Key Intervention
a. Install traffic monitoring (inductive loops) to identify real-time traffic volumes, speeds and classification b. ANPR traffic information additionally provides age, Euro class and queuing information.		To increase traffic information: detailed traffic data to identify and correlate to 15minute/hourly pollution spikes for future analysis and modelling.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

5.2.11.2 Emissions monitoring

Measure	Title	
M 23.	Investigate the feasibility of roadside remote emissions monitoring	
Definition		Key Intervention
a. Investigate the feasibility of undertaking roadside remote emissions trials to identify specific gross polluter vehicles, provide vehicle classification, age and loading on vehicles through cross-road measurements and ANPR cameras.		To identify specific vehicles which emit the most pollutants to target intervention measures.
Responsible authority and other partners		Powers to be used
Caerphilly County Borough Council		Voluntary

6 Air Quality Action Plan modelling assessment

From the long list of measures, a short list of measures was selected by Caerphilly County Borough Council for further assessment through dispersion modelling. The purpose of the dispersion modelling was to assess the impacts of selected measures and their predicted impact on NO_2 concentrations within the AQMA.

6.1 Modelling Assessment

Annual mean NO_2 concentrations for a 2016 baseline year and future year scenarios have been modelled using the atmospheric dispersion model ADMS Roads (version 4). Hourly sequential meteorological data (wind speed, direction etc.) for 2016 from the Cardiff Airport meteorological measurement site was obtained and used in this assessment.

Baseline annual average daily traffic (AADT) flow and detailed vehicle fleet splits were collated from 2015 DfT count point on the main road going through the AQMA. A growth factor of 1.0177 calculated using TEMPRO 7 has been applied to get the 2016 traffic flow. A summary of the baseline traffic count data is presented in Table 10. Average vehicle speeds were based on speed limits.

Table 10: Traffic Data 2016

Road	Traffic flow	%Cars	%LGV	%Rigid HGV	%Artic HGV	%Bus	%Motorcycle
A472	21,402	81.3	14.3	2.0	1.2	0.5	0.6

The 2016 baseline model was verified by comparing the modelled road NOx concentrations with the available 2016 roadside automatic monitoring and diffusion tube measurements. Following initial comparison of the modelled concentrations with the available monitoring data, limited refinements were made to the model set-up to achieve the best possible agreement with the monitoring results. Further details on the model method summary and verification process are provided in Appendix 2.

It should be noted that any dispersion modelling study has a degree of uncertainty associated with it; all reasonable steps have been taken to reduce this where possible.

6.1.1 Overview of Scenarios Modelled

This study aims to provide an indication of the potential benefits of pursuing emission reductions through various traffic management strategies in the Hafod-yr-ynys AQMA. The scenarios included in the assessment are summarised in Table 11.

Table 11 : Traffic Scenarios Modelled for the Assessment

Scenario	Description
Recent baseline 2016	Used to verify the dispersion model and derive Road NOx and adjustment factors.
Future Baseline years 2020	Future year baseline, traffic flows have been calculated by applying locally specific TEMPRO growth factor to the existing baseline flows.
Scenario 1: Localised traffic management (2020)	Combination of localised traffic management options to improve traffic flow (+5-10%) including: bus stop relocations, prohibit right turn access, removal parking bays.
Scenario 2: Gating traffic outside of street canyon environment of AQMA (2020)	Traffic would be held at top of hill and filtered through as traffic dispersed at junction below. Resulting in improved avg. speed (+10%) and avg. traffic vol. reduction through AQMA due to displacement (-5%).
Scenario 3: By-pass (2020)	Future (new) by-pass constructed to divert traffic to the south of the AQMA, connecting the A472 to A467. a) One-way rerouting for south-bound vehicles (A472 traffic toward A467(south)). Resulting in reduced traffic (-20% AADT) and avg. speed (+5%) b) Two-way re-routing for southbound (A472 traffic) and east-bound (A467 traffic coming from south). Resulting in reduced traffic (-40% AADT) and avg. speed (+5%)
Scenario 4: (NOT modelled) removal of properties	The removal of properties was not modelled as the there are no emissions or concentration reductions proposed. The only change would be that by removing the local receptors (residential properties) there would no longer be an exposure to concentrations. This scenario is included in the measures assessment.

6.1.2 Modelling Limitations

Air quality models predict concentrations of pollutants following detailed verification and comparison of results to measurements. This process is inherently reliant on the quality of the input data as well as the appropriate type of model used for the environment and type of emissions to be modelled, such as road traffic sources.

Ricardo Energy & Environment strictly adheres to the detailed air quality modelling guidance set-out in LAQM.TG (16) and utilises the most up-to-date input data available. The Hafod-yr-ynys AQMA modelling environment included a street canyon environment with parking bays, accelerating and decelerating traffic and a steep gradient, all within close proximity to residential properties. The model used here (ADMS Roads) is validated to be used in these types of environments and was verified, however challenges were encountered and the limitations of the model need to be understood.

When interpreting the results for the baseline and future scenarios assessed it is worth noting the limitations of the input data and modelling to better understand and interpret the results. Such limitations presented for the Hafod-yr-ynys AQMA modelling are presented below:

- Future baseline traffic has been projected using a TEMPRO local growth factor for Caerphilly that may not account for all future committed or planned developments within the immediate locality of the AQMA. No trip generation or distribution data for future developments likely to affect road traffic was available at the time of conducting this modelling assessment.
- Traffic data used in this model is of low resolution, indeed we only had the AADT for 2015 taken from the DfT count which has then been factored using the TEMPRO growth factor to get an estimation of the 2016 traffic data. To represent the hourly change in flows over the day, the average UK diurnal has been applied as a local diurnal profile was not available
- Uncertainties in projected background concentrations and vehicle emission rates
- Meteorological conditions during future years e.g. some years have cold winters with extended periods where dispersion is poor and pollutant concentrations are greater.
- Verifying modelling data with diffusion tube monitoring data will always be subject to uncertainty due to inherent limitations in such monitoring data (even data from continuous analysers has notable uncertainty).

The model results should be considered in this context and for the purposes of this assessment we are presenting the modelled projections with the range of predicted concentrations to take into account the model RMSE range of $\pm$ 4.55 $\mu g.m^{-3}$; and highlighted any of the residential (receptor) locations that are within 10% of the objective.

6.1.3 Modelling Results

For all scenarios assessed, the adjusted model results have been used to predict annual mean NO_2 concentrations at a selection of specified receptors within the study area. The receptors are located at the facade of residential buildings where relevant exposure exists and have been selected to be representative of worst case exposure to road traffic emissions; the selected locations are considered worst case as they are the closest residential properties to the road sources being modelled. All receptors have been modelled at a height of 1.5 m to represent human exposure at ground floor level. Where ground level is elevated above or below the adjacent roads being modelled receptor height has been adjusted accordingly. The Automatic monitoring station (Auto) is identified as being only 0.8m above the road height. This is due the kerbside station inlet (receptor position) being down slope from the road, as it sits on the pavement area lower than the level of the road. The receptor height of houses to the south-west (prefixed HS) and houses to the north-east (prefixed HN) along the A472 also differ. The HS receptor heights are at 1m, as the properties are down slope from the road level, whereas the HN receptor heights relate to those properties as being up-slope above the road in the valley.

Direct comparison of predicted annual mean pollutant concentrations at the specified receptors for each scenario will provide a good indication of the likely air quality impact of each scenario modelled. The locations of the specified receptors and receptor heights are presented in

Table 12 and

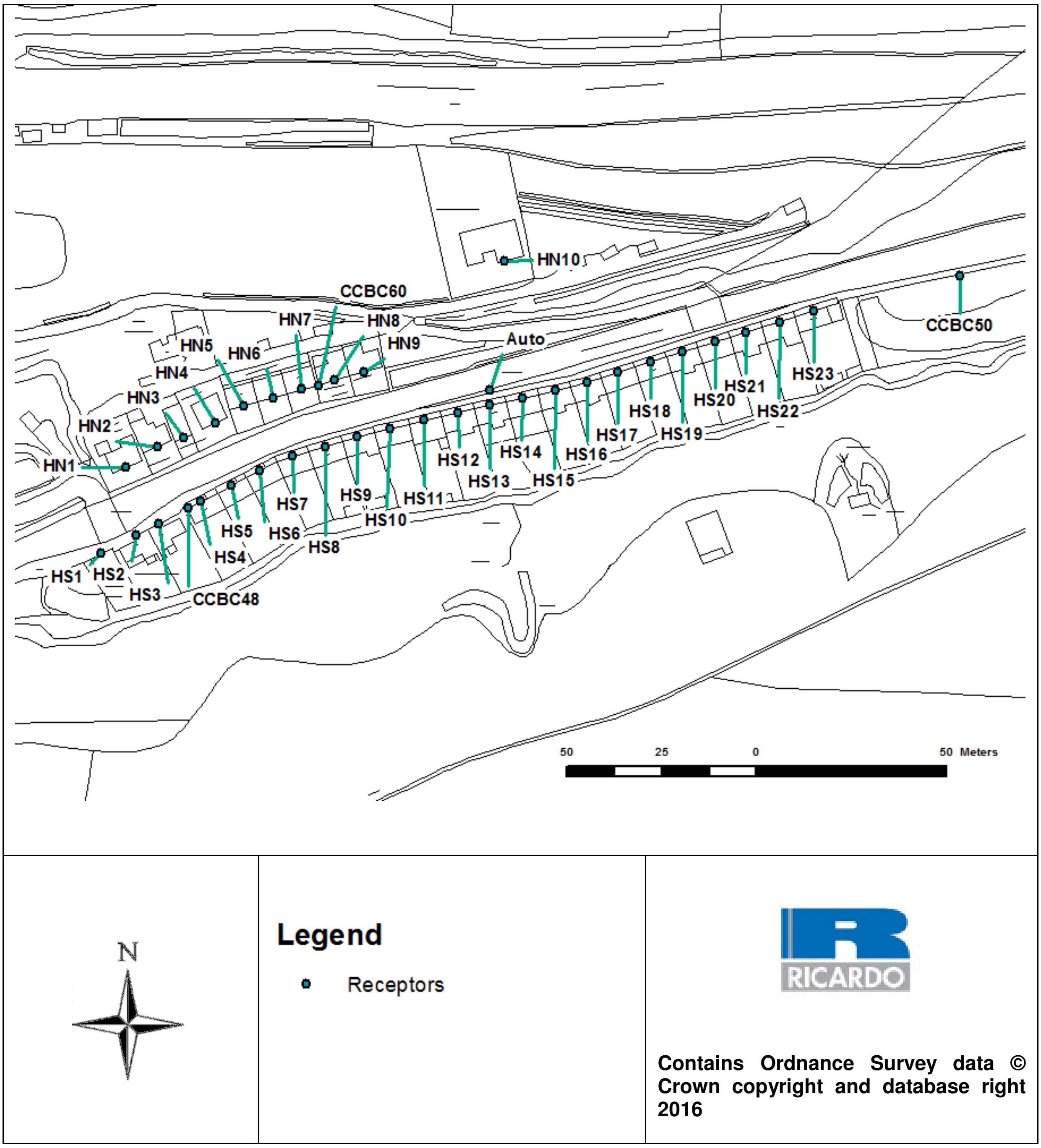
Figure 8.

All future modelled NO_2 concentrations account for currently available evidence regarding the predicted reduction in background pollutant concentrations, projected decreases in vehicle emissions, and projected changes to the fraction of NOx emitted as primary NO_2 from road vehicles over time as the vehicle fleet changes.

Table 12: Specified Receptor Locations

Receptor	Easting	Northing	Height modelled	Description
Auto	321727	198589	0.8	Monitoring site
CCBC48	321642	198559	1.5	Monitoring site
CCBC50	321851	198619	1.5	Monitoring site
CCBC60	321681	198584	3.5	Monitoring site
HS1	321625	198546	1	Residential
HS10	321701	198579	1	Residential
HS11	321710	198581	1	Residential
HS12	321719	198583	1	Residential
HS13	321727	198585	1	Residential
HS14	321736	198587	1	Residential
HS15	321744	198589	1	Residential
HS16	321753	198591	1	Residential
HS17	321761	198594	1	Residential
HS18	321769	198596	1	Residential
HS19	321778	198599	1	Residential
HS2	321634	198551	1	Residential
HS20	321786	198602	1	Residential
HS21	321795	198604	1	Residential
HS22	321803	198607	1	Residential
HS23	321813	198610	1	Residential
HS3	321640	198554	1	Residential
HS4	321651	198560	1	Residential
HS5	321659	198564	1	Residential
HS6	321666	198568	1	Residential
HS7	321675	198571	1	Residential
HS8	321684	198574	1	Residential
HS9	321692	198577	1	Residential
HN1	321631	198569	3.5	Residential
HN10	321731	198623	3.5	Residential
HN2	321640	198574	3.5	Residential
HN3	321646	198576	3.5	Residential
HN4	321655	198580	3.5	Residential
HN5	321662	198585	3.5	Residential
HN6	321670	198587	3.5	Residential
HN7	321678	198589	3.5	Residential
HN8	321686	198592	3.5	Residential
HN9	321694	198594	3.5	Residential

Figure 8:Specified Receptor Locations



6.1.4 Current and Future Year Baseline NO2 Annual Mean

The predicted annual mean NO_2 concentrations at each of the specified receptors during the model verification year of 2016 and in each future year assessed i.e. without any traffic management interventions, are presented in

Table 13. The results indicate that NO_2 annual mean concentration is likely to be compliant with the 40 µg.m^{-3} objective at all of the modelled receptor locations by 2020. However, when taking into account the error of ±4.55 µg.m^{-3} range of the predicted concentrations, eight (8) residential (receptor) locations have been identified that lie within the ±10% modelling confidence limit range i.e. >36 µg.m^{-3}.

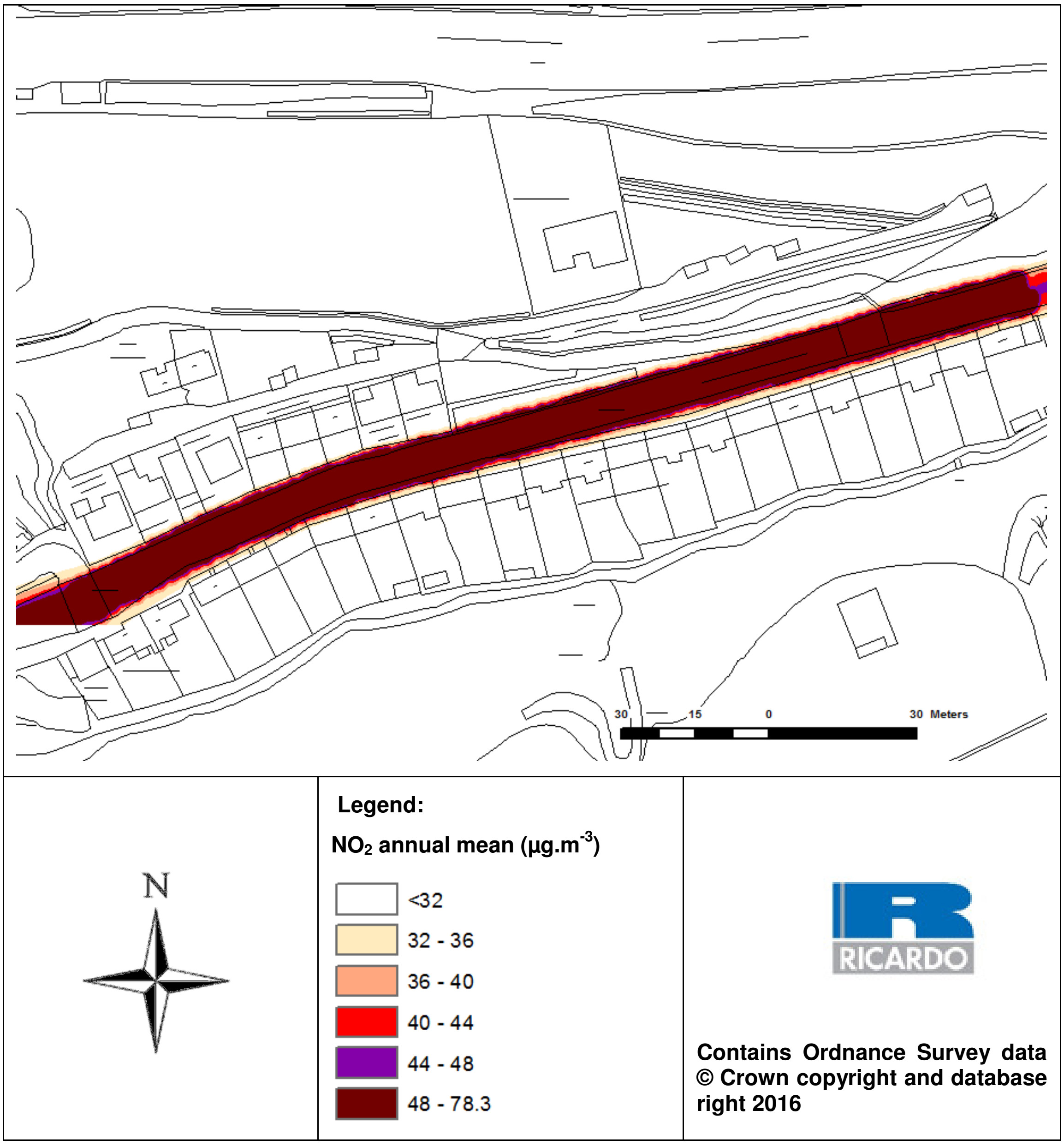
Table 13: Predicted annual mean NO_2 concentrations ($\mu g.m^{-3}$) Current + future baseline years

Receptor location	Height (m)	2016	2020	2020 baseline (range ±4.55 $\mu g/m^3$)	
CCBC48	1.5	36.4	30.8	26.3	35.4
CCBC50	1.5	38.4	34.3	29.7	38.8
CCBC60	3.5	26.6	22.1	17.5	26.6
HS1	1	38.7	34.7	30.1	39.2
HS10	1	37.6	32.7	28.2	37.3
HS11	1	36.8	31.5	26.9	36.0
HS12	1	36.8	31.0	26.4	35.5
HS13	1	37.1	31.1	26.5	35.6
HS14	1	38.3	32.1	27.5	36.6
HS15	1	38.7	32.4	27.8	36.9
HS16	1	37.9	31.6	27.1	36.2
HS17	1	38.2	31.9	27.4	36.5
HS18	1	37.4	31.4	26.9	36.0
HS19	1	36.7	31.1	26.5	35.6
HS2	1	35.9	30.5	26.0	35.1
HS20	1	35.4	30.2	25.7	34.8
HS21	1	34.7	29.6	25.1	34.2
HS22	1	34.1	29.1	24.6	33.7
HS23	1	34.0	29.0	24.5	33.6
HS3	1	34.5	29.5	25.0	34.1
HS4	1	35.0	30.0	25.4	34.5
HS5	1	35.5	30.4	25.9	35.0
HS6	1	35.7	30.7	26.1	35.2
HS7	1	36.1	31.0	26.4	35.5
HS8	1	36.3	31.2	26.6	35.7
HS9	1	37.0	31.9	27.3	36.4
HN1	3.5	27.6	23.4	18.8	27.9
HN10	3.5	26.2	22.0	17.5	26.6
HN2	3.5	12.3	22.3	17.8	26.9
HN3	3.5	26.5	22.0	17.5	26.6
HN4	3.5	25.3	21.0	16.4	25.5
HN5	3.5	25.8	21.4	16.8	25.9
HN6	3.5	26.1	21.7	17.1	26.2
HN7	3.5	26.3	21.8	17.2	26.3
HN8	3.5	26.3	21.8	17.3	26.4
HN9	3.5	19.2	15.9	11.4	20.5
Auto	0.8	73.1	64.5	60.0	69.1

To provide a visual representation of the predicted spatial variation in annual mean NO_2 concentrations across the AQMA in 2020, a contour plot of the 2020 baseline results across the AQMA are presented in

Figure 9.

Figure 9: Modelled NO2 Annual mean concentrations Hafod-yr-ynys AQMA at 1.5m



6.1.5 Scenario 1: Localised Traffic Management 2020 Results

Scenario 1 assesses the impact of introducing localised traffic measures that could potentially result in increased traffic flow (+5-10%) in 2020. These include bus stop relocations, prohibiting right turns across traffic within the AQMA and removal of parking bays to widen road. The results are presented in

Table 14. The results are presented as a range of predicted concentrations, taking into account the error of ±4.55 $\mu g.m^{-3}$.

Table 14: Scenario 1 - Localised traffic management (2020) annual mean NO_2 concentrations (µg.m^{-3})

Receptor location	Height (m)	2020 baseline (range ±4.55 µg/m^3)		2020 Traffic management (range ±4.55 µg/m^3)		2020 difference
CCBC48	1.5	26.3	35.4	24.4	33.5	-1.8
CCBC50	1.5	29.7	38.8	28.9	38.0	-0.8
CCBC60	3.5	17.5	26.6	16.2	25.3	-1.3
HS1	1	30.1	39.2	29.5	38.6	-0.6
HS10	1	28.2	37.3	26.9	36.0	-1.3
HS11	1	26.9	36.0	25.3	34.4	-1.6
HS12	1	26.4	35.5	24.5	33.6	-1.9
HS13	1	26.5	35.6	24.5	33.6	-2.0
HS14	1	27.5	36.6	25.3	34.4	-2.2
HS15	1	27.8	36.9	25.5	34.6	-2.3
HS16	1	27.1	36.2	24.8	33.9	-2.3
HS17	1	27.4	36.5	25.1	34.2	-2.3
HS18	1	26.9	36.0	24.6	33.7	-2.3
HS19	1	26.5	35.6	24.3	33.4	-2.2
HS2	1	26.0	35.1	23.8	32.9	-2.2
HS20	1	25.7	34.8	23.5	32.6	-2.1
HS21	1	25.1	34.2	23.0	32.1	-2.1
HS22	1	24.6	33.7	22.6	31.7	-2.0
HS23	1	24.5	33.6	22.5	31.6	-2.0
HS3	1	25.0	34.1	23.0	32.1	-2.0
HS4	1	25.4	34.5	23.4	32.5	-2.1
HS5	1	25.9	35.0	23.8	32.9	-2.1
HS6	1	26.1	35.2	24.0	33.1	-2.1
HS7	1	26.4	35.5	24.3	33.4	-2.1
HS8	1	26.6	35.7	24.6	33.7	-2.1
HS9	1	27.3	36.4	25.3	34.4	-2.0
HN1	3.5	18.8	27.9	17.9	27.0	-0.9
HN10	3.5	17.5	26.6	16.5	25.6	-1.0
HN2	3.5	17.8	26.9	16.7	25.8	-1.1
HN3	3.5	17.5	26.6	16.4	25.5	-1.1
HN4	3.5	16.4	25.5	15.4	24.5	-1.1
HN5	3.5	16.8	25.9	15.7	24.8	-1.2
HN6	3.5	17.1	26.2	15.9	25.0	-1.2
HN7	3.5	17.2	26.3	16.0	25.1	-1.2
HN8	3.5	17.3	26.4	16.0	25.1	-1.3
HN9	3.5	11.4	20.5	10.8	19.9	-0.6
Auto	0.8	60.0	69.1	54.8	63.9	-5.2

The results indicate that at the worst case receptor (HS1) is likely to have a maximum exposure reduction in annual mean NO_2 concentrations of 0.6 µg.m^{-3}, however is potentially within the range of exceeding the NO2 objective (40 µg.m^{-3}) at 38.6 µg.m^{-3}.

6.1.6 Scenario 2: Gating Traffic Outside of Street Canyon in AQMA (2020)

Scenario 2 assessed the impact of introducing a gating approach to restricting and smoothing the flow of vehicles through the AQMA. Traffic would be held at the top of hill and filtered through as traffic dispersed at junction below. Resulting in improved avg. speed (+10%) and avg. traffic vol. reduction through AQMA due to displacement (-5%). The results are presented in Table 15Table 15.

Table 15: Scenario 2 - Gating traffic (2020) annual mean NO_2 concentrations (µg.m^{-3})

Receptor location	Height (m)	2020 baseline (range ±4.55 µg/m^3)		2020 Gating traffic (range ±4.55 µg/m^3)		2020 difference
CCBC48	1.5	26.3	35.4	24.2	33.3	-2.0
CCBC50	1.5	29.7	38.8	27.4	36.5	-2.4
CCBC60	3.5	17.5	26.6	16.2	25.3	-1.3
HS1	1	30.1	39.2	28.1	37.2	-2.0
HS10	1	28.2	37.3	26.1	35.2	-2.1
HS11	1	26.9	36.0	24.9	34.0	-2.0
HS12	1	26.4	35.5	24.4	33.5	-2.1
HS13	1	26.5	35.6	24.4	33.5	-2.1
HS14	1	27.5	36.6	25.3	34.4	-2.2
HS15	1	27.8	36.9	25.6	34.7	-2.3
HS16	1	27.1	36.2	24.9	34.0	-2.2
HS17	1	27.4	36.5	25.1	34.2	-2.3
HS18	1	26.9	36.0	24.6	33.7	-2.2
HS19	1	26.5	35.6	24.3	33.4	-2.2
HS2	1	26.0	35.1	23.8	32.9	-2.2
HS20	1	25.7	34.8	23.5	32.6	-2.2
HS21	1	25.1	34.2	23.0	32.1	-2.1
HS22	1	24.6	33.7	22.5	31.6	-2.1
HS23	1	24.5	33.6	22.4	31.5	-2.1
HS3	1	25.0	34.1	22.9	32.0	-2.1
HS4	1	25.4	34.5	23.3	32.4	-2.2
HS5	1	25.9	35.0	23.7	32.8	-2.2
HS6	1	26.1	35.2	23.9	33.0	-2.2
HS7	1	26.4	35.5	24.2	33.3	-2.3
HS8	1	26.6	35.7	24.4	33.5	-2.3
HS9	1	27.3	36.4	25.0	34.1	-2.3
HN1	3.5	18.8	27.9	17.5	26.6	-1.3
HN10	3.5	17.5	26.6	16.2	25.3	-1.2
HN2	3.5	17.8	26.9	16.5	25.6	-1.3
HN3	3.5	17.5	26.6	16.2	25.3	-1.3
HN4	3.5	16.4	25.5	15.2	24.3	-1.2
HN5	3.5	16.8	25.9	15.6	24.7	-1.2
HN6	3.5	17.1	26.2	15.8	24.9	-1.3
HN7	3.5	17.2	26.3	15.9	25.0	-1.3
HN8	3.5	17.3	26.4	16.0	25.1	-1.3
HN9	3.5	11.4	20.5	10.7	19.8	-0.7
Auto	0.8	60.0	69.1	54.8	63.9	-5.2

The results indicate that at the worst case receptor (HS1) is likely to have a maximum exposure reduction in annual mean NO_2 concentrations of 2.0 $\mu g.m^{-3}$ however, it is potentially within the range of exceeding the NO_2 objective (40 $\mu g.m^{-3}$) at 37.2 $\mu g.m^{-3}$.

6.1.7 Scenario 3: By-pass 2020

Scenario 3 assesses the impact of introducing a future (new) by-pass constructed to divert traffic to the south of the AQMA, connecting the A472 to A467. The assessment targeted 2020 to demonstrate potential impacts of such a development on the AQMA, however it is recognised that such a construction would most likely be much further in the future.

Two by-pass options were considered:

- Scenario 3a: One-way rerouting for south-bound vehicles (A472 traffic toward A467(south)). Resulting in reduced traffic (-20% AADT) and avg. speed (+5%).

- Scenario 3b: Two-way re-routing for southbound (A472 traffic) and east-bound (A467 traffic coming from south). Resulting in reduced traffic (-40% AADT) and avg. speed (+5%)

The results of both scenarios (3a and 3b) are presented in

Table 16 and Table 17. The results are presented as a range of predicted concentrations, taking into account the error of ±4.55 μg.m^{-3}.

Table 16: Scenario 3a - By-pass One-way rerouting for south-bound vehicles (2020) annual mean NO_2 concentrations ($\mu g.m^{-3}$)

Receptor location	Height (m)	2020 baseline (range ±4.55 μg/m³)		2020 One-way bypass (range ±4.55 μg/m³)		2020 difference
CCBC48	1.5	26.3	35.4	21.8	30.9	-4.5
CCBC50	1.5	29.7	38.8	24.7	33.8	-5.1
CCBC60	3.5	17.5	26.6	14.7	23.8	-2.8
HS1	1	30.1	39.2	25.2	34.3	-4.9
HS10	1	28.2	37.3	23.5	32.6	-4.7
HS11	1	26.9	36.0	22.4	31.5	-4.6
HS12	1	26.4	35.5	21.9	31.0	-4.6
HS13	1	26.5	35.6	21.9	31.0	-4.6
HS14	1	27.5	36.6	22.7	31.8	-4.8
HS15	1	27.8	36.9	23.0	32.1	-4.9
HS16	1	27.1	36.2	22.3	31.4	-4.7
HS17	1	27.4	36.5	22.6	31.7	-4.8
HS18	1	26.9	36.0	22.2	31.3	-4.7
HS19	1	26.5	35.6	21.9	31.0	-4.7
HS2	1	26.0	35.1	21.4	30.5	-4.6
HS20	1	25.7	34.8	21.2	30.3	-4.5
HS21	1	25.1	34.2	20.7	29.8	-4.4
HS22	1	24.6	33.7	20.3	29.4	-4.3
HS23	1	24.5	33.6	20.2	29.3	-4.3
HS3	1	25.0	34.1	20.6	29.7	-4.4
HS4	1	25.4	34.5	21.0	30.1	-4.5
HS5	1	25.9	35.0	21.3	30.4	-4.6
HS6	1	26.1	35.2	21.5	30.6	-4.6
HS7	1	26.4	35.5	21.8	30.9	-4.7
HS8	1	26.6	35.7	22.0	31.1	-4.7
HS9	1	27.3	36.4	22.5	31.6	-4.8
HN1	3.5	18.8	27.9	15.9	25.0	-3.0
HN10	3.5	17.5	26.6	14.7	23.8	-2.7
HN2	3.5	17.8	26.9	14.9	24.0	-2.8
HN3	3.5	17.5	26.6	14.7	23.8	-2.8
HN4	3.5	16.4	25.5	13.9	23.0	-2.6
HN5	3.5	16.8	25.9	14.2	23.3	-2.7
HN6	3.5	17.1	26.2	14.4	23.5	-2.7
HN7	3.5	17.2	26.3	14.5	23.6	-2.8
HN8	3.5	17.3	26.4	14.5	23.6	-2.8
HN9	3.5	11.4	20.5	9.9	19.0	-1.5
Auto	0.8	60.0	69.1	49.4	58.5	-10.6

The results indicate that at the worst case receptor (HS1) is likely to have a maximum exposure reduction in annual mean NO_2 concentrations of 4.9 $\mu g.m^{-3}$.

Table 17: Scenario 3b - By-pass Two-way rerouting for south-bound vehicles (2020) annual mean NO_2 concentrations ($\mu g.m^{-3}$)

Receptor location	Height (m)	2020 baseline (range ±4.55 µg/m3)		2020 Two-way bypass (range ±4.55 µg/m3)		2020 difference
CCBC48	1.5	26.3	35.4	17.8	26.9	-8.4
CCBC50	1.5	29.7	38.8	20.2	29.3	-9.6
CCBC60	3.5	17.5	26.6	12.4	21.5	-5.2
HS1	1	30.1	39.2	20.6	29.7	-9.5
HS10	1	28.2	37.3	19.2	28.3	-9.0
HS11	1	26.9	36.0	18.3	27.4	-8.6
HS12	1	26.4	35.5	18.0	27.1	-8.5
HS13	1	26.5	35.6	18.0	27.1	-8.6
HS14	1	27.5	36.6	18.6	27.7	-8.9
HS15	1	27.8	36.9	18.8	27.9	-9.0
HS16	1	27.1	36.2	18.3	27.4	-8.8
HS17	1	27.4	36.5	18.5	27.6	-8.9
HS18	1	26.9	36.0	18.2	27.3	-8.7
HS19	1	26.5	35.6	17.9	27.0	-8.6
HS2	1	26.0	35.1	17.6	26.7	-8.4
HS20	1	25.7	34.8	17.4	26.5	-8.3
HS21	1	25.1	34.2	17.0	26.1	-8.1
HS22	1	24.6	33.7	16.7	25.8	-7.9
HS23	1	24.5	33.6	16.6	25.7	-7.8
HS3	1	25.0	34.1	17.0	26.1	-8.0
HS4	1	25.4	34.5	17.2	26.3	-8.2
HS5	1	25.9	35.0	17.5	26.6	-8.4
HS6	1	26.1	35.2	17.7	26.8	-8.4
HS7	1	26.4	35.5	17.9	27.0	-8.6
HS8	1	26.6	35.7	18.0	27.1	-8.6
HS9	1	27.3	36.4	18.5	27.6	-8.9
HN1	3.5	18.8	27.9	13.3	22.4	-5.6
HN10	3.5	17.5	26.6	12.4	21.5	-5.1
HN2	3.5	17.8	26.9	12.5	21.6	-5.2
HN3	3.5	17.5	26.6	12.4	21.5	-5.1
HN4	3.5	16.4	25.5	11.7	20.8	-4.7
HN5	3.5	16.8	25.9	11.9	21.0	-4.9
HN6	3.5	17.1	26.2	12.1	21.2	-5.0
HN7	3.5	17.2	26.3	12.2	21.3	-5.1
HN8	3.5	17.3	26.4	12.2	21.3	-5.1
HN9	3.5	11.4	20.5	8.7	17.8	-2.7
Auto	0.8	60.0	69.1	40.2	49.3	-19.8

The results indicate that at the worst case receptor (HS1) is likely to have a maximum exposure reduction in annual mean NO_2 concentrations of 9.5 µg.m^{-3}. All of the results presented in this report are subject to the limitations outlined in this chapter. The results reported above are the predicted change in NO_2 concentrations.

6.2 Summary of modelled scenarios

The modelling of future year 2020 air quality was undertaken and predicted concentrations for the 3 most significant interventions (or measures) were provided in the previous sub-sections. The results, considering the limitations of the modelling demonstrated the following:

- Scenario 1 assessed the impact of introducing localised traffic measures that could potentially result in increased traffic flow (+5-10%) and demonstrated that:
  - There were significant potential reductions of between 0.6 to 2.3 µg/m³ at the receptor locations.
  - Most properties would likely achieve compliance (below 40 µg/m³) in 2020 except for HS1 and HS2

- Scenario 2 assessed the impact of introducing a gating approach to restricting and smoothing the flow of vehicles through the AQMA and demonstrated that:
  - There were significant potential reductions of between 0.7 to 2.3 µg/m³ at the receptor locations.
  - Most properties would likely achieve compliance (below 40 µg/m³) in 2020 except for HS1.

- Scenario 3 was split into two by-pass options:
- Scenario 3a: One-way rerouting for south-bound vehicles (A472 traffic toward A467(south)). Resulting in reduced traffic (-20% AADT) and avg. speed (+5%) and demonstrated that:
  - There were significant potential reductions of between 1.5 to 5.1 µg/m³ at the receptor locations.
  - All properties would likely achieve compliance (below 40 µg/m³) in 2020, although HS1 would still be within 15% of the objective value.

- Scenario 3b: Two-way re-routing for southbound (A472 traffic) and east-bound (A467 traffic coming from south). Resulting in reduced traffic (-40% AADT) and avg. speed (+5%) and demonstrated that:
  - There were significant potential reductions of between 5.1 to 9.5 µg/m³ at the receptor locations.
  - All properties would likely achieve compliance (below 40 µg/m³) in 2020.

- Scenario 4: the demolition of Woodside Terrace housing, was not modelled as a scenario as the removal of properties would simply remove the exposure of pollution to residents in houses HS1 -23. Baseline 2020 modelling showed that there would be no exceedances of the objective at the northern side properties (HN1 – 9), therefore if the southern properties were removed then there would be no requirement for an AQMA in 2020.

6.2.1 Future improved modelling input data

Improvements in the quality of the input data would improve the confidence in the models future predicted concentrations. The modelling is not able to reproduce the hourly measurement profiles and peaks in concentration due to the lower resolution of input data. The 1-hour NO_2 mean diurnal profile of concentrations presented in Figure 4 illustrates the peaks and troughs of concentrations in line with daily traffic flows. The model is unable to replicate similar profiles without detailed hour by hour traffic input data and potentially can be missing peak emissions periods and be under predicting concentrations at the façades.

Therefore, it is recommended that improved detailed input data could be sourced to better replicate the environment and concentration exposures presented in the AQMA. The following are suggested improved data sources and methods to collect them:

- Detailed traffic monitoring to identify vehicles and fleet using the route:
  - Actual fleet composition, age and volume
  - High resolution volume and speed profile on route
- Façade monitoring for detailed concentration profile:
  - Establish an air quality monitoring station on the façade or façade line of properties

  - Co-locate with NO_2 triplicate diffusion tubes
  - Further NO_2 diffusion tube locations along route.
- Emissions profile of vehicles using route:
  - Undertake emissions tests to identify emissions profile of vehicles on route
  - Identify gross polluters and periods/activities of high and low emissions

7 Assessment of Shortlisted Measures

7.1 Approach to economic analysis

Economic analysis or appraisal is a common element of the evidence base underpinning policy choices. Cost-benefit analysis (or CBA) is a frequently deployed type of economic analysis: CBA aims to identify, assess and place a monetary value on all impacts associated with a given policy option. In doing so, the costs and benefits of an option can be compared and combined to provide a net overall position.

As such, CBA is a useful tool to assist weighing up the pros and cons associated with a policy option, and to compare these between options to see which option best delivers a given policy objective. However, CBA has limitations and caveats. First, it may not be possible to quantify all impacts. Or where these can be quantified, methodologies may not exist to assign a monetary value. Further where these can be valued, there will be uncertainty around the estimation.

For this study, where possible we have sought to monetise impacts but have adopted a qualitative approach where Data (and in some cases methodological approaches) do not exist to quantify effects.

Three options have been included in the economic analysis:

- Scenario option 1: Localised traffic management
- Scenario option 3 (‘a’ and ‘b’): Bypass for traffic- trunk road
- Scenario option 4: Demolition of Woodside Terrace housing

7.2 Potential Air Quality Impact

Air pollution has a range of associated detrimental impacts, including on human health and the natural and built environments. The Interdepartmental Group on Costs and Benefits (IGCB) has published guidance on valuing these impacts in UK policy appraisal[5].

This guidance sets out three possible approaches to assessing impacts on air pollution. Which approach is applicable is determined by the size of impacts and the influence on compliance with legal limits. In this analysis we have applied the IGCB damage cost approach[6] given impacts are likely to be less than £50m and the baseline pollutant concentration modelling suggests there will be no exceedance of legal limits.

The damage costs aggregate and monetise the impacts associated with air pollutant emissions into a single impact value for each pollutant, expressed in terms of a ‘£’ impact per tonne of emission. A range of impacts associated with the emission of pollutants are captured, namely:

- Mortality as a consequence of long-term pollutant exposure
- Mortality and morbidity as a consequence of short-term exposure
- Impact on crop yields
- Building soiling and material damage.

The value of reductions in air pollutants is calculated by combining estimated changes in emissions with the damage costs. The impact of the measures on air pollutant emissions is taken from the preceding air pollution modelling. Caerphilly is defined as an ‘Urban medium’ area with respect to the damage costs, as defined by the UK-wide air pollutant modelling underpinning the derivation of the damage costs. Further the emissions under consideration are associated with transport. These factors have guided our selection of which damage costs are applicable in this case.

The damage cost for NOx applied in the analysis is £26,500 per tonne in 2020, and for PM is £73,200 per tonne in 2020.

Modelled scenario options: impacts of options 1, 3a and 3b

The following table sets out the results of applying the damage costs to the scenario options under consideration.

[5] https://www.gov.uk/guidance/air-quality-economic-analysis
[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/182391/air-quality-damage-cost-methodology-110211.pdf

Table 18 – Estimated change in air pollutant emissions and monetary benefit

			Baseline	Option 1	Option 3a	Option 3b
Total emissions	**PM10**	**Grams**	**11,728**	**11,674**	**9,167**	**6,876**
	NOx	**Grams**	**1,061**	**1,059**	**830**	**622**
Change in emssions	**PM10**	**Grams**		**53.71**	**2,561**	**4,853**
	NOx	**Grams**		**2.20**	**232**	**439**
Value of change in emissions	**Central**	**£**		**£1.50**	**£79**	**£150**
	Low-high range	**£**		**£0.65 - £2.40**	**£36 - £122**	**£68 - £230**

As can be seen from the results in
Table 18, the monetary value of the air pollution impacts associated with the different options is extremely small.

Of the options considered, the bypass options appear to deliver a greater benefit than local traffic management measures. However, air pollution impacts have only been modelled on existing links: this does not include the 'increase' in emissions that would be associated with the new bypass link under Option 3. As such, if the scope of the air pollution modelling was wider, the net impact of Option 3 would be even smaller than displayed here.

A key factor in the small size of these benefits is the link lengths involved: the total modelled area covered only 1.5km of road. As such, even though the measures involved could have a significant impact on the movement of vehicles along the existing links, the fact that these are small links with relatively few movements to begin with produces only a small change in overall emissions.

However, there are limitations to assessing impacts using the damage costs, not least they assume an average relationship between emission and impact and capture impacts in a high-level and aggregated way. What the damage costs do not illustrate is the impact of the measures on concentrations on the links in question, and subsequently on the likelihood of meeting limit values and on the health of people who live on and travel (either on foot, cycle or in vehicles) along the affected road links.

A selection of the modelled concentration results are presented in Table 19. A similar trend is observed for the other receptor points for NO_2.

Table 19 – Selection of modelled NO_2 concentration results (µg.m-3)

Receptor I.D.	Baseline 2016	Baseline 2020	Scenario 1	Scenario 3a	Scenario 3b
HS1	38.65	34.65	34.01	29.78	25.18
HS2	37.62	32.73	31.45	28.03	23.77
HS3	36.79	31.47	29.88	26.91	22.87

As the results show, the options could have a very significant impact on concentrations on the targeted links. This will have an impact on the ability to meet exceedance limits on these links. More importantly, these will also have very real benefits on the health of residents and those who travel along the links through exposure to much lower concentrations of pollutants. In aggregate, given the number of residents and number of people travelling along the links, these impacts are unlikely to be substantial, but there will be an effect. Further where local patterns of exposure or baseline incidence of associated health effects differ to UK-average, the effects could be higher.

Other factors which could influence the assessment are that the damage costs do not incorporate all detrimental effects associated with air pollution. Further, the air pollutant modelling will not capture effects outside the links analysed. However, in this case both effects are unlikely to significantly affect the size of impacts assessed.

Scenario option 4

The housing demolition option was not included in the air pollution modelling. In effect, this option is unlikely to have a significant impact on air pollution emissions (there may be a small reduction of emissions associated with the removal of travel of local residents who no longer live there). As such, applying the damage costs to this option would produce an even smaller (if no negligible) assessment of the value of associated benefits.

Although this option does not reduce emissions, this option will reduce exposure. As such there will be a positive impact on the health of residents who no longer live in the affected area, although health impacts on those using the road links and wider impacts (e.g. on crops and buildings) will still likely occur.

Summary assessment

A summary assessment of the impacts is included below.

Scenario	Summary assessment	Description
Option 1	✓	Option will have an impact on improving air quality through reduction in emissions, but modelling suggests this will have small monetary value
Options 3	✓	Option will have an impact on improving air quality through reduction in emissions, but modelling suggests this will have small monetary value
Option 4	(✓)	Option will not impact on emissions, but will impact on exposure of residents to air pollution. But wider effects of air pollution will still exist

7.3 Implementation Costs

Each of the options will incur costs to implement. The nature of the costs will be determined by the detail of each option. Given the scope of this analysis, no quantitative estimate of the potential costs of the options has been made in this report. Instead, a qualitative assessment has been made and summarised below. It is likely that the costs will predominantly be upfront capital costs, but there may also be ongoing costs associated with some of the options. Further, there is likely to be a tangible difference in the costs between the options.

Scenario	Summary assessment	Description
Option 1	- -	**Capex:** There will be small, one-off costs associated with physically moving or removing bus stops, installing measures to prohibit parking (e.g. road markings) and prohibit turning right **Opex:** Likely to be no or only limited ongoing costs associated with these measures Overall there are only likely to be small costs associated with this

		measure, which is likely to be the least cost across those assessed
Option 3	- - - - -	**Capex:** There will be substantial upfront costs associated with the construction of a new bypass, whether this is one lane or two. This includes construction costs (e.g. structures, earthworks, etc), potential land and property costs (e.g. land acquisition) and preparation and administration costs (e.g. design, consultation, etc). **Opex:** There will be additional ongoing costs to maintain and repair the new bypass, although these are likely to be small relative to the upfront costs Overall costs of this option are likely to be substantial, and significantly greater than the other options
Option 4	- - - -	**Capex:** There will be a large upfront cost associated with the purchase and demolition of properties. Further, this option will also incur costs associated with planning, organisation and consultation of the measure. There may also be a hidden cost associated with potential delay whilst residents are consulted and the terms of purchases are negotiated. **Opex:** Likely to be no or only limited ongoing costs associated with these measures Overall, this option will incur substantial upfront costs. The cost of compulsory purchase and demolition will likely run into the hundreds of thousands, if not millions. However, this should still be cheaper than the construction of a new bypass.

7.4 Wider environmental Impacts

All options will have wider environmental impacts, separate to their effects on air pollution.

To the extent that the options will have an impact on air pollution through the reduction of fuel consumption, the options will also have a positive impact on Greenhouse Gas (GHG) emissions which are also associated with the combustion of transport fuel. Conserving GHG emissions carries with it the benefit of reducing the risk of climate change effects and helping the UK to meet its climate change targets. This can be valued using DECC's Supplementary Green Book Guidance which assumes a carbon price of £67/tonne in 2020. No quantitative estimate of change in GHG emissions has been made in this study and as such the monetary effect is not captured here. However, these impacts are likely to move in-step with air pollution effects and given these have been assessed to be small across the options, and impact on GHGs will also be small.

Through changing traffic flows, or changing the proximity of people to the traffic, this will also influence the noise impacts associated with road transport. Noise, like air pollution, can have a range of detrimental effects, for example on health, wellbeing, productivity and the natural environment. The annual social cost of urban road noise in England alone is estimated to be in the range of £7 to 10 billion[7]. For options 3 and 4, it is clear that there will be a positive impact on noise pollution. Under option 3, traffic and its associated noise are being moved away from a residential street to an unpopulated bypass, increasing the distance between the source of the road and receptors (the actual impact will depend on the design and site of the new road, but the construction of a new road brings with it a chance to manage noise sufficiently). Likewise, under Option 4, the exposure of the receptor to the noise source is again reduced, in this case through moving the receptor. For Option 1, the effects are less clear: this option will not reduce the traffic count along affected links, but instead will change the speed, flow and movement of the traffic along these routes. As such the impact here will depend on the design of the traffic management measures, their type and placement along the links, and proximity to households. However, as with air pollution, given the number of local residents

[7] https://www.gov.uk/guidance/noise-pollution-economic-analysis

is small (i.e. small number of receptors), the size of any change in effect on these residents is also likely to be small.

One further consideration, in particular for Option 3, is effects on landscape, habitats and biodiversity. The proposed option is for the bypass to run across fields to the south of the problematic links. Where this is the case, there may be a loss of landscape amenity (depending on current perceptions around this area of land) and a loss of habitat and potentially biodiversity (depending on the presence of local wildlife and importance of this land to those species). To determine the true nature of these effects would require a more detailed study, but the potential for these effects is highlighted here for consideration.

These wider environmental effects are summarised below.

Scenario	Summary assessment	Description
Option 1	• ✓	Option will have some GHG effect but likely to be small. Ambiguous impact on noise: could reduce noise associated with less stop/starting at bus stops but could increase noise associated with higher speeds of traffic.
Option 3	✓ / -	Option will have some GHG effect but likely to be small. Likely to be a positive effect on noise pollution, reducing negative associated effects. Potential for negative effects on landscape (and habitats)
Option 4	✓	Option unlikely to have any significant impact on GHG emissions. Likely to be a positive effect on noise pollution, reducing negative associated effects.

7.5 Further analysis

Further analysis of the cost effectiveness of viable measures will be undertaken after the consultation and engagement of stakeholders by Caerphilly County Borough Council. Once options and measures have been agreed more detailed analysis will be undertaken and feed into the final AQAP. Additional analysis will include:

7.5.1 Economic Impacts

- Travel time - Congestion / travel speed +ve
- Fuel costs
- Business / local economy
    - Road – creates jobs
    - Reduced congestion reduces travel time / costs - +ve
    - Less congestion / AP - more attractive place to visit
    - costs to business / households

7.5.2 Social Impacts

- Accident risk
- Modal shift
- Time cost / upheaval of compulsory purchase

7.5.3 Risk Factors

- Assumptions around traffic
    - That people will use bypass as predicted
    - That reduction in congestion will not increase traffic flows overall
- Where people will go under compulsory purchase
- Assumptions around emissions
    - Continue to fall from vehicles – erode AQ (and GHG) benefits over time

7.5.4 Feasibility and Acceptability

- Will options bring AQ benefits
- What options are acceptable

8 Next steps and consultation

This report has been prepared to evaluate and present options that Caerphilly County Borough Council can consider and take forward as a AQAP for the Hafod-yr-ynys AQMA.

This draft AQAP sets out the current and future predicted air quality and provides modelled scenarios and analysis of potential Action Plan measures. The Council will take forward this information to develop and finalise the Hafod-yr-ynys AQAP.

8.1 Stakeholder engagement

Stakeholder engagement is key in the process of developing the final AQAP. The Council set up a Steering Group at the beginning of the Action Planning process. The Steering group is made up of residents and local ward members, external stakeholders such as Public Health Wales and representatives from neighbouring authorities along with appropriate representatives from Caerphilly County Borough Council.

The steering group will support the Council in developing the final list of measures to put in the AQAP for submission to the Welsh Government. In addition, the steering group provides the Council with key partners who will form part of the delivery body responsible for implementing and monitoring the progress of the AQAP. Key delivery partners will be identified within the steering group meetings and the Council will work with these partners to set out the delivery programme and key milestones with the objective of working towards improved air quality and revocation of the Hafod-yr-ynys AQMA.

8.1.1 Review of AQAP measures

The measures developed within the draft AQAP are set out in in Appendix 2: List of AQAP measures. The measures take into account long term and short term measure options which the Council and delivery partners can potentially deliver to improve air quality. Key measures have been assessed through air quality modelling and analysis to determine their likely future impact, however the Council will also consider complimentary measures which will support long term objectives for improving air quality not only within the AQMA but across Caerphilly County as well.

The steering group will work with the Council to review and identify the key measures to take forward in the final AQAP. This review may be taken forward through a workshop or meeting forum, whereby the Council will present the options and discuss the viability of the measures with the stakeholders.

8.1.2 Finalising the AQAP

The AQAP will be finalised following a 12 week public consultation which will take place at the beginning of May following the local elections. The final Action Plan will then incorporate any comments / views from the public consultation and be formatted for presentation to the Welsh Government. Appendix 1 sets out the format of the report required by the Welsh Government

The AQAP to be consulted upon should include:

- details of which pollutants the authority will be taking action on, and an indication of the pollutant emission source(s);
- what local authorities are doing or will need to do to meet the action plan's objectives;
- the timescales for implementing each proposed measure and the emissions (and concentration, if possible) reductions expected by the end of the relevant review and assessment round (or by the specified date in the 2000 Regulations, as amended); and

- details of other individuals, bodies or agencies whose involvement is needed to meet the plan's objectives and what the authority is doing to encourage their co-operation.

8.2 Consultation process

The AQAP will follow the Welsh Government interim policy guidance (LAQM PG(16)) consultation process and is due to go out to a 12 week public consultation in May following the local elections.

Appendices

Appendix 1: Hafod-yr-ynys Air Quality Action Plan (Formatted for Welsh Government submission)

Appendix 2: AQAP list of measures

Appendix 3: Model Methodology and Verification

Appendix 1: Hafod-yr-ynys Air Quality Action Plan

The Hafod-yr-ynys AQAP will be set-out in a format as required the Welsh Government, in fulfilment of Part IV of the Environment Act 1995 - Local Air Quality Management.

(The following sections are set-out for the final AQAP submission to Welsh Government.)

Introduction

This report outlines the actions that Caerphilly County Borough Council will deliver between 2016-2020 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to the local authority's administrative area.

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

This Plan will be reviewed every five years at the latest and progress on measures set out within this Plan will be reported on annually within Caerphilly County Borough Council's air quality ASR.

Summary of Current Air Quality in Caerphilly County Borough Council.

The summary shall include pollutants of concern and the general air quality.

(A summary of air quality is presented in section 4 Local Air Quality Management and previous Assessments of Air Quality.)

Caerphilly County Borough Council's Air Quality Priorities

Public Health Context

(Details provided in section 3.)

Planning and Policy Context

Supporting planning and policy documents that will contribute toward improvements in air quality in Caerphilly County Borough and will be outlined in the full AQAP.

Source Apportionment

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of traffic emissions within Caerphilly County Borough Council's area. *(See section 4.5).*

Required Reduction in Emissions

The required emissions reductions will be presented in the final AQAP.

Key Priorities

The key priorities for Caerphilly County Borough Council and the Hafod-yr-ynys AQAP will be discussed through the engagement and consultation process (see Section 8).

Development and Implementation of Hafod-yr-ynys AQAP

AQAP Measures

The measures adopted within the AQAP have been created from a list of initial options considered by Caerphilly Borough Council. The measures taken forwards have been screened in terms of their social, economic and environmental acceptability. The measures and actions set-out in Appendix 2. are the Hafod-yr-ynys draft AQAP measures for consultation.

Action Plan option evaluation

The Action plan measures were evaluated on their effectiveness to reduce concentrations of NO_2 *(set-out in Section 6 Air Quality Action Plan modelling assessment*) and the evaluation of cost-benefit analysis for (*See section 7*). Further detailed economic analysis is recommended once stakeholder and community consultations feed-back on the draft AQAP.

Action Plan Delivery

The Action Plan will be delivered mainly by Caerphilly County Borough Council, in conjunction with other organisations, local businesses and schools to carry out the measures listed in the action plan. Engagement will be a key requirement to adopt the measures outlined in the action plan, key groups for engagement will include:

- Council member and key internal stakeholder engagement
- Steering group
- Community engagement
- Stakeholder engagement
- Powers
- Welsh Government support

Actions outside a local authority's control

Some of the actions needed to improve air quality may be outside the local authority's direct control. Therefore the Council will set-out which measures and delivery partners identified in the process who will support the delivery of measures.

Action Plan Implementation Schedule

Clear timescales in which the authority and other organisations propose to implement the measures within the plan.

Monitoring of the Action Plan Progress

Caerphilly County Borough Council's progress against the measures outlined in the Action Plan will be reported annually in the LAQM Annual Status Report for air quality. Monitoring carried out within the AQMA will also provide evidence on the progress of the action plan and the effectives of measures. Monitoring will continue to be undertaken for NO_2. Remote sensing surveys are currently being considered as a tool to collect further emissions data for the AQMA and the effectiveness of the Action Plan.

Monitoring measures and their effectiveness

Where possible quantification of the expected impacts of the proposed measures and an indication whether the proposed measures will be sufficient to meet the air quality objectives.

Effectiveness of the proposed of measures will be monitoring using both automatic and non-automatic monitoring of NO_2 concentrations within the AQMA.

Appendix 2: List of AQAP measures

Table A1. AQAP list of measures

Intervention Category	Measure (M)	AQ Impact	Timescale	Costs	Progress indicator	Responsible Authority
Strategic	**M 1.** Develop local polices in line with air quality – Local Transport plan, development plan, procurement plans	Low/long-term	2018	+	If any new plans or policies are put in place	Planning / Pollution Control / Procurement / Policy / Highways / any others deemed necessary
	M 2. Integrate with local well-being plans	Non quantifiable	2018	+		
	M 3. Provision of local air quality strategy for Caerphilly	Low/long-term	2018/19	+		
Long Term Infrastructure						
	M 4. Bypass for traffic to by-pass the area	High				CCBC Highways
	a. One-way rerouting for south-bound vehicles (A472 traffic toward A467(south)).	High/med	2025/30	++++++	- traffic reductions	However this project would require significant investments and would be reliant on external funding streams
	b. Two-way re-routing for southbound (A472 traffic) and east-bound (A467 traffic coming from south)	High	2025/30	++++++	- traffic reductions	
	M 5. Investigate the feasibility of trialling speed and flow management through enforcement of speed limits which will reduce vehicles accelerating up Hafod-yr-ynys Road.	Med	2019/20	+++	- pollutant emissions	Highways / External Agencies

	M 6. Investigate the feasibility of demolishing the housing on the southern boundary of the road. This would include Woodside Terrace, Woodside shops and Yr Adfa.	High				Pollution Control to lead with input from various services Again, this option would require significant investment and would be reliant on external funding streams.
	a. Remove all affected properties.		2020	++++	- number of exposed properties	
Smarter choices	**M 7.** Encourage Green Travel Plans for business, schools and CCBC.	Low	2018	+	- number of events/meetings to promote	Planning / Highways
Development Control	**M 8.** Use planning system, to secure air quality improvements	Low/long-term	2018/19	+	- number of traffic assessments undertaken and outcome	Planning / Pollution Control
	M 9. Traffic assessment for any proposed development that is likely to increase local traffic and add to congestion.	Low				Highways / Pollution Control / Planning
Awareness	**M 10.** Publicise alternative Transport available locally	Low	2018/19	+	- number of engagement events - number of school visits, number of signs/banners deployed	Highways
	M 11. Work with health improvements team to add air quality awareness to promotional and education packages.	Low		+		Pollution Control / Education / Policy Team
	M 12. Electronic “pollutant signage” within AQMA and local area	Low		+		Pollution Control / Highways
	M 13. Signs and banners for approved variable message sign in AQMA	Low		+		Pollution Control / Highways

Fleet operators (HGVS)	**M 14.** Travel plans for local HGV fleet operators (ECOstars)	Low	2019/20	++	- number of local business with travel plans in place	
Bus Emissions	**M 15.** Low emissions buses within the AQMA	Med	2020	++++	- number of LEB's operating through AQMA	Highways
Cycling/Walking	**M 16.** Improve walking routes to and from school	Low	2018/19	++	- length and number of new or renovated cycling network routes	Planning / Highways / Countryside
	M 17. Improvements in cycling network and routes and signage/publicity of cycling network					
	M 18. Green Travel plans for schools and local businesses					
Improve and reduce CCBC own emissions	**M 19.** Improvements CCBC Fleet	Low	2020	+	- difference in Euro standards	Fleet Management / various local authority services
	M 20. Encourage car sharing for CCBC staff and/or car-club			+	- number car shares/car club memberships	Policy Team
Monitoring	**M 21.** Continue monitoring NO_2 – increase diffusion tube network for evidence base if proposed measures are having an impact - additional façade monitoring	N/A	2017/18	+++	Installation/deployment of further monitoring	Pollution Control
Traffic and emissions monitoring AQMA	**M 22.** Install traffic monitoring - Identify real-time traffic volumes, speeds and classification - ANPR traffic information additionally provides age, Euro class and queuing information.	N/A	2017/18	++	Annual survey – traffic data	Pollution Control / Highways

	M 23. Roadside remote emissions monitoring - Consider trials to identify specific gross polluter vehicles, provide vehicle classification, age and loading on vehicles with integrated ANPR cameras.	N/A	2017	++	Bi-annual survey - emissions data for fleet profile	Pollution Control

Cost key:

+ =Low **++ = Medium** **+++ =High** **++++ =Very High** **+++++++= Extremely High**

Appendix 3: Model Methodology and Verification

Emission Factors

We have calculated vehicle NOx emissions using the latest vehicle emission factors as published in the COPERT version 5.0 (COPERT5) emission model. We have calculated these using our own in-house emissions calculator. The vehicle emission factors used therefore use the latest evidence base on emissions from Euro V and Euro VI light duty vehicles, these data supersede the COPET4v11 emission rates contained in the current Defra EFT v7.0.

COPERT is a software tool used world-wide to calculate air pollutant and greenhouse gas emissions from road transport. The development of COPERT is coordinated by the European Environment Agency (EEA), in the framework of the activities of the European Topic Centre for Air Pollution and Climate Change Mitigation. The European Commission's Joint Research Centre manages the scientific development of the model. COPERT has been developed for official road transport emission inventory preparation in EEA member countries. However, it is applicable to all relevant research, scientific and academic applications[8].

The COPERT methodology is part of the EMEP/EEA air pollutant emission inventory guidebook for the calculation of air pollutant emissions and is consistent with the 2006 IPCC Guidelines for the calculation of greenhouse gas emissions. The use of a software tool to calculate road transport emissions allows for a transparent and standardized, hence consistent and comparable data collecting and emissions reporting procedure, in accordance with the requirements of international conventions and protocols and EU legislation.

Background concentrations

Background NOx concentrations for a dispersion modelling study can be accessed from either local monitoring data conducted at a representative background site or from the Defra background maps[9]. In the future, background concentrations are expected to be lower than currently as the result of reductions in emissions throughout the UK; estimates of the reduction on background concentrations are provided in the background maps up to the year 2030.

In this case the 1km x 1km mapped background NOx concentrations for the appropriate grid square where the Hafod-yr-ynys AQMA is located were used for the assessment. CSV files containing the mapped background concentrations across the council area were downloaded and the concentration for the appropriate grid square extracted for both the baseline year of 2016 and the future scenario years. The sector contributions from road traffic emissions on A Class Roads were subtracted from the total background NOx concentration to avoid double counting of the road contribution when explicitly modelling road traffic emissions. The background concentrations used in the assessment are presented below.

It should be noted that the background maps are the outputs of a national scale dispersion model provided at a 1km x 1km resolution and are therefore subject to a degree of uncertainty.

Mapped background annual mean Oxides of Nitrogen (NO_x) concentrations used in the assessment

Year	NO_x background concentration ($\mu g.m^{-3}$)
2016	16.47
2020	13.00

NOx/NO_2 chemistry

It is necessary to convert the modelled road vehicle contribution of NOx concentrations to NO_2 for comparison with the relevant objectives.

[8] EMISIA (2017) http://emisia.com/products/copert (accessed Jan 2017)
[9] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc (UK background maps recently updated to 2013 base year and NAEI emissions inventory)

The latest release of the Defra NOx/NO_2 model was used to calculate NO_2 concentrations from the NOx concentrations predicted by ADMS-Roads. The model requires input of the background NOx, the modelled road contribution and the proportion of NOx released as primary NO_2.

Verification of the model and model performance

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations. This helps to identify how the model is performing at the various monitoring locations. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. LAQM.TG(16) recommends making the adjustment to the road contribution only and not the background concentration these are combined with.

It is appropriate to verify the performance of the ADMS Roads model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). To verify the model, the predicted annual mean Road NOx concentrations were compared with concentrations measured during 2016.

The model output of Road NOx (the total NOx originating from road traffic) has been compared with the measured Road NOx, where the measured Road NOx contribution is calculated as the difference between the total NOx and the background NOx value. Total measured NOx for each diffusion tube was calculated from the measured NO_2 concentration using the latest version of the Defra NOx/NO_2 calculator.

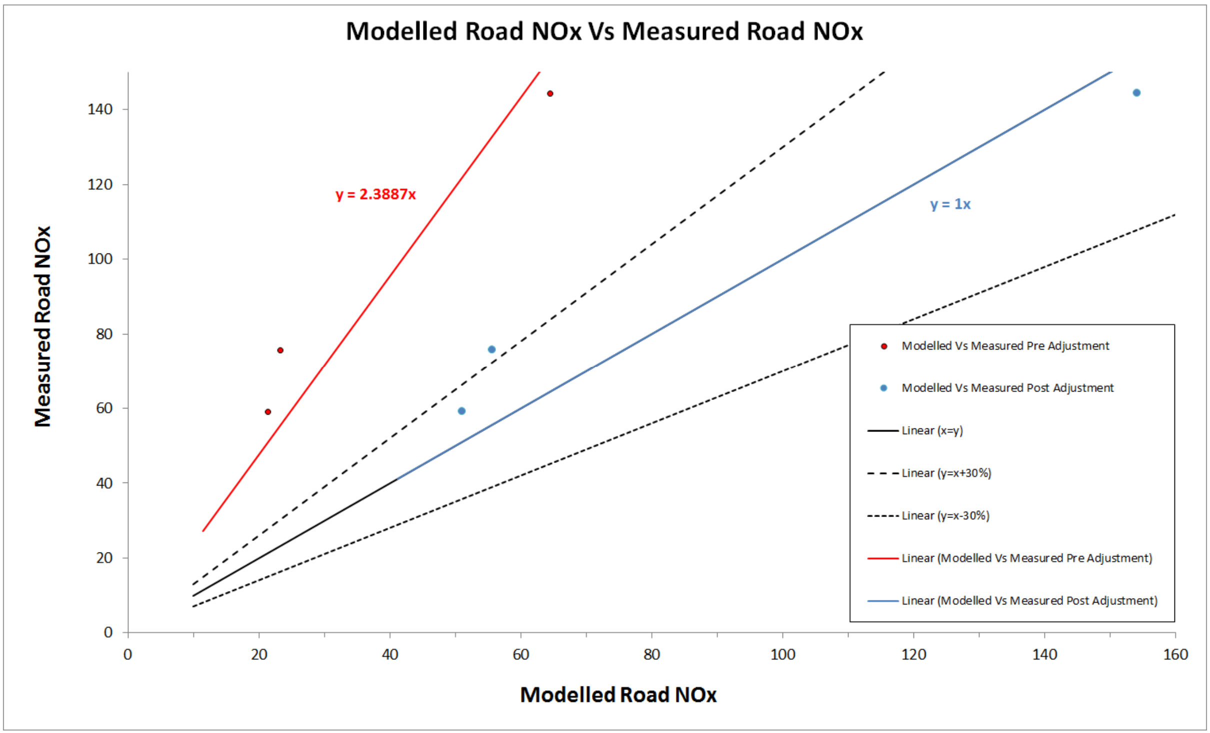
The initial comparison of the modelled vs measured Road NOx identified that the model was under-predicting the Road NOx contribution at some locations. Where possible, refinements were made to the model input to improve the overall model performance.

The gradient of the best fit line for the modelled Road NOx contribution vs. measured Road NOx contribution was then determined using linear regression and used as the adjustment factor. This factor was then applied to the modelled Road NOx concentration for each modelled point to provide adjusted modelled Road NOx concentrations. A plot comparing modelled and monitored Road NOx concentrations before and after adjustment is presented below.

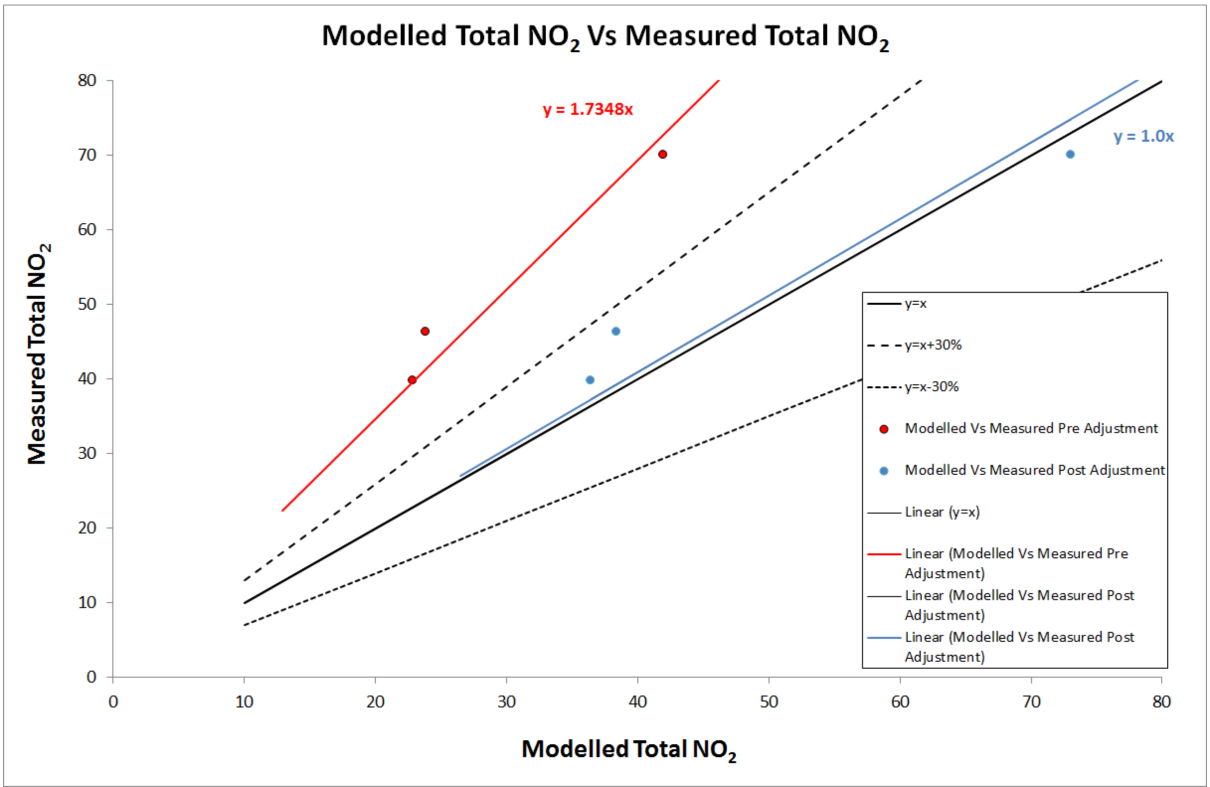
The background NOx concentration was then added to determine the adjusted total modelled NOx concentrations. The total annual mean NO_2 concentrations were then determined using the NOx/NO_2 calculator.

A primary NOx adjustment factor (PAdj) of **2.3887** was applied to all modelled Road NOx data prior to calculating an NO_2 annual mean. A plot comparing modelled and monitored NO_2 concentrations before and after adjustment during 2016 is presented below.

Modelled Road NO_x vs Measured Road NO_x 2016 before and after adjustment



Linear regression analysis of modelled vs. monitored NO_2 annual mean 2016



To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented below.

It is recommended that the RMSE is below 25% of the objective that the model is being compared against, but ideally under 10% of the objective i.e. 4 µg.m^{-3} (NO_2 annual mean objective of 40 µg.m^{-3}). In this case the RMSE is calculated at 4.55 µg.m^{-3}; the model uncertainty is therefore considered acceptable and the model has performed sufficiently well for use within this type of assessment.

Root mean square error

NO_2 monitoring site	Measured NO_2 annual mean concentration (µg.m^{-3})	Modelled NO_2 annual mean concentration (µg.m^{-3})
Automatic	70.0	73.1
CCBC48	39.7	36.4
CCBC50	46.3	38.4
	RMSE	**4.55**

Ricardo
Energy & Environment

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR
United Kingdom

t: +44 (0)1235 753000
e: enquiry@ricardo.com

ee.ricardo.com