Air Quality Action Plan: Inverness. Highland Council

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Experts in air quality management & assessment

Document Control

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Executive Summary

This Air Quality Action Plan for Inverness has been prepared to address concentrations of nitrogen dioxide (NO_2) to which people are exposed to at the junction of Academy Street and Queensgate, for which an Air Quality Management Area (AQMA) has been declared. The document is part of a statutory process for which local authorities are required to work towards improving air quality in locations where health based air quality objectives are not met.

Six broad areas of Action have been established to help deliver better air quality, with specific measures then identified for each of these Actions areas. The categories of Action are as follows:

- Action 1: Promote Smarter Travel Choices.
- Action 2: Actively promote low emission vehicles and supporting infrastructure.
- Action 3: Use the planning system to ensure that air quality is fully considered for new development.
- Action 4: Traffic management to reduce emissions in locations within the AQMA.
- Action 5: Communication to inform the public about health impacts of Air Pollution and how they can change behaviour to reduce emissions and reduce exposure
- Action 6: Continue to monitor and assess air quality in line with Government guidance on LAQM.

These Actions are evaluated in terms of their impacts on:

- air quality;
- cost;
- feasibility or practicability; and
- timescale for implementation.

An implementation plan is outlined, which includes a time scale for implementation for each measure and funding source. Ultimately the delivery of this Action Plan is dependent on adequate levels of resourcing, both for capital costs and staffing.

Inverness is the fastest growing city in Scotland and hence it is to be expected that traffic levels will increase in future. The measures highlighted in this Air Quality Action Plan should reduce concentrations of NO_2 at the relevant sensitive receptors, although it is too early to say exactly what impacts they will have on improving air quality. The Council is continuing to monitor air quality at several locations within and around the AQMA and will start real time monitoring on

Queensgate. The results of the monitoring will be made available through the annual review and assessment reports along with proxy measures for quantifying improvements.

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1 Introduction and Aims of the Plan

1.1 It is now well documented that air pollution adversely affects human health. Poor air quality has both long- and short-term health impacts, particularly for respiratory and cardiovascular health, including increased hospital admissions and premature death. The impacts are not distributed equally, with the effects on life expectancy being greatest for the elderly and those with pre-existing heart and lung conditions[1]. The World Health Organisation estimates that some 80% of outdoor air pollution-related premature deaths worldwide are due to heart disease and strokes, while 14% of deaths are due to chronic obstructive pulmonary disease or acute lower respiratory infections and 6% of deaths are due to lung cancer. The majority of health evidence relates to particulate matter (PM), but evidence associating nitrogen dioxide (NO_2) with health effects, including premature deaths, has strengthened substantially in recent years (Committee on the Medical Effects of Air Pollution, 2015).

1.2 Within the Highland Council area, air quality is generally very good. However, a location in central Inverness has been identified where pollutant levels are high. This location is at the junction of Queensgate and Academy Street. Local streets are relatively congested, with tall buildings either side of the road creating street canyons which reduce the dispersion of pollutants. The consequence is that annual mean NO_2 concentrations have exceeded the air quality objective, and an Air Quality Management Area has been declared by the Council.

1.3 The Action Plan set out in this document aims to reduce NO_2 concentrations, so as to meet the air quality objective. There is a growing body of evidence of the health effects arising from exposure to both NO_2 and particulate matter, and it is important that measures that reduce NO_2 do not inadvertently increase emissions of particulate matter, as there is no threshold for health effects of particulate matter (PM). In most cases, actions to reduce NO_2 should also reduce PM, especially where the actions aim to reduce traffic, but there may be some measures which increase PM, such as the use of certain exhaust treatment systems.

1.4 At a UK level, the Environmental Audit Committee published its third report on Air Quality in December 2014, which concluded that recommendations from its previous two reports had not been implemented. It concluded that the UK Government must act urgently to:

Meet EU nitrogen dioxide targets as soon as possible;

Engage with local authorities to establish best practice in tackling air pollution across the UK;

Adjust planning guidance to protect air quality in local planning and development; and

[1] Within the Highland Council area air pollution is estimated to account for up to 57 premature deaths per annum attributable to particulate matter $PM_{2.5}$
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/332854/PHE_CRCE_010.pdf

Examine fiscal and other measures to gradually encourage a move away from diesel vehicles towards low emission options.

1.5 Road transport is the main source of emissions in relation to NO_2, and to a lesser extent for particulate matter, with diesel vehicles likely to be making the biggest contribution within the AQMA. In particular, stop-start traffic (i.e. acceleration and deceleration) results in higher emissions.

1.6 This Air Quality Action Plan aims to reduce air pollution within the Inverness AQMA, in order to reduce the health impacts of current concentrations. It sets out how Highland Council, and its partners intend to act to locally reduce emissions of relevant pollutants. The document is part of a statutory process for which local authorities are required to work towards improving air quality in locations where health based air quality objectives are not met.

2 Context of Air Quality within Highland Council

Air Quality

2.1 Under Part IV of the Environment Act 1995, Local Authorities are required to review and assess air quality in their areas and to report against objectives for specified pollutants of concern, to the Scottish Government. For each air quality objective in the Regulations, local authorities have to consider whether the objective is likely to be achieved. Where it appears likely that the air quality objectives are not being met, the authority must declare an AQMA. Following the declaration of an AQMA, the authority must then develop an **Air Quality Action Plan** which sets out the local measures to be implemented in pursuit of the air quality objectives. Prompted by the Review and Assessment process, an AQMA has been declared in Inverness. The AQMA has been declared for NO_2 at the junction of Academy Street with Queensgate, with the main source of emissions being from road traffic (particularly where congested), often exacerbated by a lack of dispersion due to surrounding buildings.

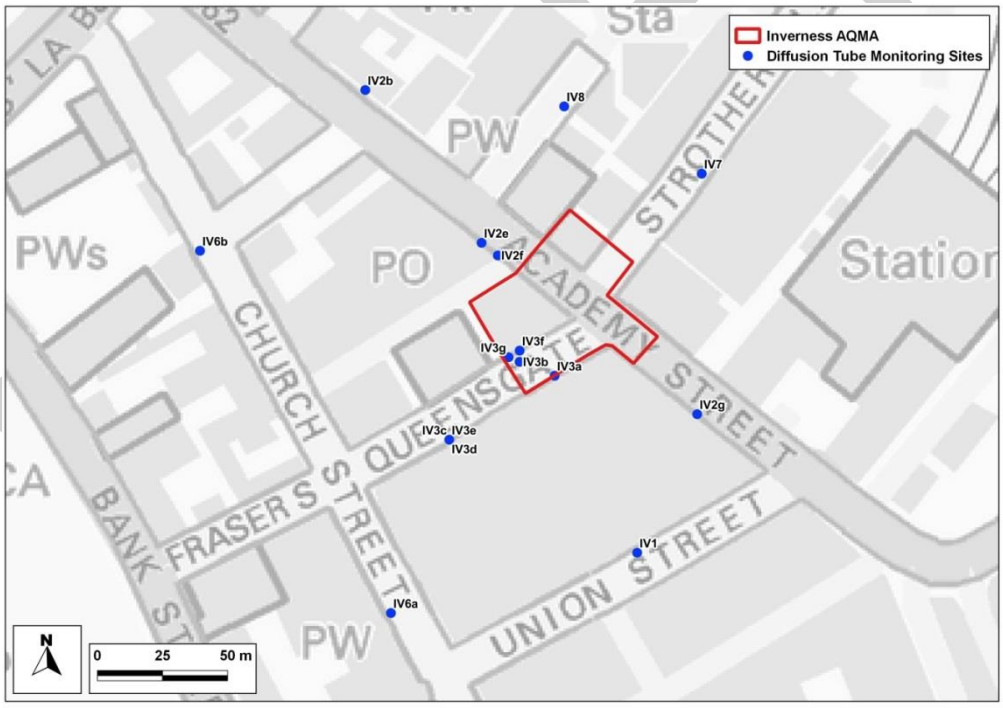

Figure 1: Inverness AQMA Showing Diffusion Tube Monitoring Locations

Source Apportionment

2.2 The overall contribution made by emissions of nitrogen oxides from motor vehicles, which includes both nitric oxide and NO_2, to measured NO_2 concentrations depends on a number of factors, including how the different species react in the atmosphere; in particular the reaction of nitric oxide with ozone, and the amount that is emitted directly as NO_2 (primary NO_2). Figure 2 shows the

contribution from different vehicle types to NO_2 concentrations including background, with the same information illustrated in **Figure** 3 as percentage contributions. At most of the locations in central Inverness (and in particular those where the objective is exceeded), the largest proportion of emissions is from buses, followed by cars. It should be noted that a UK average emission factor for buses has been used, which does not take into consideration the composition of the Inverness bus fleet, which includes 6 electric buses and a high proportion of Euro V buses.

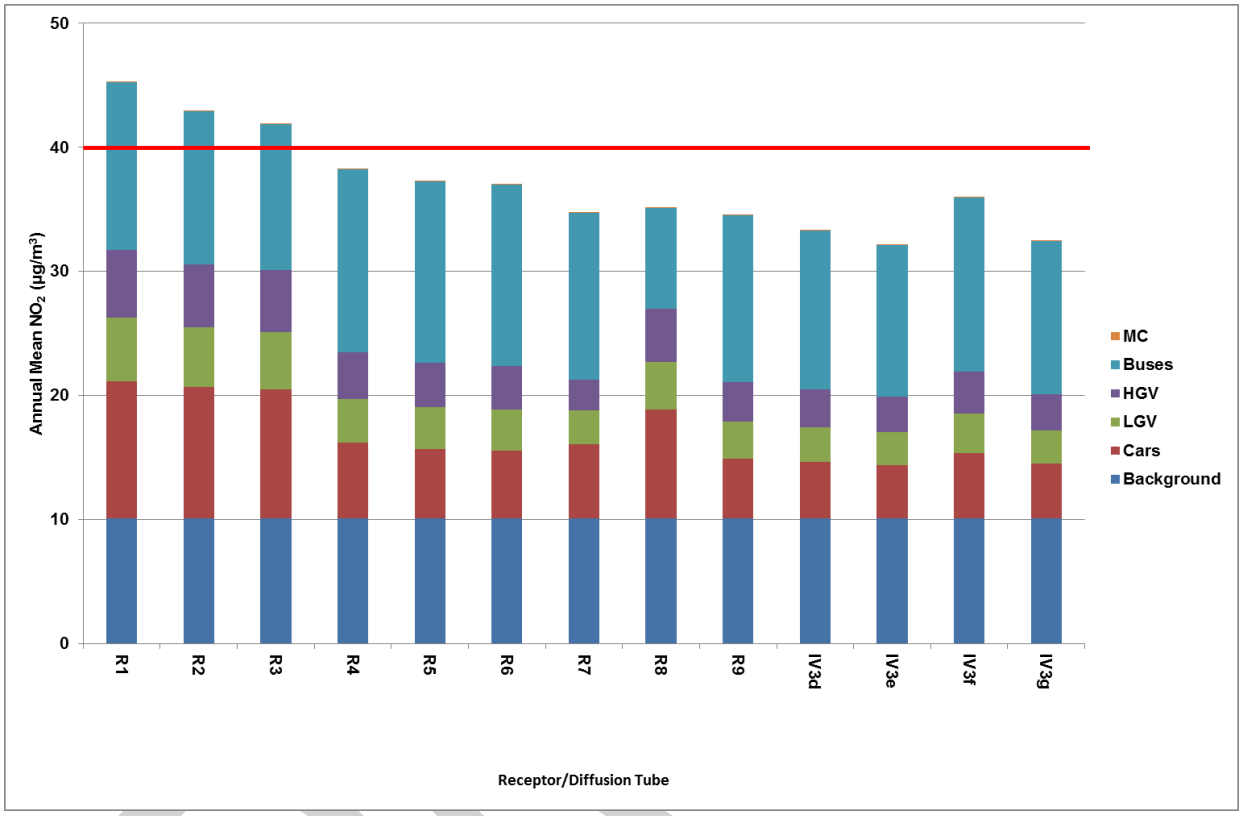

Figure 2: Apportionment NO_2 Concentrations by Source including Background (2014)

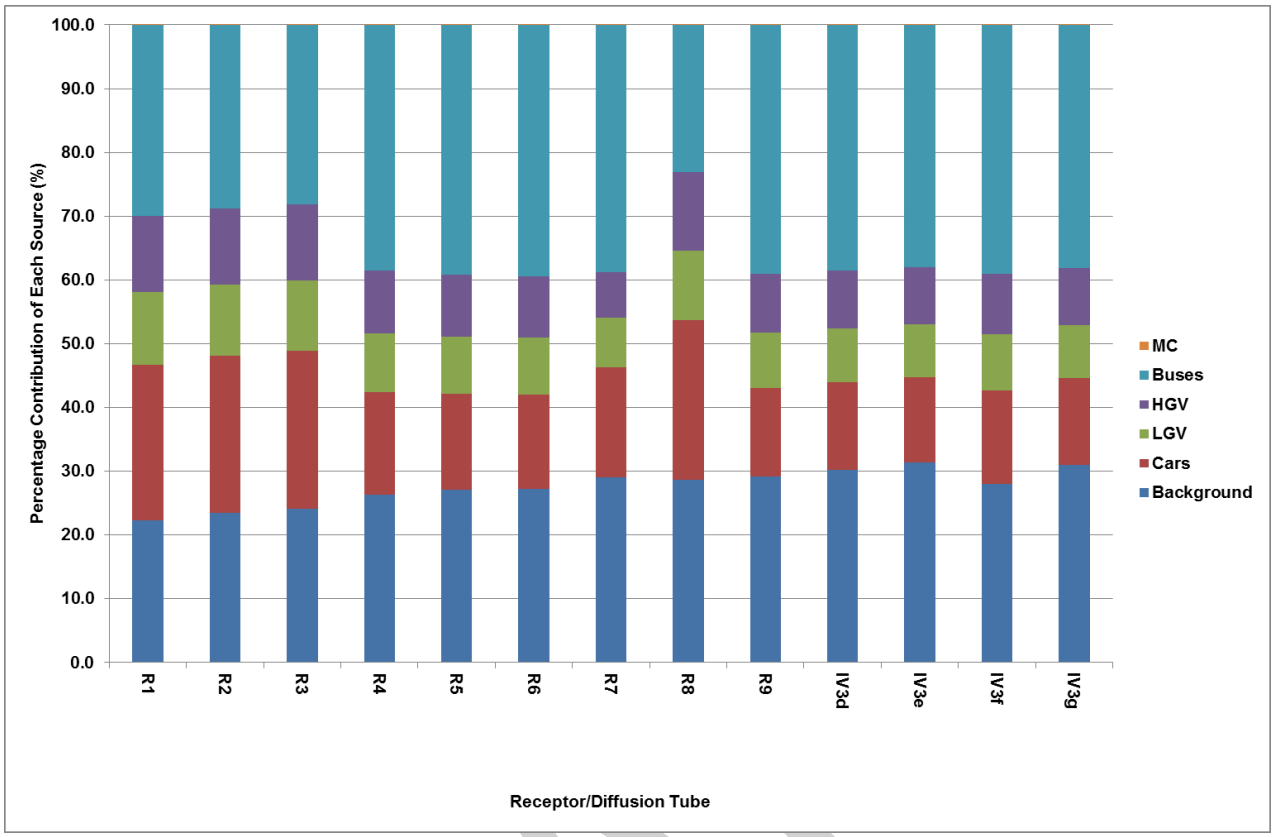

Figure 3: Apportionment NO_2 Concentrations by Source including Background as percentages (2014)

Improvements Required

2.3 The degree of improvement required to meet the annual mean objective is defined by the difference between the highest measured or predicted annual mean concentration and the 40 µg/m^3 objective level. The highest nitrogen dioxide concentration within the study area is that predicted by the model at Receptor 11 at second floor level (47.7 µg/m^3), requiring a reduction of 7.7 µg/m^3 in order for the objective to be achieved.

2.4 It is conventional to consider the improvement required in terms of the nitrogen oxides (NO_x). Different vehicle types are characterised by different proportions of primary NO_2 emitted, and so the reduction in NO_x required to achieve the nitrogen dioxide objective depends on the types of vehicle being managed. For example, the required degree of reduction of NO_x emissions will be different if it is brought about through reducing car emissions compared with reducing bus emissions. For the purposes of calculating the indicative data in Table 1, it has been assumed that any emission reductions are achieved without altering the composition of the vehicle fleet.

2.5 Table 1 shows that, at R11 (Second Floor) a NO_x reduction of 21.3 µg/m^3 would be required to achieve the objective. This equates to a reduction of 24.5 % in local road traffic emissions at this receptor location.

Table 1: Improvement Required in Annual Mean Nitrogen Dioxide and Nitrogen Oxides Concentrations in 2014 to Meet the Objective

Receptor	Required Reduction in Annual Mean Nitrogen Dioxide (NO_2) Concentration		Required Reduction in Road Nitrogen Oxides (NO_x) Concentration	
	µg/m^3	% of total predicted NO_2	µg/m^3	% reduction in road NO_x
R1 (First Floor)	5.3	11.7	14.3	17.9
R2 (First Floor)	2.9	6.9	7.8	10.7
R3 (First Floor)	1.9	4.4	4.9	7.0
R1 (Second Floor)	0.2	0.6	0.6	1.0
R11 (Second Floor)	7.7	16.2	21.3	24.5

2.6 It should also be borne in mind that congestion, which increases emissions, particularly where stop start traffic is common, and the local street topography (i.e. 'street canyons' which limit dispersion) are important contributors to the high concentrations. The latter cannot be affected, but measures to reduce congestion can be an effective Action Plan measure, alongside measures to reduce NO_x emissions.

Robustness of Data/ Uncertainty

2.7 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

2.8 An important stage in the process is model verification, which involves comparing the model output with measured concentrations. Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2014) concentrations.

2.9 Historically, large reductions in nitrogen oxides emissions have been projected, which has led to significant reductions in nitrogen dioxide concentrations from one year to the next being predicted. Over time, it was found that trends in measured concentrations did not reflect the rapid reductions that Defra and the DfT had predicted (Carslaw et al., 2011). This was evident across the UK, although the effect appeared to be greatest in inner London; there was also considerable inter-site variation. Emission projections over the 6 to 8 years prior to 2009 suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25%,

whereas monitoring data showed that concentrations remained relatively stable, or even showed a slight increase. Analysis of more recent data for 23 roadside sites in London covering the period 2003 to 2012 showed a weak downward trend of around 5% over the ten years (Carslaw and Rhys-Tyler, 2013), but this still falls short of the improvements that had been predicted at the start of this period.

2.10 The reason for the disparity between the expected concentrations and those measured, relates to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have had to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles has often been no better than that of earlier models. This has been compounded by an increasing proportion of nitrogen dioxide in the nitrogen oxides emissions, i.e. primary nitrogen dioxide, which has a significant effect on roadside concentrations (Carslaw et al., 2011) (Carslaw and Rhys-Tyler, 2013). In relation to this study, the figures presented are as robust as they can be in light of the various uncertainties outlined above, but the figures should be interpreted as the best available estimates of concentrations within the study area.

2.11 Quantification of measures has not been possible within the context of this Action Plan. Uncertainties surrounding the impacts of the measures (such as the impacts of a smarter choice travel package in terms of modal shift, or the impacts of a communication strategy) mean that these impacts cannot be translated into concentration improvements.

3 Existing Policies, Strategies and Programmes

Cleaner Air for Scotland. The Road to a Healthier Future

3.1 Cleaner Air for Scotland. The Road to a Healthier Future (CAFS) was published in November 2015 and is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health. The document sets out the Scottish Government's vision that '*Scotland's air quality will be the best in Europe*' and then sets out a number of measures within different policy areas in order to work towards achieving this vision. In addition, a new National Modelling Framework (NMF) is proposed, which will provide a significant proportion of the quantitative evidence for the National Low Emission Framework (NLEF) also described within the document. The NMF will provide a standardised approach to modelling air quality at both regional and local levels, ensuring consistency across Scotland. The NLEF is designed to enable local authorities to appraise, justify the business case for, and implement a range of, air quality improvements options related to transport (and associated land use).

Local Transport Strategy

3.2 The most recent Highland Local Transport Strategy covered financial years up to 2013/14. The Highland Council LTS Vision is as follows:

> *Through its Local Transport Strategy, the Highland Council seeks to enable and facilitate sustainable development and economic growth; support, include and empower communities through transparent decision-making, and establish an integrated transport network which supports safe and sustainable environments in which people can live, work and travel.*

3.3 LTS objectives include the following:

> *Environment: Manage/reduce the impacts of transport on the natural and built environment;*
>
> *Health: Increase levels of cycling and walking to promote health improvement and modal shift;*
>
> *Traffic reduction: Where appropriate consider targets for reducing traffic, although noting the variation in conditions and requirements between rural and urban areas.*

3.4 The LTS has a sub objective '*To protect and enhance the current air quality of the Highland area*'.

Local Development Plan

3.5 The Inner Moray Firth Local Development Plan was adopted on 31 July 2015. The document sets out the policies and land allocations to guide development in the Inner Moray Firth area over the following 20 years. It sits alongside the Highland-wide Local Development Plan which was adopted in 2012. The Highland-wide Local Development Plan has the following Policy 73 addressing air quality:

> *Development proposals which, individually or cumulatively, may adversely affect the air quality in an area to a level which could cause harm to human health and wellbeing or the natural environment must be accompanied by appropriate provisions, such as an Air Quality Assessment, (deemed satisfactory to the Local Authority and SEPA as appropriate) which demonstrate how such impacts will be mitigated. Some existing land uses may have a localised detrimental effect on air quality. Any proposals to locate development in the vicinity of such uses and therefore introduce receptors to these areas (e.g. housing adjacent to busy roads) must consider whether this would result in conflict with the existing land use. Proposals which would result in an unacceptable conflict with the existing land use to air quality impacts will not be approved.*

3.6 Alongside these Local Development Plans, the Council has published the Inverness City Centre Development Brief (2012) which identifies opportunities for the regeneration and enhancement of the City Centre. The Development Brief refers to a number of opportunity sites on and around Academy Street, and provides guidance on the layout and uses appropriate to each location. A review of the Development Brief will be carried out in 2016 with a draft document to be reported to the City Committee in the autumn.

Climate Change

3.7 In 2007, Highland Council signed Scotland's Climate Change Declaration. In becoming a signatory of the Declaration, Highland Council has made a commitment to cut greenhouse gas emissions, set timescales and targets for action and publish an annual progress report. This commitment (previously voluntary) has now been replaced with mandatory climate change reporting to the Scottish Government. The Council is working with partners to address climate change issues in the Highlands, as outlined through Commitment 7 in the Highland First programme (“7. Helping Communities Reduce their Energy Use and Costs. The Council, with partners, will support communities to reduce their energy use and associated carbon emissions and costs.”). There are a variety of projects currently being developed to deliver improvements in energy efficiency which will also reduce greenhouse gas emissions. It would also be beneficial that these projects deliver wider air quality improvements where possible.

3.8

Smart Cities Project

3.9 The Smart Cities Project is a European-funded project incorporating all 7 Scottish Cities looking at developing 'smart city' infrastructure. The work programmes are currently being developed, but are likely to include a wireless, adaptable, integrated Urban Traffic Management System for Inverness, which would then enable other projects such as adaptive bus priority, real time transport displays, integrated ticketing and the development of smart parking to be implemented.

Physical Activity Strategy

3.10 The Physical Activity Strategy for Highland (Active Highland Strategy) is currently in development with community planning partners and other key agencies. The main themes relate to encouraging physical activity from the earliest age and throughout life, maintaining and improving Highland's active infrastructure (people and places including the natural environment) and improving the opportunities to participate in sport. The Physical Activity strategy will support some of the measures outlined in this plan, particularly those relating to active travel.

4 Actions for Improving Air Quality

4.1 Some of the following Actions are already underway, with others in the early planning stages, or do not have funding associated with them yet. The Actions therefore have different likely implementation timeframes. There are 6 broad Actions and for each of them, specific measures have been included.

Evaluation Approach

4.2 The Actions are evaluated in relation to their expected impact on:

- air quality (i.e. reduction in emissions or concentrations);
- cost;
- feasibility or practicability of option (including the wider non-air quality impacts); and
- timescale for implementation.

Air Quality Impact

4.3 Air quality impacts have been classified to represent 'low 'to 'high' impact. The higher the impact, the greater the improvement in air quality, i.e. the greater the reduction in NO_2 concentrations. For each Action, the expected reduction in annual mean NO_2 concentrations has been determined based on professional judgement, drawing, wherever possible, on experience gained from other studies. It should be noted that the impacts on air quality are judged in relation to the impacts within the AQMA(s). So, for example, an Action may have wide reaching benefits, but only be slightly beneficial within the AQMA(s). The following classification scheme has been used:

Low: *imperceptible* (a step in the right direction). Improvements unlikely to be detected within the uncertainties of monitoring and modelling;

Medium: *perceptible* (a demonstrable improvement in air quality). An improvement of up to 2μg/m^3 NO_2, which could be shown by a modelling scenario. Improvement is not likely to be shown by monitoring due to confounding factors of the weather; and

High: *significant*. Improvement of more than 2μg/m^3 NO_2. Can be clearly demonstrated by modelling or monitoring (a significant improvement is likely to be delivered by a package of options rather than by a single intervention).

Cost

4.4 The implementation of the measures set out in this Action Plan are dependent on securing a sufficient and consistent level of funding both to support any additional staff that may be required,

and to deliver the programme. In line with current Government guidance, it is not necessary to carry out a detailed cost-benefit analysis. Rather the aim is to provide a broad indication of costs so that the proposed measures can be ranked according to the cost and the expected improvement to air quality. Costs are represented as follows:

'Very Low' cost is taken to be £10K and under;

'Low' cost is taken to be £10 - £50K;

'Medium' cost is £50 - 500K;

'High' cost is £500K - £2 million; and

'Very High' cost is over £2 million.

Feasibility

4.5 The feasibility of individual measures is not straightforward to quantify. The following factors have been taken into consideration:

- alignment / synergies with other Highland Council initiatives, strategic initiatives such as The Highland-wide Local Development Plan, The Inner Moray Firth Local Development Plan or Local Transport Strategy;
- wider non-air quality impacts (social, environmental or economic);
- stakeholder acceptance / "political" feasibility; and
- source of funding available or possible.

The Feasibility has been judged as follows:

Low feasibility;

Medium feasibility;

High feasibility.

Timescale

4.6 The timescale for the implementation of measures has also been considered. The following classifications have been used: **Short-term** relates to those measures that can be implemented within the 2016/17 financial year; **Medium-term** relates to those implemented within 2-5 years; **Long-term** options are those which are 6+ years.

Action 1: Promote Smarter Travel Choices

4.7 The traditional approach to meeting the demand for an increasing number of cars in towns and cities has typically centred around the implementation of 'hard measures' which are based on physical improvements to the transport network, such as creating road space, traffic controls, etc. In recent times this established approach is increasingly being recognised as unsustainable, with a tendency to create places that are based around the motorised vehicle and are not for people who wish to use more active and sustainable forms of transport. The use of 'softer measures' is gradually being seen as an important aspect of creating multi-modal environments. 'Softer measures', sometimes referred to as 'smarter measures', are defined as interventions that are designed to influence behaviour away from single occupancy car use to more active and sustainable forms of travel such as walking, cycling, public transport or car sharing.

4.8 The use of 'softer measures' is already embodied in Highland Council policy and central to the Council's strategy for sustainability is the removal of barriers to cycling and walking and the development of an efficient public transport network within urban centres such as Inverness. Enhancing the train station environment (including cycle parking) is already underway through the Scotrail Abellio franchise. There is also a current bike hire scheme with 6 electric bikes in 2 locations in central Inverness, run by CoWheels. A Statutory Quality Partnership[2] is also currently under negotiation with Stagecoach, which may provide a means for implementing actions relating to buses specifically. All schools have developed Safe Travel Plans which are supported by Highland Council Road Safety team. There are a number of initiatives incorporated in these plans which support Active Travel. SEPA has developed an air quality teaching package in association with North Lanarkshire Council (http://www.learnaboutair.com/index.html) which could also be used in schools within Inverness[3].

4.9 In 2011 an Active Travel Audit of Inverness was undertaken (Halcrow Group Ltd, 2011), with the overall aim of assessing where best to apply available funding in order to increase the potential for active travel and ideally to see an increase in the numbers of people choosing to walk or cycle. It was concluded that existing levels of active travel in Inverness are high, with both walking and cycling far exceeding the national average. Inverness is a rapidly expanding city and it should be a priority to maintain and promote active travel to and from new developments. The Scottish Government target of 10% of all journeys by bike by 2020 published in the Cycling Action Plan for Scotland is achievable in Inverness, perhaps more so than in other cities. This target should be used to assist in the leverage of funding for infrastructure improvements and for the promotion of Inverness as a "Cycling City".

[2] An SQP is an agreement between a local authority and public transport operators as defined in the Transport (Scotland) Act 2001. The local authority provides facilities for the operation of public transport and key to the scheme is that to use the facilities, bus operators need to satisfy the standards of service set by the transport authority.

[3] More details about the package can be found at http://media.sepa.org.uk/media-releases/2015/changing-our-children-s-choices-to-tackle-air-pollution/

4.10 The Council is currently investigating options for improving the area around Station Square and the Victorian Market, and connections to and from the rail and bus stations. It is also investigating longer term options for achieving a better balance between pedestrian, cycle and traffic movement on Academy Street, including streetscape improvements that could complement the Inverness Townscape Heritage project launched in October 2015.

4.11 In addition, a pilot project for integrated ticketing on public transport is currently underway in Lochaber. Whether this initiative extends to the rest of the Highland area will be reviewed. In the context of this Action Plan, integrated ticketing should encourage use of public transport, and hence is supported. It is not however included as a specific measure because it is considered that within the AQMA it is likely to have minimal impact.

4.12 Specific measures will include;

- enhancement to train station and cycle parking;
- further encouragement of active travel, including supporting infrastructure, such as cycle lanes, cycle priority etc., where necessary;
- making Academy Street more pedestrian friendly (wider pavements, crossing points etc);
- developing a Cycling Strategy to encourage greater levels of cycling and support the 'Cycling City' concept;
- developing Travel Plans for Highland Council and other major employers, potentially including ecodriving lessons;
- feasibility study of wider bike-hire scheme in Inverness;
- engaging with schools
- promotion and encouragement of online tool for car sharing (http://ifyoucareshare.com/).

Options considered but not taken forward as part of this plan are:

- a Park and Ride (because of minimal impact on the AQMA);
- a Car Club (previously tried and investigated - business case doesn't demonstrate viability);
- integrated ticketing on public transport (see text above).

Table 2: Evaluation of Action 1

ACTION 1	Promote Smarter Travel Choices
Air Quality Impact	Emissions from transport form the biggest single contributor to NO_2 concentrations in Inverness. Increasing the use of public transport and active travel, such as walking and cycling, as well as car sharing, should reduce single occupancy car use and hence improve air quality, as well as mitigate against climate change. It is judged that initially benefits to air quality would be **Low**, but should progressively increase over time depending on the level of investment. **Low/ Medium** impact depending on level of investment.
Cost	The cost of implementing smarter choices options as an overall package would be **Medium** to **Very High**, although the costs of individual options would be **Low** to **Medium**.
Feasibility	**High** feasibility as politically acceptable. Aligns with Highland Council policies. Positive impacts for health, climate change gas emissions and potentially noise.
Ownership	Highland Council.
Partners	HiTrans, Scottish Government, Cycling Scotland, Sustrans.
Funding	Scottish Government, European Regional Development Fund, developer contributions (based on policy/ supplementary guidance).
Timescale	**Short** to **Long** term.

Action 2: Actively Promote Low Emission Vehicles and Supporting Infrastructure

4.13 Highland Council is already promoting Electric Vehicles, through the installation of an electric charging point in the Cathedral Car Park, Asda, as well as those in a number of hotels, the Highland Council car park, Inverness College and Scottish Government Inverness. This action will enhance the promotion of Electric Vehicles in particular and Low Emission Vehicles more widely. It will also include measures to investigate the feasibility of reducing emissions from the taxi sector, either through reducing idling within the vicinity of the AMQA, or reducing emissions on a more widespread basis by using the taxi licensing system to reduce emissions from the taxis.

4.14 Also proposed is an ECO Stars Fleet Recognition Scheme, which is a free scheme that aims to help fleet operators improve efficiency, reduce fuel consumption & emissions and thereby make cost savings. The scheme provides recognition for best operational practices, and guidance for making improvements. Originally set up in South Yorkshire in 2009 by the four local councils, the scheme has now been adopted by numerous other council areas across the UK (including some in Scotland) as well as several cities across Europe.

4.15 Specific Actions will include giving reasonable consideration to the following:

- investigating the feasibility of increasing the number of low emission buses in Inverness. Discussions will be needed with bus companies and funding through the Bus Investment Fund explored;
- limiting buses to those above a particular Euro standard (this could be implemented through the SQP[4]);
- introducing further electric charging points in Inverness town centre and on the road network in the Highlands;
- investigating using lower emission vehicles within the Council's fleet which are likely to be used within Inverness;
- using the taxi licensing system to reduce emissions from taxis;
- feasibility study investigating the use of parking charge differentiation for low emission vehicles;
- promotion of the Ecostars system for lorries, buses or taxis.

Table 3: Evaluation of Action 2

ACTION 2	**Actively promote low emission vehicles and supporting infrastructure**
Air Quality Impact	As the proportion of Ultra Low Emission Vehicles such as electric vehicles increases, emissions of NO_x and PM_{10} will decrease and concentrations will reduce. There will need to be a large swing towards electric vehicles before improvements are measurable. Therefore initially benefits to air quality would be **Low**, but should progressively increase over time depending on the level of investment.
Cost	Costs will largely be dependent on the level of investment gained. In order to make a difference to the vehicle parc[5], it is considered that the overall investment would need to be **High** or **Very High**. The costs of individual options (such as Ecostars) would be **Low** to **Medium**.
Feasibility	**Medium** feasibility.
Ownership	Highland Council
Partners	Switch on Scotland, HiTrans, Bus operators, Taxi operators.
Funding	Switch on Scotland, Bus Investment Fund, Scottish Government Air Quality Grants.
Timescale	**Short** to **Long** term.

[4] The mechanism for implementation would be investigated but could include a Traffic Regulation Condition.

[5] Total number of vehicles in use

Action 3: Use the planning system to ensure that air quality is fully considered for new development

4.16 Inverness is the fastest growing city in Scotland and the associated potential growth in traffic that this is likely to generate means that this action is critical to ensure not only that air quality improvements come to fruition, but that the status quo is maintained. It is imperative that the planning system is utilised to ensure that new development can support the Air Quality Action Plan, rather than hinder its implementation. It is recognised that this action relates both to developments that may increase emissions of pollutants, and those which may introduce relevant exposure into areas which are already polluted.

4.17 The Highland Wide Local Development Plan (April 2012), Policy 73 states that:

Development proposals which, individually or cumulatively, may adversely affect the air quality in an area to a level which could cause harm to human health and wellbeing or the natural environment must be accompanied by appropriate provisions, such as an Air Quality Assessment, (deemed satisfactory to the Local Authority and SEPA as appropriate) which demonstrate how such impacts will be mitigated.

Some existing land uses may have a localised detrimental effect on air quality. Any proposals to locate development in the vicinity of such uses and therefore introduce receptors to these areas (e.g. housing adjacent to busy roads) must consider whether this would result in conflict with the existing land use. Proposals which would result in an unacceptable conflict with the existing land use to air quality impacts will not be approved.

4.18 Supplementary Guidance (SG) on air quality could be used to prescribe how the above policy will work in practice. An SG document could include issues such as which types of development require an air quality assessment, considerations for air quality assessments, technical details of what needs to be included, as well as determining the significance of the predicted impact on air quality and defining when mitigation would be required, and the sorts of mitigation which should be considered. At a practical level, much of this information is already included within the EPUK/ IAQM Planning Guidance and it is suggested that this is used as the basis for local decisions on when an air quality assessment is required, and what that assessment should include. There is potential for additional air quality guidance within the forthcoming update of the Supplementary Guidance on Developer Contributions.

4.19 Specific Actions will include:

- ensuring that relevant planning applications are identified in consultation with EH officers. This should include both introducing relevant exposure into central Inverness streets, and ensuring that developments generating traffic which may impact on the AQMA are fully addressed;

- ensuring that planning applications with potential air quality impacts are fully assessed for their impacts, at relevant locations using appropriate methodologies (methodologies could be outlined within a Supplementary Guidance Document);
- ensuring that appropriate mitigation is not only proposed but also implemented where any relevant impacts are identified;
- encouraging Travel Plans for relevant new developments;
- encouraging Electric Vehicle infrastructure through the planning system;
- providing information re: sustainable transport for residents of new developments.

4.20 Option considered but not taken forward is:

- the compulsory purchase of existing flats within the AQMA (as not politically acceptable)

Table 4: Evaluation of Action 3

ACTION 3	Using the planning system to ensure that air quality is fully considered for new development
Air Quality Impact	In the longer term, the air quality impact of ensuring new development takes air quality into consideration is likely to have a **High** impact on air quality. In the shorter term, the impact will be **Low**.
Cost	**Low** cost for Highland Council.
Feasibility	**High** feasibility assuming political will.
Ownership	Highland Council.
Partners	Scottish Government, Developers.
Funding	Section 75 Planning Obligation.
Timescale	Short to Long term. Ongoing over the timescale of the Local Development Plan (and beyond).

Action 4: Traffic management to reduce emissions in locations within the AQMA

4.21 Controlling the road network to ensure that traffic flows smoothly will be critical to the success of this Action Plan. Inverness was the first city in the UK to implement a SCOOT (Split Cycle Offset Optimisation Technique) system which uses current conditions in real time to allow a quick response to any changes, through changes to the traffic light phasing. In addition to this, a major new link, West Link, will complete the link between the Dores Roundabout and the A82 at Torvean, crossing the River Ness. A new river crossing should help reduce congestion in the city centre.

4.22 As the largest component of local NO_x emissions is buses, they also need consideration. This Action Plan will not provide detailed plans for reviewing bus routes, but instead proposes a review of bus movements in central Inverness, the outcomes of which will be used to inform the way forward.

4.23 In addition, a study investigating specifically the phasing of traffic lights (plus any other measures) at the junction of Queensgate and Academy Street using microsimulation modelling is proposed, subject to funding. Measures, which aim to smooth traffic flow, rather than reduce traffic, are not well characterised by modelling using traditional methods which rely on average speed emission factors. Therefore, it is proposed that microsimulation traffic modelling coupled with instantaneous emission factors could be used to more accurately identify emissions for different scenarios based on acceleration and deceleration profiles. Emissions changes would then be modelled using the ADMS-Roads model to calculate concentration changes, particularly at relevant locations.

4.24 Specific measures will include:

- using the SCOOT system more effectively to ensure traffic is not queuing on Queensgate/ Academy Street. This may be undertaken as part of the Smart Cities initiative;
- study using microsimulation modelling to more accurately investigate impacts of traffic light phasing at the Queensgate/ Academy Street junction;
- reviewing bus movements round Inverness, both in terms of routes in and out of the bus station, bus stops and routes around the city centre;
- completion of West Link;
- investigating the feasibility of shortening delivery hours to reduce delivery vehicles causing congestion at peak hours in central streets; and
- investigating the feasibility of taking refuse collection vehicles out of the city centre at peak times.

4.25 Option considered but not taken forward is:

- banning traffic from Academy Street (as not feasible).

Table 5: Evaluation of Action 4

ACTION 4	Traffic management to reduce emissions in locations within AQMAs
Air Quality Impact	Reviewing the bus movements, and implementing recommendations in a way that would be positive for air quality could potentially have a **medium** impact on air quality. West Link is likely to have a minimal impact, but may take some traffic out of the city centre. Reducing potential additional congestion due to delivery vehicles stopped in peak hours will have a **low** impact. SCOOT may also have a **medium** impact.
Cost	**Low** to **Medium** for the specific measures, other than West Link which is being implemented anyway.
Feasibility	**Medium** feasibility.
Ownership	Highland Council.
Partners	HiTrans, Bus Operators.
Funding	Potential SCOOT funding from Scottish Government. West Link already funded.
Timescale	**Short** to **Long** term.

Action 5: Communication to inform the public about health impacts of air pollution and how they can change behaviour to reduce emissions and reduce exposure

4.26 Air quality is a key issue for Public Health, as exposure to high levels of air pollution can have adverse effects on the health of the population. This is because pollutants can exacerbate conditions such as asthma, and contribute to the risk of developing respiratory and cardiovascular disease, as well as lung cancer. These conditions are more likely to be present in people living in areas of deprivation, and nationally, evidence highlights linkages between the most deprived areas experiencing the worst air quality, thereby exacerbating health inequalities.

4.27 Active travel would lessen these health inequalities, as well as improve the health and wellbeing of people and achieve positive public health outcomes. For example, if people choose to walk and cycle more there would be a reduction in transport pollution, as well as an increase in physical activity. Not only will this increased activity lead to a reduction in obesity levels, and health conditions associated with obesity, evidence shows that exercise improves mental wellbeing, leading to greater feelings of revitalisation and a reduction in depression and anxiety.

4.28 An active travel map for inverness has been produced by Hitrans and Highland Council, utilising funding from the Bus Investment Fund, and real time information on bus stops has been expanded. In addition, the Inverness City Partnership has produced a leaflet for the public which encourages cycling by highlighting how commuters and tourists can

cycle in and around Inverness.

4.29 Specific measures will include:

- communicating with residents within the AQMA about the issues and this Action Plan;
- improving bus information provision;
- further Real time bus information;
- supporting existing campaigns for active travel, such as the Inverness City Partnership initiatives;
- providing appropriate signposting to car parks and other destinations (where possible routing cars on a more appropriate direction away from Academy Street);
- improving communications within the Council (to ensure that other policy areas don't conflict with air quality improvements). This would initially entail a workshop for Council Officers to raise awareness of the issues.

Table 6: Evaluation of Action 5

ACTION 5	**Work with Public Health colleagues to inform the public about health impacts of Air Pollution and how they can change behaviour to reduce emissions and reduce exposure**
Air Quality Impact	**Low** in relation to the AQMA, but required as a complementary measure to traffic management, Smarter Travel and Low Emission Vehicles.
Cost	**Low** cost for each of the elements of this measure. As a whole the Action is likely to be **Medium** cost.
Feasibility	Highly feasible option as it aligns with existing initiatives etc.
Ownership	Highland Council
Partners	NHS Highland, HITrans, Bus Operators.
Funding	Scottish Government Air Quality Grants and Public Health funding.
Timescale	**Short** to **Medium** term.

Action 6: Continue to monitor and assess air quality in line with Government guidance on Local Air Quality Management

4.30 The Scottish Government is currently consulting on changes to LAQM, with changes to the reporting process likely in order to simplify procedures for local authorities. It is also likely that some objectives will be dropped from LAQM, but with $PM_{2.5}$ to be included within the process. Highland Council currently monitors extensively for NO_2 and this Action will retain this commitment.

The monitoring will assist in assessing the impacts of this Air Quality Action Plan, as well as ensuring that new development does not cause exceedences of the air quality objectives.

4.31 In order to get the most out of the air quality monitoring within the AQMA, and to potentially track the traffic impacts of any measures implemented, it is judged that traffic monitoring should be undertaken on a permanent or regular basis at the Academy Street/ Queensgate junction. It would also be helpful in prioritising measures, to understand the Origin-Destination of those travelling within the AQMA and the reason for their journeys.

4.32 Specific measures will include:

- continuation of monitoring within Highland Council, focussed on the Inverness AQMA, but also in other strategic locations;
- operation of new real time monitoring site in Queensgate;
- annual assessment of air quality against air quality objectives, as specified by the LAQM process, with reports to Scottish Government and the public;
- a review of measures set out in this Action Plan on a regular basis, to ensure they are up to date and being implemented; and
- traffic monitoring (counts and Origin-Destination study).

Table 7: Evaluation of Action 6

ACTION 6	**Continue to monitor and assess air quality in line with Government guidance on Local Air Quality Management**
Air Quality Impact	None directly in relation to LAQM, but acts as evidence base for measures.
Cost	**Low** cost (per annum) to Highland Council.
Feasibility	**High** Feasibility
Ownership	Highland Council
Partners	SEPA, Scottish Government.
Funding	Scottish Government funding for monitoring site. Internal budget for Review and Assessment and traffic monitoring.
Timescale	Ongoing.

5 Consultation

5.1 Under Schedule 11 of the Environment Act, local authorities are required to consult on their draft Air Quality Action Plan. It is important to have involvement of all local stakeholders to ensure the success of the Action Plan. This Action Plan has been drafted through a partnership approach in particular with (transport and public health), planners, Business Improvement District manager and climate change officer.

5.2 The next stage will be to consult more widely on this document including both internal and external stakeholders. Stakeholders will include:

The Scottish Government;

SEPA;

Councillors;

local residents within and bordering the AQMA;

relevant local businesses, community groups and forums;

taxi operators;

Business Improvement District;

Road Haulage Associations;

Freight Transport Association;

Confederation of Passenger Transport;

Public Transport Operators; and

The general public.

6 Implementation Plan

6.1 To implement the Action Plan measures, Highland Council will work jointly with all relevant partners, particularly planners and transport planners and bus operators. To secure the necessary air quality improvements, all local stakeholders and Highland Council must be involved.

6.2 Ultimately the delivery of this Action Plan is dependent on adequate levels of resourcing, both for capital costs and staffing. Funding sources have been highlighted in the evaluation tables.

6.3 The implementation and effectiveness of the Action Plan will be carefully monitored through the monitoring of NO_2 concentrations at relevant locations within Inverness. In addition, other indicators such as traffic flow, proportions of different categories of vehicles, use of public transport and levels of cycling will be incorporated. There will be regular reviews of the Action Planning proposals, which will be reported on an annual basis to the Scottish Government. These reviews will include both direct air quality monitoring information, as well as information on proxy measures such as traffic counts. The following tables include a more refined timescale for implementation.

Table 8: Measures to be Included in the Air Quality Action Plan

Action	Proposed Measure	Timescale	Funding
1	Enhancement to train station and cycle parking	Completed	n/a
	Further encouragement of active travel	Ongoing	Highland Council
	Making Academy Street more pedestrian friendly (wider pavements, crossing points etc)	2017	Funding being pursued
	Cycling Strategy to encourage greater levels of cycling and support the 'Cycling City' concept	2017	Implemented through the forthcoming Green Transport Strategy
	Travel Plan for Highland Council	2016	Highland Council
	Feasibility Study of wider bike hire scheme in Inverness	2016	Highland Council
	Engage with schools	Ongoing	Highland Council
	Promotion and encouragement of online tool for car sharing	2016 onwards	Highland Council

Action	Proposed Measure	Timescale	Funding
2	Investigate the feasibility of increasing the number of low emission buses in Inverness.	2016	Highland Council
	Limits on Euro standards of buses (this could be implemented through the SQP)	2016/17	Funding through SQP
	Further electric charging points in inverness town centre and on the road network in the Highlands	Ongoing	Developer contributions
	Investigating using lower emission vehicles within the Council's (Inverness based) fleet	2016/17	Highland Council
	Investigating using the taxi licensing system to reduce emissions from taxis	2016/17	n/a
	Feasibility study investigating the use of parking charge differentiation for LEVs	2016/17	Highland Council
	Ecostars	2016/17	SG Air Quality Grant
3	Ensuring that relevant planning applications are identified in consultation with EH officers.	Ongoing	n/a
	Ensuring that planning applications with potential air quality impacts are fully assessed for their impacts, at relevant locations using appropriate methodologies (methodologies could be outlined within a Supplementary Planning Document)	Ongoing	n/a
	Ensuring that appropriate mitigation is not only proposed but also implemented where any relevant impacts are identified	Ongoing	n/a
	Encouraging Travel Plans for relevant new developments	Ongoing	n/a
	Encouraging Electric Vehicle infrastructure through the planning system	Ongoing	n/a
	Providing information re: sustainable transport for residents of new developments	2016 onwards	n/a
4	Use SCOOT system more effectively to ensure traffic is not queuing on Academy Street. This may be undertaken as part of the Smart Cities initiative	2016/17	Highland Council
	Study using microsimulation modelling to more accurately investigate impacts of traffic light phasing at the Queensgate/ Academy Street junction	2016/17	Apply for SG Air Quality Grant
	Review bus movements round Inverness, both in terms of routes in and out of the bus station, bus stops and routes around the city centre	2016/17	Highland Council
	Completion of West Link	2017	SG/ Highland Council

Action	Proposed Measure	Timescale	Funding
	Investigate the feasibility of shortening delivery hours to reduce delivery vehicles causing congestion at peak hours in central streets	2016/17	Highland Council
	Investigate the feasibility of taking refuse collection vehicles out of the city centre at peak times	2016/17	Highland Council
5	Communicate with residents within the AQMA about the issues and this Action Plan;	2016	Highland Council
	Improve bus information provision	Ongoing	Highland Council
	Real time bus information	2017	European Regional Development Fund
	Support existing campaigns for active travel	Ongoing	Highland Council and NHS
	Appropriate signposting to car parks and other destinations	2017	Highland Council
	Improve communication within the Council (Workshop for Council officers)	2016	Highland Council
6	Continuation of monitoring within Highland Council, focussed on the Inverness AQMA, but also in other strategic locations	ongoing	Highland Council
	Operation of new real time monitoring site in Queensgate	Before March 2016	Scottish Government
	Regular assessment of air quality against air quality objectives, as specified by the LAQM process, with reports to Scottish Government and the public	ongoing on an annual basis	Highland Council
	A review of measures set out in this Action Plan on a regular basis, to ensure they are up to date and being implemented	ongoing on an annual basis	Highland Council
	Traffic monitoring (counts and Origin Destination study)	To be in place by 2016 then ongoing on an annual basis	Highland Council

7 Summary and Conclusions

7.1 This Air Quality Action Plan sets out 6 broad Actions, for which specific measures have been included. The Actions are as follows:

- Action 1: Promote Smarter Travel Choices.
- Action 2: Actively promote low emission vehicles and supporting infrastructure.
- Action 3: Use the planning system to ensure that air quality is fully considered for new development.
- Action 4: Traffic management to reduce emissions in locations within the AQMA.
- Action 5: Communication to inform the public about health impacts of Air Pollution and how they can change behaviour to reduce emissions and reduce exposure.
- Action 6: Continue to monitor and assess air quality in line with Government guidance on LAQM.

7.2 At this stage, it has not been possible to quantify emissions reductions for specific Actions. It is considered that in order to achieve the annual mean nitrogen dioxide air quality objective, a combination of the above measures will be required. In the short term, it is considered that traffic management measures are likely to have the greatest impact within the AQMA. It will still be important to invest in smarter travel choices, low emission vehicle infrastructure and communication with the public, which will all reduce concentrations, and hence improve health across a wider area of Inverness.

7.3 Inverness is the fastest growing city in Scotland and hence it is to be expected that traffic levels will increase in future. Although this should be counteracted by improving vehicle emissions and a greater number of low emission vehicles on the roads, monitoring should continue across Inverness to ensure other locations do not trigger exceedences of the relevant objectives.

7.4 The measures highlighted in this Air Quality Action Plan should reduce concentrations of NO_2 at the relevant sensitive receptors, although it is too early to say exactly what impacts they will have on improving air quality. The Council is continuing to monitor air quality at several locations within and around the AQMA and will start real time monitoring on Queensgate. The results of the monitoring will be made available through the annual review and assessment reports along with proxy measures for quantifying improvements.

7.5 This Action Plan will be updated as and when required. The Air Quality Action Plan supports the policies of Highland Council, as well as the CAFS.

8 References

Carslaw, D., & Rhys-Tyler, G. (2013, July). *Remote sensing of NO2 exhaust emissions from road vehicles*. Retrieved from http://uk-air.defra.gov.uk/assets/documents/reports/cat05/1307161149_130715_DefraRemoteSensingReport_Final.pdf

Carslaw, D., Beevers, S., Westmoreland, E., & Williams, M. (2011). *Trends in NOx and NO2 emissions and ambient measurements in the UK*. Retrieved from uk-air.defra.gov.uk/reports/cat05/1108251149_110718_AQ0724_Final_report.pdf

Committee on the Medical Effects of Air Pollution. (2015). *Statement on the Evidence for the Effects of Nitrogen Dioxide on Health.* COMEAP.

Halcrow Group Ltd. (2011). *Inverness Active Travel Audit. Final Report.*

9 Glossary

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
BID	Business Improvement District
CAFS	Clean Air for Scotland. The Road to a Healthier Future
COMEAP	Committee On the Medical Effects of Air Pollution
Defra	Department for Environment, Food and Rural Affairs
EH	Environmental Health
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HITRANS	Highlands and Islands Transport Partnership
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LEZ	Low Emission Zone
$\mu g/m^3$	Microgrammes per cubic metre
NLEF	National Low Emission Framework
NMF	National Modelling Framework
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date.
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
SCOOT	Split Cycle Offset Optimisation Technique

Section 75 The increase in land value which results from planning permission being granted, mainly accrues to the owner of the land, but a levy or tax may be applied to divert some of the planning gain to the public sector. This diversion of funds is made under a Section 75 planning obligation (Section 75 of the Town and Country Planning (Scotland) Act 1997).

SEPA Scottish Environment Protection Agency

SG Scottish Government

SQP Statutory Quality Partnership

Standards A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

10 Appendices

A1 Professional Experience

Prof. Duncan Laxen, BSc (Hons) MSc PhD MIEnvSc FIAQM

Prof Laxen is the Managing Director of Air Quality Consultants, a company which he founded in 1993. He has over forty years' experience in environmental sciences and has been a member of Defra's Air Quality Expert Group and the Department of Health's Committee on the Medical Effects of Air Pollution. He has been involved in major studies of air quality, including NO_2, lead, dust, acid rain, PM_{10}, $PM_{2.5}$ and ozone and was responsible for setting up the UK's urban air quality monitoring network. Prof Laxen has been responsible for appraisals of all local authorities' air quality Review & Assessment reports and for providing guidance and support to local authorities carrying out their local air quality management duties. He has carried out air quality assessments for power stations; road schemes; ports; airports; railways; mineral and landfill sites; and residential/commercial developments. He has also been involved in numerous investigations into industrial emissions; ambient air quality; indoor air quality; nuisance dust and transport emissions. Prof Laxen has prepared specialist reviews on air quality topics and contributed to the development of air quality management in the UK. He has been an expert witness at numerous Public Inquiries, published over 70 scientific papers and given numerous presentations at conferences. He is a Fellow of the Institute of Air Quality Management.

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

Dr Beattie is a Principal Consultant with AQC, with more than fourteen years' relevant experience. She has been involved in air quality management and assessment, and policy formulation in both an academic and consultancy environment. She has prepared air quality review and assessment reports, strategies and action plans for local authorities and has developed guidance documents on air quality management on behalf of central government, local government and NGOs. Dr Beattie has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has also provided support to the integration of air quality considerations into Local Transport Plans and planning policy processes. She has carried out numerous assessments for new residential and commercial developments, including the negotiation of mitigation measures where relevant. Clare also works closely with Defra and has managed the Defra Air Quality Grant Appraisal contract. She is the Secretary of the Institute of Air Quality Management.

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