



**Winchester**  
City Council

## Winchester City Council Air Quality Action Plan

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

January (2017)

|                         |   |
|-------------------------|---|
| Local Authority Officer | Dave Ingram   |
| Department              | Environmental Health and Licensing  |
| Address                 | Winchester City Council, City Offices,<br>Colebrook Street, Winchester SO23 9LJ |
| Telephone               | 01962 848479  |
| E-mail                  | dingram@winchester.gov.uk   |
| Report Reference number |   |
| Date                    | January 2017  |

## Public Statement

This Air Quality Action Plan outlines how Winchester City Council propose to put in place a number of measures to work towards the annual mean air quality objective for nitrogen dioxide to meet their Local Air Quality Management duties. This pollutant currently exceeds this objective close to busy roads within the city centre and it is estimated that road traffic related emissions may need to be reduced by a quarter to meet this objective by 2020<sup>1</sup>. Long term exposure to high concentrations of pollutants including nitrogen dioxide is associated with health impacts such as heart and lung conditions<sup>2</sup> and through this plan, the Council commits to reduce the exposure of people in Winchester to poor air quality to improve health.

In this plan, the Council has prioritised a number of high impact core actions to reduce traffic flow, congestion and emissions within the city centre. These measures are under the influence or direct control of the Council (i.e. not a shared responsibility with the County). The Council will also lobby other agencies to assist in the delivery of additional measures and commits to review progress made on the plan each year.

### **Core actions:**

- 1. Review current car parking charges and increase the cost to park in central car parks;*
- 2. Review and consider introducing restrictions of delivery vehicles by time of day;*
- 3. Introduce a Park and Ride site in the North of Winchester;*
- 4. Introduce new parking charges to limit diesel and high polluting petrol cars parking in central car parks;*
- 5. Reduce emissions from lorries and buses in the city centre by 2020;*
- 6. Reduce emissions from all Council owned, leased or contracted vehicles by 2020 ;*
- 7. Put in place requirements to integrate air quality fully into the planning process;*
- 8. Continue to work with and lobby Hampshire County Council to identify and deliver additional projects;*
- 9. Monitor the performance of the plan and reassess the need to introduce additional measures to achieve the objective.*

For the action plan to be successful, it is vital that the solutions are delivered in cooperation with local and national government as well as residents and businesses.

<sup>1</sup> The assumptions behind this estimate are given in Section 3.4 of the action plan.

<sup>2</sup> <https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions>

## Executive Summary

Under the Local Air Quality Management (LAQM) framework, local authorities have a duty to monitor, assess and take actions to improve local air quality. As part of this process, Winchester City Council declared a single Air Quality Management Area (AQMA) within the city centre due to exceedances of the annual mean objective for nitrogen dioxide (NO<sub>2</sub>). This new Air Quality Action Plan (AQAP) has therefore been produced to specifically fulfil the requirements to address the problem of NO<sub>2</sub> exceedances. However, it is noted that many of the measures discussed in the plan will also lead to reductions in other local air quality pollutants such as particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) and global pollutants such as carbon dioxide (CO<sub>2</sub>).

Air pollution is associated with a number of adverse health impacts and is a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society such as children and older people or those with heart and lung conditions. There is also often a strong correlation with equality issues, because areas with poor air quality are also often the less affluent areas<sup>3,4</sup>. Because of this evidence, Winchester City Council is committed to working together with other agencies, local residents and businesses to reduce the exposure of people in Winchester to poor air quality in order to improve health.

This new action plan replaces the previous action plan which ran from 2006 to 2016. Projects already delivered in Winchester include Park and Ride facilities, variable message signs for car parks, improving the emissions of the bus fleet and a number of schemes to encourage public transport use through the Winchester Town Access Plan (WTAP).

Our priorities for this new action plan are to consider a number of high impact measures to reduce traffic flow and congestion and encourage cleaner vehicles with the overarching aim of reducing vehicle related emissions in the AQMA. The following core actions have been agreed by the Cabinet to be taken forward in the short-term and are all under the influence or direct control of the City Council.

1. Review and build on the current car parking pricing differential strategy in central, inner and outer Winchester;
2. Review and consider restrictions to enforce goods deliveries by time of day;

---

<sup>3</sup> Environmental equity, air quality, socioeconomic status and respiratory health, 2010

<sup>4</sup> Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

3. Introduce a Park and Ride to the north of the City of Winchester;
4. Introduce new parking charges or incentives to limit diesel car parking and high polluting petrol vehicles (older than Euro 4 emission standard) in central car parks;
5. Reduce emissions of all heavy duty vehicles that enter the AQMA by ensuring that they meet Euro VI (Stage II) emission standard by 2020, for example through a Clean Air Zone (CAZ) strategy;<sup>5</sup>
6. Reduce emissions of all Council owned, leased, contracted or influenced vehicles (e.g. taxis) that enter the AQMA, by ensuring that no diesel vehicles are used and that vehicles meet an agreed emission standard for ultra-low emission vehicles by 2020 (i.e. <75 g/km CO<sub>2</sub>) where possible;<sup>6</sup>
7. Develop an air quality supplementary planning document (SPD) as part of the formal planning process that is integrated into the planning process;
8. Continue to work with and lobby Hampshire County Council to identify and deliver other projects which will make an early and positive impact on air quality;
9. In consultation with the Portfolio Holder for Environmental Health and Wellbeing, monitor the performance of the action plan and reassess the necessity and feasibility of introducing additional measures if these are required to meet the annual mean air quality objective.

Following the latest guidance and assumptions provided by the Department for Environment, Food and Rural Affairs (Defra)<sup>7</sup> we have estimated that a reduction in road traffic related nitrogen oxide (NO<sub>x</sub>) emissions of around 40 percent is currently required at roadside locations to meet the annual mean objective for NO<sub>2</sub>. By 2020, due to predicted improvements in emissions and lower background concentrations (as assumed in Defra's guidance), this reduction is likely to be lower at around 25 percent. For further assumptions regarding this estimate, please refer to Section 3.4 of the plan.

We have conducted a simplistic modelling study to determine the potential reductions in NO<sub>x</sub> emissions in 2020 with a number of actions in place, to understand whether

---

<sup>5</sup> <https://consult.defra.gov.uk/airquality/implementation-of-cazs/>

<sup>6</sup> It is noted that there is whilst there is no agreed standard for low NO<sub>x</sub> vehicles, the combination of these two requirements should lead to a reduction in NO<sub>x</sub> emissions.

<sup>7</sup> <http://laqm.defra.gov.uk/supporting-guidance.html>

the annual mean objective is likely to be met within the AQMAS (see Appendix C). We have found that core action plan measures 1-5 could achieve a NO<sub>x</sub> reduction of 18 percent close to busy roads (e.g. St. George's Street), with an average reduction of 15 percent across the AQMA. If measure 6 is implemented, then this may further reduce NO<sub>x</sub> emissions by reducing the contribution from Council and contracted vehicles from 2 percent to less than 1 percent, depending on how many trips these vehicles take within the AQMA.

Taking into account the assumptions made and limitations of the modelling undertaken, we recognise that it is unlikely that the proposed core actions would achieve the estimated 25 percent required to meet the annual mean objective for NO<sub>2</sub> at relevant roadside locations by 2020. Therefore, on an annual basis, we will commit to gather better data to further assess impacts and consider whether additional measures will need to be introduced as part of the ongoing annual status report (ASR) process. We also recognise that there are a large number of air quality policy areas that are outside of our direct control (such as vehicle emissions standards agreed in Europe and factors influencing regional emissions that affect background pollutants). We will continue to work with neighbouring and regional authorities on policies and issues beyond Winchester City Council's direct influence as part of our commitment towards developing a regional Low Emission Strategy.

## **Responsibilities and Commitment**

This AQAP was prepared by the Environmental Health and Licensing Department of Winchester City Council with the support and agreement of the Overview and Scrutiny Committee for Environment, Health and Wellbeing.

This AQAP will be subject to an annual review, appraisal of progress and reporting to the Cabinet. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Winchester City Council, as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Dave Ingram at:

Environmental Health and Licensing, Winchester City Council

[dingram@winchester.gov.uk](mailto:dingram@winchester.gov.uk)

01962 848479

# Table of Contents

|  |           |
|--|-----------|
| <b>Public Statement .....</b>  | <b>1</b>  |
| <b>Executive Summary .....</b>   | <b>2</b>  |
| Responsibilities and Commitment .....                                  | 4         |
| <b>1. Introduction .....</b>   | <b>7</b>  |
| <b>2. Summary of Current Air Quality in Winchester .....</b>           | <b>8</b>  |
| <b>3. Winchester's Air Quality Priorities .....</b>                    | <b>10</b> |
| 3.1 Public Health Context .....  | 10        |
| 3.2 Planning and Policy Context .....                                  | 10        |
| Wider context .....  | 10        |
| Local context .....  | 11        |
| 3.3 Source Apportionment .....   | 13        |
| 3.4 Required Reduction in Emissions .....                              | 15        |
| 3.5 Key Priorities.....  | 17        |
| <b>4. Development and Implementation of Winchester's AQAP .....</b>    | <b>18</b> |
| 4.1 Steering Group .....   | 18        |
| 4.2 Consultation and Stakeholder Engagement .....                      | 19        |
| <b>5. AQAP Measures .....</b>  | <b>20</b> |
| 5.1. Modelling of shortlisted measures.....                            | 20        |
| 5.2 Core action plan measures .....                                    | 21        |
| 5.3 Delivery plan .....  | 23        |
| 5.4 Encouraging behavioural change.....                                | 24        |
| 5.5 Monitoring progress.....   | 25        |
| <b>6. Glossary of Terms.....</b>                                       | <b>34</b> |
| <b>7. References.....</b>  | <b>36</b> |
| <b>Appendix A: Response to Consultation .....</b>                      | <b>37</b> |
| <b>Appendix B: Reasons for Not Pursuing Action Plan Measures .....</b> | <b>39</b> |
| <b>Appendix C: Modelling of short list scenarios.....</b>              | <b>40</b> |

## List of Tables

|   |    |
|---|----|
| Table 3-1: Required reduction in NO <sub>2</sub> and road NO <sub>x</sub> to achieve annual mean NO <sub>2</sub> objective at selected roadside monitoring sites, 2015..... | 15 |
| Table 3-2: Projected future NO <sub>2</sub> concentrations in 2020 using Defra's factors .....  | 16 |
| Table 4-1 – Consultation Undertaken .....   | 19 |
| Table 5-1: Modelled road NO <sub>x</sub> emissions, St. George's Street in 2020 .....   | 21 |
| Table 5-2: Annual NO <sub>x</sub> emissions due to core action plan measures in 2020 .....  | 23 |
| Table 5-3: Proposed KPIs to monitor progress on action plan measures.....   | 26 |
| Table 5-4 – Air Quality Action Plan Core Actions .....  | 29 |

|   |    |
|---|----|
| Table 5-5 - Air Quality Action Plan Complementary Measures..... | 31 |
|---|----|

### List of Figures

|  |    |
|--|----|
| Figure 2-1: Map of AQMA boundary in Winchester City Centre (from AQMA order) ...   | 8  |
| Figure 2-2: Trends in measured annual mean NO <sub>2</sub> concentrations at selected<br>roadside monitoring sites in the Winchester City Centre AQMA..... | 9  |
| Figure 3-1: Percentage of modelled annual mean NO <sub>2</sub> concentration at three<br>receptors above the air quality objective, 2014.....              | 14 |
| Figure 3-2: Percentage road-based NO <sub>x</sub> emissions at St George's Street .....  | 14 |

DRAFT



## 1. Introduction

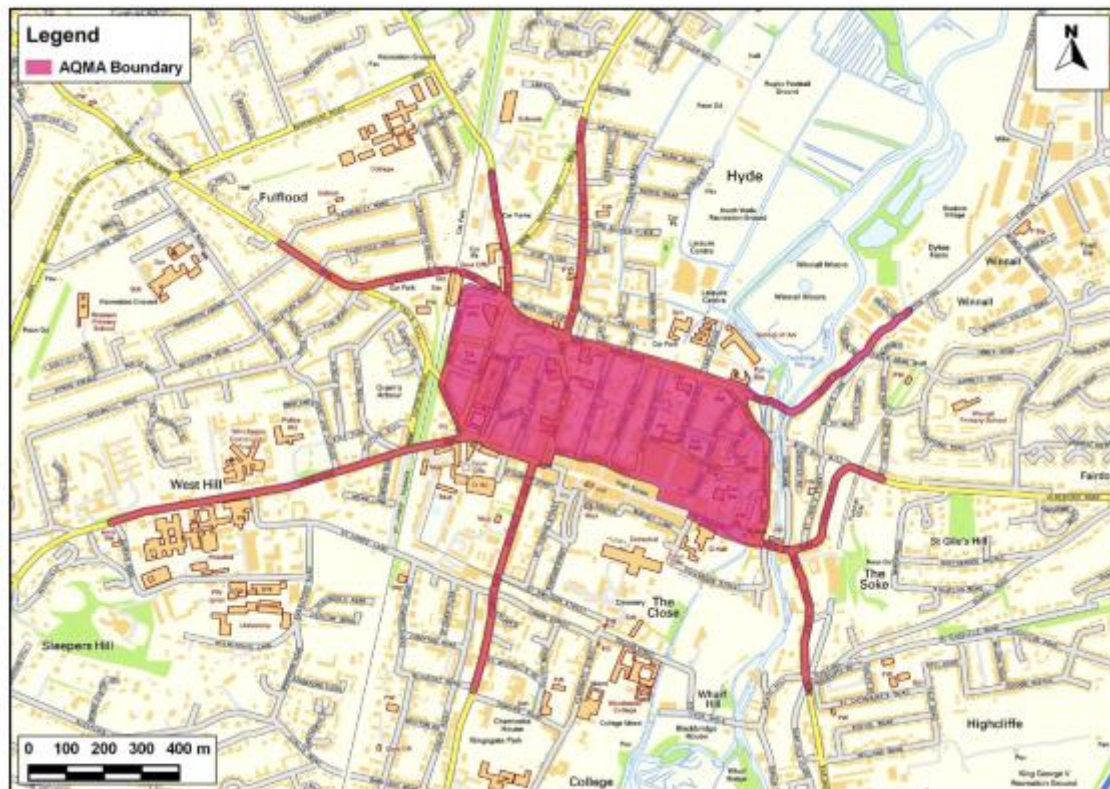
This report outlines the actions that Winchester City Council will deliver between 2017-2023 in order to reduce concentrations and exposure to air pollutants, specifically nitrogen dioxide (NO<sub>2</sub>); thereby positively impacting on the health and quality of life of residents and visitors to Winchester City Centre.

The plan 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. In central Winchester, there are exceedences of the objective for annual mean NO<sub>2</sub> and therefore this plan has been developed to primarily address this pollutant. The objectives given in the regulations are currently met for all other pollutants.

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 Winchester City Council's air quality ASR against agreed key performance indicators (KPIs). As part of this annual review against the KPIs, the Council will consider whether further measures need to be introduced to meet the air quality objective for annual mean NO<sub>2</sub>.

## 2. Summary of Current Air Quality in Winchester

Winchester City Council has a single AQMA within the city centre which was declared in 2003 due to exceedances of the annual mean nitrogen dioxide (NO<sub>2</sub>) objective and 24 hourly mean PM<sub>10</sub> objective. The AQMA has since been revoked for the PM<sub>10</sub> objective in 2010. The current AQMA boundary is given in Figure 2-1.

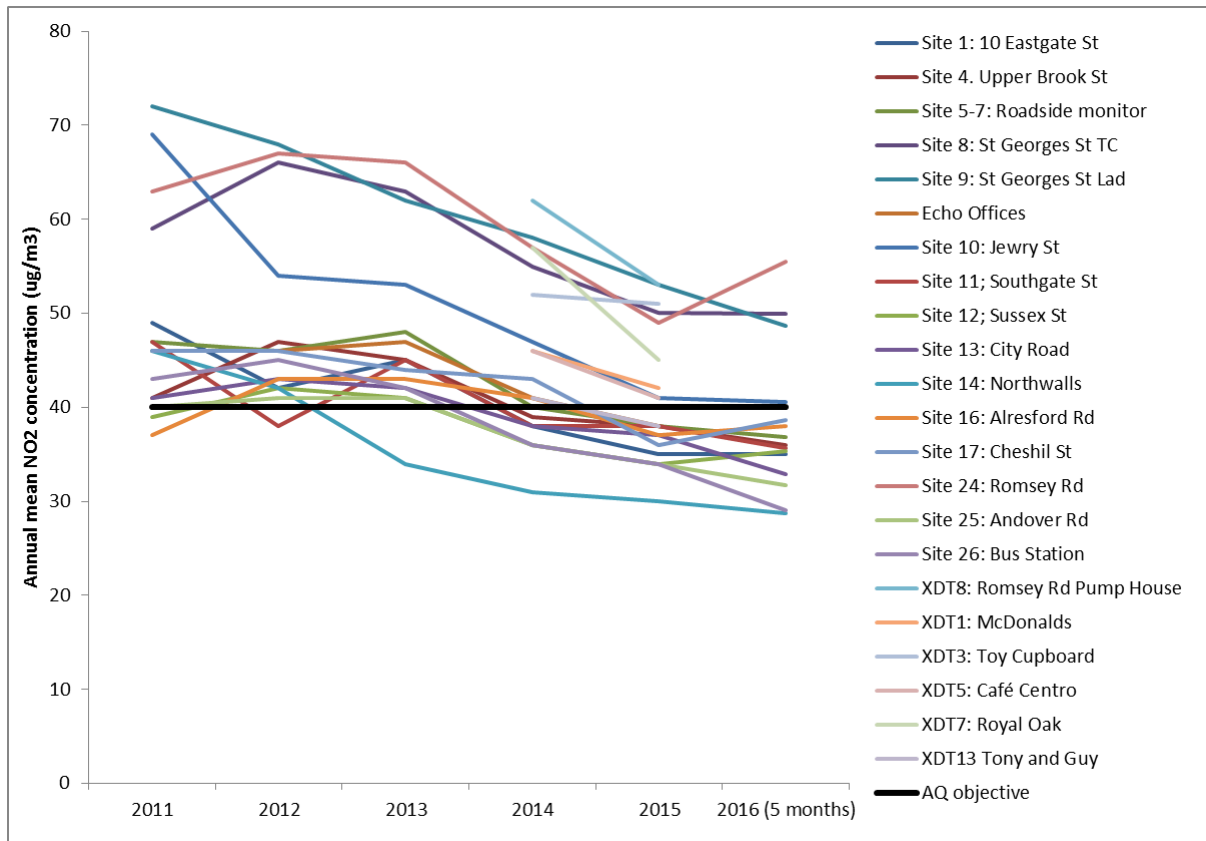


**Figure 2-1: Map of AQMA boundary in Winchester City Centre (from AQMA order)<sup>8</sup>**

Winchester City Council developed their first action plan for the AQMA in 2006. This plan had 21 measures split into a number of areas including engineering solutions, traffic management, EU Miracles project and policy and promotional solutions. The local authority has now completed the viable options in this plan and has a number of new actions and priorities to take forward. As a result, there is a need to develop a revised action plan. This new action plan therefore replaces the previous 2006 plan. Both automatic and diffusion tube monitoring have been undertaken at selected roadside sites within the AQMA over a number of years. Annual mean NO<sub>2</sub>

<sup>8</sup> Reproduced from the 2016 Annual Status Report available at <http://www.winchester.gov.uk/environment/pollution/air-quality/>

concentrations have reduced slightly in the last few years but exceedances of the annual mean objective remain at roadside sites (see Figure 2-2). The most recent 2016 concentrations to date appear to be similar to 2015 levels. There were no measured concentrations above 60  $\mu\text{g}/\text{m}^3$  in 2015 which suggest that exceedances of the hourly mean objective are unlikely.



**Figure 2-2: Trends in measured annual mean NO<sub>2</sub> concentrations at selected roadside monitoring sites in the Winchester City Centre AQMA**

Please refer to the latest air quality information in the 2016 ASR for more detailed information on the current air quality situation.

## 3. Winchester's Air Quality Priorities

### 3.1 Public Health Context

Winchester City Council is working with Public Health Colleagues to prioritise action on air quality, including implementing measures that encourage active travel such as the Feet First campaign. These measures have wider public health benefits in terms of increased physical activity.

### 3.2 Planning and Policy Context

#### Wider context

Winchester is located within the Central Hampshire & New Forest Transport Strategy Area. The city has a central position within a well-connected transport network, including the M3 and A34(T) providing the main access routes to the north and south, with access to the east from the A31 and A272.

Hampshire County Council's **Local Transport Plan (LTP)** acknowledges the challenges faced in the wider area including:

- Congestion on inter-urban roads including motorways and some trunk roads in town and village centres.
- Minimising the adverse impacts of traffic on the quality of life of rural communities and market towns through speed management and goods vehicle routing.

The junction of the A34 (T) and M3 at Winnall (Winchester), which acts as a gateway to the South Hampshire sub-region, presents particular difficulties of congestion, including capacity problems and difficulties for local traffic joining the network.

The **Hampshire Sustainable Transport Towns (HSTT)** comprises a package of 31 complementary measures to improve the attractiveness of walking, cycling and public transport within the six Hampshire towns of Andover, Aldershot, Basingstoke, Farnborough, Fleet and Winchester. The County Council was awarded £4.1m for the Hampshire Sustainable Towns Project (up to March 2015) to achieve the following:

- To reduce congestion at peak times on local roads as a result of fewer car trips per household.

- To reduce carbon and greenhouse gas emissions, helping address the contribution of local transport to climate change, and to improve air quality.
- To improve health and general wellbeing as a result of more people building in physical activity into their daily travel routines.

Delivery of some of the initiatives in this project, including cycle compounds at rail stations, station travel plans in all six towns and real time bus improvements have now been completed.

### **Local context**

The **Winchester Town Access Plan (WTAP)** was jointly developed by Hampshire County Council and Winchester City Council in 2011. This plan acknowledges that Winchester faces a number of factors which combine to result in traffic levels and air quality problems beyond that which would normally be associated with a town of its size. The city experiences many of the problems associated with ancient city centres, such as narrow streets and footways that mean there is limited scope for improving provision for road users and pedestrians.

The WTAP focuses on improving accessibility and air quality, reducing the level of traffic in the city centre and therefore improving the situation in terms of localised congestion. It has four key aims:

- To ensure that the vitality and resilience of the local economy is strengthened by planning for movement and access which is economically and environmentally sustainable;
- To lead a transition to cycling, walking, public transport and low-carbon, modes of travel, including low emission private and commercial vehicles;
- To reduce the negative effects of transport-related carbon emissions on all neighbourhoods, including the Town's historic environment, particularly in relation to air quality and the safety of pedestrians and cyclists;
- To enhance the social and cultural wellbeing of Winchester by providing access for all.

Additionally, the WTAP includes a number of strategic priorities which link with spatial planning aims and objectives for Winchester and the delivery processes for the development strategy. The Plan acknowledges that its aims can be achieved by

reducing the distance that people have to travel in their daily activities through 'self containment' policies such as providing good local facilities, employment and community based facilities which can be accessed by means other than the car.

The Plan is supported by action plans covering the short and long term. The short term plan includes committed improvements such as improvements to the High Street and Market Street and an approach to support the park and ride facilities by reducing low cost central parking spaces.

**The Winchester Transport Statement** produced in September 2012 aims to support economic prosperity, measures to address climate change and local transport to promote safe and sustainable transport choices to improve quality of life to achieve:

- Growth and planned regeneration where needed
- Greater travel choices to encourage the safer and more sustainable movement of people and goods.
- Lower carbon emissions and the dominance of traffic through more walking, cycling and passenger transport use.

**The Transport Vision for Winchester district** has the following four aims that underpin the priorities to promote economic growth and reduce the environmental effects of transport:

- Promoting economic growth: Providing key transport improvements and tackling congestion hotspots, helping to unlock new developments to provide jobs and housing where needed.
- Maintaining a safe and efficient highway network: Further support for economic growth through reducing casualties and effective management to provide a safe, well-maintained and efficient highway network.
- Improving access: Improving access to jobs, facilities and services by all forms of transport.
- Protecting the environment: Reducing carbon emissions and the effects of transport on communities, the countryside and the environment generally, while maintaining special regard to the purposes of the South Downs National Park.



**The Winchester District Local Plan (Part 1)** provides the spatial strategy for growth across the District up to 2031. It anticipates that Winchester will make provision for about 4,000 new homes through a range of accommodation to meet the needs of the whole community and to ensure that the local economy builds on its existing and growing strengths in higher education, creative and media industries, and other knowledge-based activities, whilst respecting the town's special heritage and setting.. Winchester is the largest retail centre in the District and planned and forecast growth are required to maintain this sub-regional role. The plan recognises that there is a need to accommodate the necessary vehicular movements whilst at the same time reducing all emissions and providing travel alternatives.

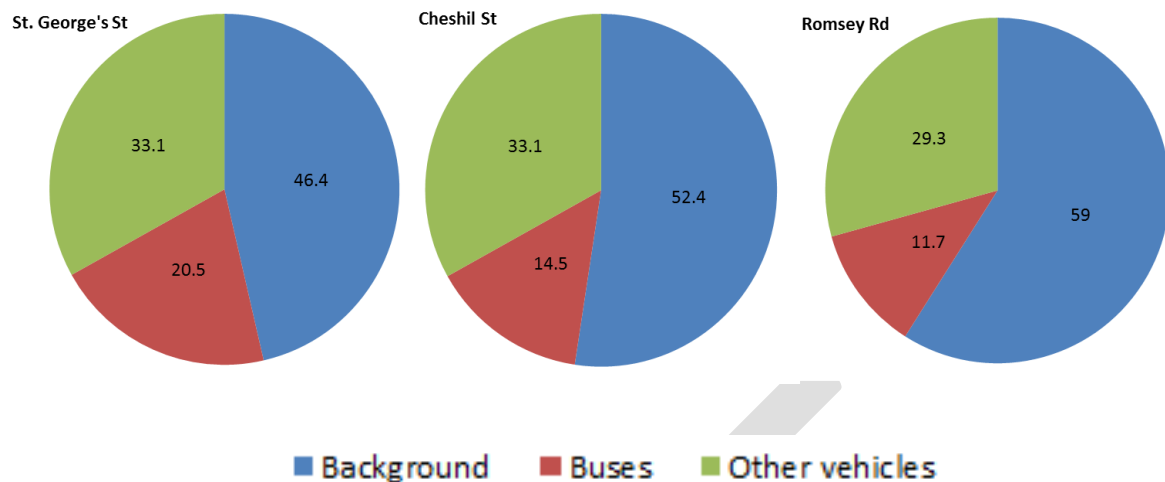
Hampshire County Council, working with the City Council, will lead the development of a **new City of Winchester Movement Strategy** during 2017 which will look at all aspects of transport in the town and its surrounding area. Part of this work will involve reviewing existing information as well capturing and obtaining new data which can then be used to inform options and actions.

The **Vision for Winchester Town 2010-2020** has eight aspirational themes including improving transport and accessibility, infrastructure and air quality. The vision has the overall aim of Winchester become a cleaner and pleasant environment that attracts visitors to boost the local economy.

### 3.3 Source Apportionment

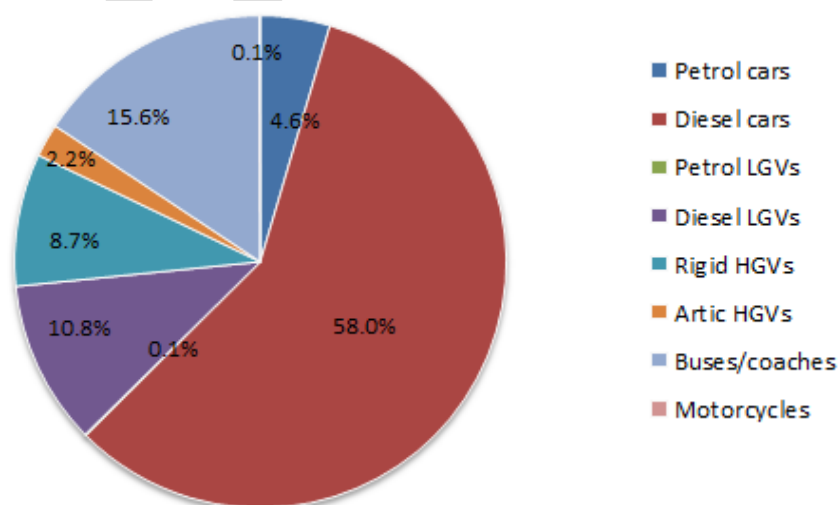
The measures presented in this action plan are intended to be targeted towards the predominant sources of NO<sub>x</sub> emissions within Winchester's AQMA.

A source apportionment exercise was carried out for NO<sub>2</sub> for the year 2014 as part of the most recent air quality detailed assessment (Winchester City Council, 2016). A summary of these results are given in Figure 3-1 for three roads. These data showed that at receptors where the annual mean NO<sub>2</sub> concentration was expected to be above the objective; almost half of the contribution was from background sources (i.e. sources outside of the AQMA). Of the road traffic contribution alone, in St. George's Street, 38 percent was from emissions from buses and 62 percent from other vehicles where as in Romsey Road, the contribution from buses was lower at 29 percent.



**Figure 3-1: Percentage of modelled annual mean NO<sub>2</sub> concentration at three receptors above the air quality objective, 2014**

By 2020, based on the modelling work undertaken for this action plan (explained in more detail in Appendix C) using Defra's predictions regarding future emissions and an assumption of the future fleet in Winchester, the contribution of buses to road traffic related NO<sub>x</sub> emissions is expected to decline. This is most likely to be due to a commitment for all public buses to meet Euro VI emission standards (for example the Council's Park & Ride operation switched to Euro VI vehicles in 2016). By 2020, Figure 3-2 shows that in St George's Street, the greatest contribution to road traffic NO<sub>x</sub> emissions is likely to be from diesel cars (58 percent), diesel lorries (11 percent) diesel vans (11 percent) and buses (16 percent).



**Figure 3-2: Percentage road-based NO<sub>x</sub> emissions at St George's Street**



### 3.4 Required Reduction in Emissions

Following Defra's methodology provided in Technical Guidance LAQM.TG16, the reduction in road NO<sub>x</sub> emissions required to achieve the annual mean NO<sub>2</sub> objective was calculated. Using Defra's NO<sub>x</sub>-NO<sub>2</sub> calculator for the year 2015, the value of the road NO<sub>x</sub> concentration at the NO<sub>2</sub> objective of 40 µg/m<sup>3</sup> was 42.6 µg/m<sup>3</sup>. The road NO<sub>x</sub> concentration at selected roadside monitoring sites was then calculated and the reduction required to achieve the objective is given in Table 3-1. These results show that in 2015, a reduction of NO<sub>2</sub> of 18-25 percent is required to meet the objective which equates to a road NO<sub>x</sub> reduction of around 40 percent.

**Table 3-1: Required reduction in NO<sub>2</sub> and road NO<sub>x</sub> to achieve annual mean NO<sub>2</sub> objective at selected roadside monitoring sites, 2015**

| Site ID (Name)              | Monitored annual mean NO <sub>2</sub> (µg/m <sup>3</sup> ) | Calculated road NO <sub>x</sub> (µg/m <sup>3</sup> ) | Reduction in NO <sub>2</sub> to meet objective µg/m <sup>3</sup> (and %) | Reduction in road NO <sub>x</sub> to meet objective µg/m <sup>3</sup> (and %) |
|-----------------------------|--|--|--|---|
| Site 8 (St Georges St TC)   | 50.2   | 68.0   | 10.2 (20%)   | 25.4 (37%)  |
| Site 9 (St Georges St LAD)  | 52.6   | 74.4   | 12.6 (24%)   | 31.8 (43%)  |
| Site 24 (Romsey Rd)         | 48.8   | 64.3   | 8.8 (18%)  | 21.8 (34%)  |
| XDT8 (Romsey Rd Pump House) | 53.2   | 76.0   | 13.2 (25%)   | 33.4 (44%)  |
| XDT8 (Toy Cupboard)         | 50.8   | 69.6   | 10.8 (21%)   | 27.0 (39%)  |

In the future, formal Defra government guidance assumes that there will be a reduction in both traffic and non-traffic related (background) emissions due to factors including reduced congestion and use of alternative and more efficient fuels. By 2020, based on Defra's roadside projection factors<sup>9</sup>, the NO<sub>2</sub> concentrations at the roadside monitoring sites in Winchester are predicted to decline by 26 percent suggesting that the annual mean objective will be met (see Table 3-2). However it is noted that measured concentrations of NO<sub>2</sub> have not declined in line with previous forecasts, so these projections must be treated with caution.

<sup>9</sup> <http://laqm.defra.gov.uk/tools-monitoring-data/roadside-no2-projection-factor.html>

**Table 3-2: Projected future NO<sub>2</sub> concentrations in 2020 using Defra's factors**

| Site ID (Name)              | 2015 measured NO <sub>2</sub> concentration (µg/m <sup>3</sup> ) | Estimated 2020 NO <sub>2</sub> concentration (µg/m <sup>3</sup> ) | Estimated reduction in NO <sub>2</sub> concentrations (µg/m <sup>3</sup> ) |
|-----------------------------|--|---|--|
| Site 8 (St Georges St TC)   | 50.2   | 37.1  | -13.1  |
| Site 9 (St Georges St LAD)  | 52.6   | 38.9  | -13.7  |
| Site 24 (Romsey Rd)         | 48.8   | 36.1  | -12.7  |
| XDT8 (Romsey Rd Pump House) | 53.2   | 39.4  | -13.8  |
| XDT8 (Toy Cupboard)         | 50.8   | 37.6  | -13.2  |

To further consider this issue, small scale dispersion modelling was conducted to model NO<sub>2</sub> concentrations in St George's Street for 2015 and 2020 (see Appendix C). The modelling assumed that background NO<sub>2</sub> concentrations declined by 27 percent in line with Defra's background maps and that road NO<sub>x</sub> emissions declined by a further 26 percent due to fleet improvements. The 2020 modelled annual mean NO<sub>2</sub> concentration at diffusion tube site 8 on St George's Street was predicted to be 36.9 µg/m<sup>3</sup> which is similar to the projected concentration given in Table 3-2. However, the model uncertainty was more than 25 percent (+/- more than 10 µg/m<sup>3</sup>) of the modelled value. This suggests that the predicted concentration at this monitoring site could still be considered very likely to exceed the objective in 2020 (i.e. 46.9 µg/m<sup>3</sup> at site 8). Based on the same methodology conducted in Table 3-1, a reduction of road NO<sub>x</sub> of approximately 25 percent was determined to meet the objective in 2020.

### 3.5 Key Priorities

Using the recommended methodologies outlined in formal Defra guidance (LAQM.TG16), based on the current measured concentrations, the roadside NO<sub>x</sub> contribution would need to be reduced by around 40 percent to achieve the annual mean NO<sub>2</sub> objective at roadside locations in central Winchester. By 2020, traffic and non-traffic related emissions are predicted to reduce, but due to the uncertainties of these future predictions, based on current Defra guidance, it has been estimated that a roadside NO<sub>x</sub> reduction of 25 percent may be required to meet the annual mean NO<sub>2</sub> objective at these sites. In this year, the greatest contribution to road traffic related NO<sub>x</sub> emissions would be from diesel vehicles (cars, vans and buses) so measures should be focused on emissions from these vehicle types.

To achieve this level of reductions, the Council has considered a number of high impact measures that they have direct control or influence over. The key priorities are therefore to focus on:

- Reducing traffic flow in the city centre by encouraging alternative transport, for example use of existing (and development of new) Park and Ride facilities
- Reducing congestion in the city centre by managing traffic flows at signal controlled junctions or limiting access in peak areas (e.g. by delivery vehicles)
- Using parking controls to discourage diesel and high polluting petrol cars and encouraging low emission cars to drive into Winchester city centre

In addition, the Council needs to ensure that measures developed as part of the action plan are fully integrated into wider strategies that may be under the control of the County Council or other bodies. The priorities here include:

- Introducing local and regional strategies to control vehicle emissions as part of Clean Air Zone (CAZ) policies, with a focus on heavy duty vehicles (lorries and buses)<sup>10</sup>
- Implementing wider traffic management strategies outside of the city centre.

---

<sup>10</sup> <https://consult.defra.gov.uk/airquality/implementation-of-cazs/>

## 4. Development and Implementation of Winchester's AQAP

### 4.1 Steering Group

To assist in the development of the action plan, Winchester City Council has set up an Air Quality Steering Group with the following members:

- Winchester City Council officers from Environmental Health and Licensing, and Engineering and Transport teams
- Winchester City Council portfolio holders and Councillors
- Hampshire County Council officers responsible for highways and transport
- Members of the Winchester Action on Climate Change (WinACC).
- Members of the former Winchester District Strategic Partnership (WDSP) Transport Group

The first steering group meeting was held on 14<sup>th</sup> March 2016. The outcome of this meeting was to agree the terms of references and roles and responsibilities of the group and identify the topics to cover in future meetings. Since this meeting, the following steering group meetings have been held to discuss a number of agreed topics.

1. Clean Air Zones and Workplace parking levies – 15<sup>th</sup> June 2016
2. Regional low emission strategies – 13<sup>th</sup> July 2016
3. Parking strategies – 7<sup>th</sup> September 2016
4. Highways, infrastructure improvements and WTAP– 3<sup>rd</sup> November 2016
5. Future monitoring, validation and other – 14<sup>th</sup> December 2016

The key priorities and potential measures were discussed with the Council and steering group to identify a long list of possible measures. These were narrowed down to a short list of measures for further testing (see Section 5.1 and Appendix C) before presenting these findings at a Cabinet meeting in December 2016.

## 4.2 Consultation and Stakeholder Engagement

In addition to the steering group, Winchester City Council works with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 4-1. As part of the consultation on the draft plan, the Council will conduct stakeholder engagement and consult with the public on proposed measures through Citizen Space. On-street polls have already been undertaken to gauge public opinion on air quality by the Winchester Action on Climate Change (WinACC).

The response to our consultation and stakeholder engagement is given in Appendix A.

**Table 4-1 – Consultation Undertaken**

| Yes/No | Consultee   |
|--------|---|
| Yes    | the Secretary of State  |
| Yes    | the Environment Agency  |
| Yes    | the Highways Authority  |
| Yes    | all neighbouring local authorities  |
| Yes    | other public authorities as appropriate, such as Public Health officials            |
| Yes    | bodies representing local business interests and other organisations as appropriate |

## 5. AQAP Measures

### 5.1. Modelling of shortlisted measures

An emissions modelling assessment was conducted for an agreed shortlist of measures for a future year of 2020 to assess changes in emissions compared to a baseline (i.e. do nothing) situation for the majority of roads within the AQMA. These measures are summarised here and further details of each scenario are given in Appendix C.

1. Parking surcharges for diesel cars in city centre car parks
2. Changes to the one-way system on Friarsgate
3. City wide congestion charging scheme.
4. Restricting deliveries outside of peak hours
5. Higher parking prices in central car parks
6. Gating controls to manage congestion into city
7. Opening of a Northern Park and Ride,
8. Emission based discounts and surcharges on residents parking
9. Introduction of a voluntary Clean Air Zone (CAZ) for heavy duty vehicles (Euro VI)

It is noted that the modelling approach taken was relatively simplistic given the data available and therefore a number of assumptions needed to be made which means there are uncertainties in the results presented in the plan. In order to assess these impacts in more detail to take into account factors such as congestion, further data and detailed dispersion modelling would need to be undertaken.

The results of the modelling showed that it is likely that the combination of actions 1, 2, 4, 5 and 6 would **not** provide sufficient reductions in emissions to achieve the annual mean objective at the worst case roadside locations such as St George's Street but the hourly mean objective should be met. If actions 1, 2, 3, 7, 8 and 9 were implemented, then these could potentially achieve the road traffic related NO<sub>x</sub> emissions improvements and lower traffic congestion to achieve the reductions required to meet the objective. The individually most effective actions in reducing emissions were considered to be a CAZ based on heavy duty vehicles, a congestion

charging zone, expansion of the Park and Ride to the north of Winchester and introducing higher parking charges in city car parks. A summary of the results for St. George's Street only are provided in Table 5-1 and further details are given in Appendix C.

**Table 5-1: Modelled road NO<sub>x</sub> emissions, St. George's Street in 2020**

| Road NO <sub>x</sub> emissions in g/km/s (% in brackets) |                                  |   |                                    |                                     |                                    |                                    |
|--|----------------------------------|---|------------------------------------|-------------------------------------|------------------------------------|------------------------------------|
| 2015 NO <sub>x</sub> Current                             | Reduction to achieve AQO in 2015 | Potential reduction required to achieve AQO in 2020 | 2020 S1 (reduction from 2020 base) | 2020 S1a (reduction from 2020 base) | 2020 S2 (reduction from 2020 base) | 2020 S3 (reduction from 2020 base) |
| 0.094  | 40%                              | ~25%  | 0.058 (-15%)                       | 0.065 (-6%)                         | 0.064 (-8%)                        | 0.056 (-18%)                       |

## 5.2 Core action plan measures

The results from the modelling of shortlisted measures were presented at a Cabinet meeting in December 2016 where it was agreed that a number of these modelled actions would be taken forward as core actions in this plan. These are summarised below:

1. Build on the current car parking pricing differential strategy in central, inner and outer Winchester;
2. Review and consider restrictions to enforce goods deliveries by time of day
3. Introduce a Park and Ride site in the north of Winchester;
4. Introduce new parking charges or incentives to limit diesel car and high polluting petrol cars (older than Euro 4) from parking in central car parks;
5. Reduce emissions of all heavy duty vehicles that enter the AQMA by ensuring that they meet Euro VI (Stage II) emission standard by 2020, for example through a CAZ strategy<sup>11</sup>;
6. Reduce emissions of all Council owned, leased contracted or influenced vehicles (e.g. taxis) by ensuring that where possible no diesel vehicles are used and that

<sup>11</sup> <https://consult.defra.gov.uk/airquality/implementation-of-cazs/>

vehicles meet the Office for Low Emission Vehicle (OLEV) standard for ultra-low emission vehicles by 2020 (i.e. <75 g/km CO<sub>2</sub>);<sup>12</sup>

7. Develop air quality supplementary planning guidance (SPG) that is integrated fully into the planning process;
8. Continue to work with and lobby Hampshire County Council to identify and deliver other projects which will make an early and positive impact on air quality;
9. In consultation with the Portfolio Holder for Environmental Health and Wellbeing, monitor the performance of the action plan and reassess the necessity and feasibility of introducing additional measures if these are required to meet the air quality objectives.

Further detail on each action is provided in Table 5-4 which contains:

- a list of the actions that form the core plan
- the responsible individual and departments who will deliver this action
- expected benefit in terms of pollutant emission and/or concentration reduction
- the timescale for implementation
- how progress will be monitored

An emission modelling exercise was conducted for these core actions using the Emission Factor Toolkit (EFT) in a similar manner to the shortlisted measures. The modelling results showed that the reduction in NO<sub>x</sub> emissions due to measures 1-5 at St George's Street would be 18 percent. Across all modelled roads in the AQMA, the reduction would be slightly less, at 15 percent.

To estimate the potential impact of measure 6, information on the current Council fleet (the "grey fleet") and contracted refuse vehicles and mileage were used<sup>13</sup>. Without details on where these vehicles are driven, it was assumed that 20 percent of the grey fleet trips and 10 percent of refuse vehicle trips took place on the modelled roads within the AQMA. In a reference case (i.e. where no vehicles were replaced from now until 2020), these vehicles contributed to 2 percent of the total NO<sub>x</sub> emissions from road traffic. With measure 6 in place, the NO<sub>x</sub> emissions from

<sup>12</sup> It is noted that there is whilst there is no agreed standard for low NO<sub>x</sub> vehicles, the combination of these two requirements should lead to a reduction in NO<sub>x</sub> emissions.

<sup>13</sup> Provided by David Howarth (WCC) and Nicola Watts (East Hants) and Biffa for refuse fleet



these vehicles reduced by 80 percent, primarily due to the removal of diesel vehicles in the Council fleet (see Table 5-2). This would mean that their contribution to total road traffic NO<sub>x</sub> emissions would be 0.8 percent.

The impacts of measures 1-5 and measure 6 have not been combined together due to the uncertainty of where the Council and contractor vehicles are driven. However, if further information were collected on trips made as part of a KPI (see Section 5.4), then the modelling of these impacts could be refined further.

Additionally measure 6 has not been combined with measures 1 – 5 as there is less certainty to the deliverability through technological innovation during the time period of this action plan.

**Table 5-2: Annual NO<sub>x</sub> emissions due to core action plan measures in 2020**

| Vehicle type | NO <sub>x</sub> emissions (kg/y) |  |                              |  |                              |  |
|--------------|----------------------------------|--|------------------------------|--|------------------------------|--|
|              | 2020 Reference                   |  | 2020 Core Actions            |  | Difference (%)               |  |
|              | Modelled roads (measure 1-5)     | Council & contracted fleet (measure 6) | Modelled roads (measure 1-5) | Council & contracted fleet (measure 6) | Modelled roads (measure 1-5) | Council & contracted fleet (measure 6) |
| Petrol car   | 3,656                            | 35                                     | 3,299                        | 166                                    | -10%                         | +371%                                  |
| Diesel car   | 49,251                           | 1,805                                  | 43,720                       | -                                      | -11%                         | -100%                                  |
| LGV          | 17,156                           | 279                                    | 15,715                       | 174                                    | -8%                          | -38%                                   |
| Rigid HGV    | 7,200                            | 809*                                   | 2,696                        | 256                                    | -63%                         | -68%                                   |
| Artic HGV    | 2,089                            | -                                      | 983                          | -                                      | -53%                         | -                                      |
| Bus/coach    | 13,172                           | -                                      | 11,843                       | -                                      | -10%                         | -                                      |
| Motorcycle   | 109                              | 5                                      | 103                          | 4                                      | -6%                          | -21%                                   |
| <b>Total</b> | <b>92,633</b>                    | <b>2,934</b>                           | <b>78,359</b>                | <b>599</b>                             | <b>-15%</b>                  | <b>-83%</b>                            |

\*Includes refuse fleet (35 vehicles)

Based on the results of the emissions modelling, it is considered **unlikely** that reductions in NO<sub>x</sub> emissions from the core actions would be sufficient to meet the annual mean objective for NO<sub>2</sub> at the roadside. Winchester City Council will consider whether further measures should be introduced into the plan as part of the review and assessment process of ASR and action plan updates to achieve the objective.

### 5.3 Delivery plan

The core actions in the plan have been chosen as the priority measures as Winchester City Council either has direct control or a controlling influence to implement them. Further details on each action including timescales will be

confirmed during the stakeholder consultation process and the final delivery plan will be outlined in the final action plan. This delivery plan will include information on the following for each of the core actions:

- The funding source and mechanism
- Identification of lead officer or department to take the action forward
- Confirmation of the implementation timescale
- Further details of action including for example information on proposed car parking pricing differentials. If necessary, additional modelling will be conducted to further model the impact of the action based on improved data sources.
- Incorporation of the action plan into other strategies including a CAZ strategy and proposed City of Winchester Movement Strategy and revised Car Parking Strategy.

## **5.4 Encouraging behavioural change**

In addition to the 'core actions', Winchester City Council is committed to a programme of encouraging behavioural change through the following actions (see Table 5-5):

- Continue to work with local authorities within the region towards the adoption of a regional low emission strategy (LES);
- Seek to commit to introduce more electric vehicle charging points within Council controlled car parks;
- Review and refresh its own Travel Plan in order to promote more sustainable travel for their staff;
- Provide web based information and sign posting to resources that will assist and encourage workplaces and schools in the City to adopt Travel Plans that promote more sustainable travel for their staff and parents delivering and collecting their children from school;
- Continue to improve public access to live parking information and new signage to better inform the public on available spaces and to guide them to the car parks most suited to the purpose of their journey so as to reduce wasted miles driven;

- Continue to work on the delivery and promotion of car club schemes operating in the city;
- Consider the introduction and promotion of additional cycle stands, in consultation with local cycling groups, as part of planned developments in the AQMA;
- Work with stakeholder organisations and maintain a programme of regular communications to encourage behavioural change and celebrate progress towards the statutory target
- Ensure air quality is a standard consideration as part of procurement practice and should be reflected in the Winchester City Council Procurement Policy;

## **5.5 Monitoring progress**

A number of key performance indicators (KPIs) are proposed for each action (see Table 5-3). These have been designed to include direct (i.e. changes to monitored concentrations) and indirect indicators. It is important for both the City and County Councils to collect appropriate data to be able to effectively monitor progress against each KPI. This will allow Winchester City Council to determine the actual improvements that are happening due to each action and if necessary, to conduct any further modelling to re-assess the actions, for example by refining assumptions and estimates. As part of the development of the new Movement Strategy in 2017, the County working in conjunction with the City Council will be conducting a study to collect further data on traffic movements (including origin and destination) and breakdown of vehicles by type which should assist in providing some of the data required.

Using the agreed KPIs, Winchester City Council will monitor progress made annually on each action and determine whether any further actions will need to be introduced into the plan to achieve the annual mean NO<sub>2</sub> objective in the future.

Table 5-3: Proposed KPIs to monitor progress on action plan measures

| # | Core actions   | Proposed KPIs   |  |   |   |   |   |
|---|--|---|--|---|---|---|---|
|   |  | #1 Description  | Data required  | #2 Description  | Data required   | #3 Description  | Data required   |
| 1 | Build on car parking pricing differential strategy   | Annual mean NO <sub>2</sub> concentration in the AQMAS (reduction)  | Air quality monitoring data collected over a calendar year (annual means). | Car park patronage in central car parks)                                      | Ticketing information from all car parks collected quarterly. Bi-annual manual 7-7 surveys to establish parking turnover. Could apply ANPR cameras to automate the process.   | Preferential customer response  | Conduct regular (e.g. annual) surveys of car park patrons to determine the influence of increased parking tariffs on preferences to park less centrally |
| 2 | Review enforcement of goods deliveries by time of day  | Annual mean NO <sub>2</sub> concentration in the AQMA (reduction)   | Air quality monitoring data collected over a calendar year (annual means). | Penalty charge notices (PCN) issued   | Number of PCNs issued for non-compliant deliveries. Reviewed quarterly  | Shift of deliveries to inter-peak hours of the day (positive). Reviewed bi-annually | Manual 7-7 classified road traffic counts to be conducted quarterly   |
| 3 | Introduce a Park and Ride site in the north of Winchester  | Bus patronage (increase)  | Ticketing information collected quarterly and analysed on a daily basis    | Traffic flows within the AQMA (reduction)                                     | Long term automatic traffic counters installed and a monthly digest started.  | Level of customer satisfaction (increase)   | Conduct quarterly surveys of P&R patrons to determine the level of satisfaction   |
| 4 | Introducing new parking charges or incentives to limit diesel and high pollution petrol cars (older than Euro 4) from parking in central car parks | Annual daily traffic flow and average speeds on roads within the AQMAS (reduction in flow, increase in speed) | Automatic traffic count data   | Ratio of petrol to diesel light duty vehicles accessing car parks (positive). | Vehicle registration details collected manually on a specific weekday and at a specific hour. Vehicle fuel type is then determined from the DVLA database. To be repeated quarterly. Could apply ANPR cameras to automate the process | Preferential customer response  | Conduct quarterly surveys of car park patrons to determine preferences to pay additional tariffs for more polluting vehicle types                       |

| # | Core actions   | Proposed KPIs   |  |  |   |                                      |  |
|---|--|---|--|--|---|--------------------------------------|--|
|   |  | #1 Description  | Data required  | #2 Description   | Data required   | #3 Description                       | Data required  |
| 5 | Ensure that all heavy duty vehicles that enter the AQMA meet Euro VI emission standard   | Annual mean NO <sub>2</sub> concentration in the AQMA (reduction) | Air quality monitoring data collected over a calendar year (annual means).   | Number of Euro VI HGVs entering the AQMA (increase)  | Vehicle registration details collected manually on a specific weekday and at a specific hour. Vehicle emission standards are then determined from the DVLA database. To be repeated quarterly. Could apply ANPR cameras to automate the process | Penalty charge notices (PCNs) issued | Number of PCNs issued for non-compliant vehicles. Reviewed quarterly |
| 6 | Ensure that all Council owned, leased or contracted vehicles are either not diesel fuelled (where possible) and that they meet the OLEV emission standard for ultra-low emission vehicles by 2020 (i.e. <75 g/km CO <sub>2</sub> ) | Numbers of Low Emissions in Fleet Register (LEFR) (increase)      | Vehicle fuel type, CO <sub>2</sub> and Euro emission standard to be recorded for all vehicles registered onto the Council LEFR | Number of trips in the AQMA  | Every trip undertaken on behalf of the Council needs to be recorded as mainly being within the City boundary or beyond  |                                      |  |
| 7 | Develop an air quality supplementary planning document   | Annual mean NO <sub>2</sub> concentration in the AQMA (reduction) | Air quality monitoring data collected over a calendar year (annual mean).  | Planning applications showing regard for SPD (i.e. with consideration of AQ impact and mitigation if required) | Introduce a tick box on all planning applications to register an applicant's due regard for AQ concerns. The number of positive ticks can be reviewed annually.   |                                      |  |
| 8 | Continue to work with and lobby Hampshire County Council to identify projects to improve air quality   | Annual mean NO <sub>2</sub> concentration in the AQMA (reduction) | Air quality monitoring data collected over a calendar year (annual mean).  |  |   |                                      |  |

| # | Core actions   | Proposed KPIs   |   |   |  |                |               |
|---|--|---|---|---|--|----------------|---------------|
|   |  | #1 Description  | Data required   | #2 Description  | Data required  | #3 Description | Data required |
| 9 | Monitor the performance of the action plan and reassess whether additional measures are required to meet the objective | Annual mean NO <sub>2</sub> concentration in the AQMA (reduction) | Air quality monitoring data collected over a calendar year (annual mean). | Estimated emission reductions due to implementation of measures | Long term automatic traffic count data and ANPR camera data on fleet |                |               |

Table 5-4 – Air Quality Action Plan Core Actions

| Measure No.   | Measure   | EU Category                         | EU Classification                        | Lead Authority | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3)  | Target Pollution Reduction in the AQMA     | Progress to Date   | Estimated Completion Date* | Comments   |
|---------------|---|-------------------------------------|--|----------------|----------------|-----------------------|--|--|--|----------------------------|--|
| Core measures |   |                                     |  |                |                |                       |  |  |  |                            |  |
| 1             | Build on existing car park pricing differentiation strategy   | Traffic Management                  | Other                                    | WCC            | 2018           | tbc                   | 1. Annual mean NO <sub>2</sub><br>2. Car park patronage<br>3. Preferential responses                   | 2% reduction in NO <sub>x</sub> emissions  | Existing car parking pricing structure for central, inner and outer Winchester | tbc                        | Integrate into new Parking Strategy due for revision in 2018 |
| 2             | Review enforcement of goods deliveries by time of day and enforce   | Freight and Delivery Management     | Quiet & out of hours delivery            | WCC            | 2017           | tbc                   | 1. Annual mean NO <sub>2</sub><br>2. PCNs issued<br>3. Change in delivery hours                        | 2% reduction in NO <sub>x</sub> emissions  |  | tbc                        |  |
| 3             | Introduce a Park and Ride site in the north of Winchester   | Alternatives to private vehicle use | Bus based Park & Ride                    | WCC            | 2017           | tbc                   | 1. Bus patronage<br>2. Traffic flow<br>3. Use and satisfaction of P&R                                  | 3% reduction in NO <sub>x</sub> emissions  | Investigation of suitable sites  | tbc                        | P&R lite already proposed for Barton Farm                    |
| 4             | Introduce new parking charges/incentives to reduce diesel car parking and high pollution petrol cars (older than Euro 4) from parking in central car parks in favour of low emission vehicles | Traffic Management                  | Emission based parking or permit charges | WCC            | 2017/2018      | tbc                   | 1. Traffic flow and speed<br>2. Increase in petrol /ULEVs using car parks<br>3. Preferential responses | 10% reduction in NO <sub>x</sub> emissions |  | tbc                        |  |

## Winchester City Council

| Measure No. | Measure  | EU Category                             | EU Classification  | Lead Authority | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3)  | Target Pollution Reduction in the AQMA     | Progress to Date              | Estimated Completion Date* | Comments  |
|-------------|--|---|--|----------------|----------------|-----------------------|--|--|-------------------------------|----------------------------|---|
| 5           | Ensure that all heavy duty vehicles that enter the AQMA meet Euro VI Stage II standard by 2020   | Promoting Low Emission Transport        | Low Emission Zone (LEZ) or Clean Air Zone (CAZ)                            | WCC            | 2017           | 2020                  | 1. Annual mean NO <sub>2</sub><br>2. Number of Euro VI entering AQMA<br>3. PCNs issued | 10% reduction in NO <sub>x</sub> emissions |                               | tbc                        | May be achieved through a voluntary CAZ strategy  |
| 6           | Ensure that all Council-owned, leased, contracted or influence vehicles that enter the AQMA meet the OLEV standards for ULEVs and are not diesel fuelled by 2020 | Promoting Low Emission Transport        | Company Vehicle Procurement - Prioritising uptake of low emission vehicles | WCC            | 2017           | 2020                  | 1. Low emission vehicles in fleet<br>2. Number of trips entering AQMAS                 | 2% reduction in NO <sub>x</sub> emissions  |                               | tbc                        |   |
| 7           | Development of air quality supplementary planning document   | Policy Guidance and Development Control | Air Quality Planning and Policy Guidance                                   | WCC            | 2017           | 2017                  | 1. Annual mean NO <sub>2</sub><br>2. Planning applications showing regard for SPG      | N/A  | To be developed in early 2017 | 2018                       | May develop a regional SPD with neighbouring authorities but to be a stand-alone document |
| 8           | Continue to work with and lobby Hampshire County Council to identify projects to improve air quality   | Policy Guidance and Development Control | Regional Groups co-ordinating programmes                                   | WCC/HCC        | 2017           | tbc                   | 1. Annual mean NO <sub>2</sub>   | N/A  |                               | tbc                        |   |



| Measure No. | Measure  | EU Category        | EU Classification | Lead Authority | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3)                                     | Target Pollution Reduction in the AQMA | Progress to Date  | Estimated Completion Date* | Comments |
|-------------|--|--------------------|-------------------|----------------|----------------|-----------------------|---|--|---|----------------------------|----------|
| 9           | Monitor the performance of the action plan and reassess whether additional measures are required to meet the objective | Public Information | Other             | WCC            | 2017           | 2018                  | 1. Annual mean NO <sub>2</sub><br>2. Modelling of actual emissions reductions | See Core Actions                       | To be undertaken as part of annual reporting requirements (ASR due in June each year) | Ongoing                    |          |

\*The implementation and completion dates will be completed following consultation

**Table 5-5 - Air Quality Action Plan Complementary Measures**

| Measure No.                   | Measure  | EU Category                             | EU Classification   | Lead Authority    | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3) | Target Pollution Reduction in the AQMA | Progress to Date | Estimated Completion Date* | Comments |
|-------------------------------|--|---|---|-------------------|----------------|-----------------------|---|--|------------------|----------------------------|----------|
| <b>Complementary measures</b> |  |   |   |                   |                |                       |   |  |                  |                            |          |
| 10                            | Work with authorities towards adoption of a regional LES                           | Policy Guidance and Development Control | Regional Groups co-ordinating programmes to develop area wide LES | WCC with SCC, EBC | 2017           | tbc                   | 1. Adoption of strategy                   |  |                  | tbc                        |          |
| 11                            | Seek to commit to introduce more electric vehicle charging points within car parks | Promoting Low Emission Transport        | Procuring infrastructure to promote low emission vehicles         | WCC               | 2017           | 2017 & beyond         | 1. Number of points installed             | N/A                                    |                  | tbc                        |          |

## Winchester City Council

| Measure No. | Measure   | EU Category                         | EU Classification           | Lead Authority | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3)  | Target Pollution Reduction in the AQMA | Progress to Date | Estimated Completion Date* | Comments   |
|-------------|---|-------------------------------------|-----------------------------|----------------|----------------|-----------------------|--|--|------------------|----------------------------|--|
| 12          | Ensure that air quality is a standard consideration as part of procurement practice and is reflected in the Council's Procurement Policy;                           | Promoting Low Emission Transport    | Company Vehicle Procurement | WCC            | 2017           | 2018                  | 1. Adoption of procurement policy<br>2. Uptake of LEVs (as per core action)            | See core action 6                      |                  | tbc                        |  |
| 13          | Continue to improve public access to live parking information and signage and better signage to encourage drivers to use the car park best suited to their journey. | Public Information                  | Via other mechanisms        | WCC            | 2016           | 2017                  | 1. Utilisation of central car parks  | N/A                                    |                  | Ongoing                    | These messaging signs are already in place for central car parks |
| 14          | To continue to work on the delivery and promotion of car club schemes operating in the city   | Alternatives to Private Vehicle Use | Car Clubs                   | WCC            | 2016           | 2017                  | 1. Number of car club members  | N/A                                    |                  | Ongoing                    |  |
| 15          | Consider the introduction and promotion of additional cycle stands, in consultation with local cycling groups, as part of planned developments in the AQMA          | Promoting Travel Alternatives       | Promotion of cycling        | WCC            | 2017           | 2017                  | 1. Number of cycle parking<br>2. Number of cyclists as a modal share (through surveys) | N/A                                    |                  | tbc                        |  |

| Measure No. | Measure   | EU Category                   | EU Classification                                 | Lead Authority | Planning Phase | Implementation Phase* | Key Performance Indicator (see Table 5-3)              | Target Pollution Reduction in the AQMA | Progress to Date | Estimated Completion Date* | Comments |
|-------------|---|-------------------------------|---|----------------|----------------|-----------------------|--|--|------------------|----------------------------|----------|
| 16          | Work with stakeholder organisations and maintain a programme of regular communication to encourage behavioural change                               | Promoting Travel Alternatives | Travel Campaigns                                  | WCC            | 2017           | 2017                  | tbc  | N/A                                    |                  | tbc                        |          |
| 17          | Review and refresh the Council Travel Plan to promote more sustainable travel for staff   | Promoting Travel Alternatives | Workplace Travel Planning                         | WCC            | 2017           | tbc                   | 1. Number of staff travelling to work by car (surveys) | N/A                                    |                  | tbc                        |          |
| 18          | Provide web based information and sign posting to resources that will assist and encourage workplaces and schools in the City to adopt Travel Plans | Promoting Travel Alternatives | Workplace Travel Planning and School Travel Plans | WCC            | 2017           | tbc                   | 1. Number of travel plans adopted                      | N/A                                    |                  | tbc                        |          |

\*The implementation and completion dates will be completed following consultation

## 6. Glossary of Terms

| Abbreviation    | Description   |
|-----------------|---|
| AQAP            | Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'    |
| AQMA            | Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives |
| AQS             | Air Quality Strategy  |
| ASR             | Air quality Annual Status Report  |
| CAZ             | Clean Air Zone  |
| CO <sub>2</sub> | Carbon dioxide  |
| Defra           | Department for Environment, Food and Rural Affairs  |
| EFT             | Emission Factor Toolkit   |
| EU              | European Union  |
| HGV             | Heavy Goods Vehicle (lorries)   |
| HDV             | Heavy Duty Vehicle (over 3.5 tonnes) including lorries and buses  |
| HSTT            | Hampshire Sustainable Transport Towns   |
| KPI             | Key Performance Indicators  |
| LAQM            | Local Air Quality Management  |
| LDV             | Light Duty Vehicle (cars and vans under 3.5 tonnes)   |
| LEFR            | Low emission fleet register   |
| LEZ             | Low Emission Zone   |
| LTP             | Local Transport Plan  |
| NO <sub>2</sub> | Nitrogen Dioxide  |
| NO <sub>x</sub> | Nitrogen Oxides   |

|                   |   |
|-------------------|---|
| OLEV              | Office for Low Emission Vehicles  |
| PCN               | Penalty Charge Notices (enforcement)  |
| PHE               | Public Health England   |
| PM <sub>10</sub>  | Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less |
| PM <sub>2.5</sub> | Airborne particulate matter with an aerodynamic diameter of 2.5µm or less                         |
| SPD               | Supplementary Planning Document   |
| ULEV              | Ultra Low Emission Vehicle  |
| WDSP              | Winchester District Strategic Partnership   |
| WinACC            | Winchester Action on Climate Change   |
| WTAP              | Winchester Town Access Plan   |

## 7. References

Hampshire County Council and Winchester City Council, 2011. Winchester Town Access Plan, July 2011

Winchester City Council, 2016. Detailed Assessment and Associated Studies, February 2016 (Bureau Veritas)

Winchester City Council 2016a. 2014 Progress Report, 2015 Updating and Screening Assessment, 2016 Air Quality Annual Status Report (ASR). August 2016 (Air Quality Consultants).

## Appendix A: Response to Consultation

**Table A.1 – Summary of Responses to Consultation and Stakeholder Engagement on the AQAP\***

| Consultee | Category | Response |
|-----------|----------|----------|
|           |          |          |
|           |          |          |
|           |          |          |
|           |          |          |
|           |          |          |

\*To be completed in the final action plan

Winchester Action on Climate Change (WinACC) has conducted a number of on-street polls to gauge the opinion of the public on air pollution on consider what measures could be taken forward. A summary of the results of the most recent polls conducted in 2016 are provided in the tables below. On both days, the measure with the most public support was restricting vehicle access to the centre (allowing only residents, taxis, disability and delivery vehicles to enter). The second most popular measure was to introduce more pedestrianised areas within the centre. In contrast measures such as congestion charging or introducing workplace parking levies whereby employees pay to park had little support by those questioned in the poll.

Table A.2 – Response of people questioned on street, 2<sup>nd</sup> October 2016

| Category   | Total numbers | Restrict vehicle access | More pedestrian areas | Different car parking charges by area | More electric vehicle charging points | Workplace parking levy | Congestion charge | Increase residents parking permit | Do nothing |
|--|---------------|-------------------------|-----------------------|---------------------------------------|---------------------------------------|------------------------|-------------------|-----------------------------------|------------|
| Residents within Winchester                        | 570           | 165                     | 149                   | 98                                    | 40                                    | 54                     | 45                | 1                                 | 18         |
| Commuters  | 41            | 12                      | 10                    | 12                                    | 4                                     | 0                      | 3                 | 0                                 | 0          |
| Regular visitors or shoppers (e.g. weekly/monthly) | 260           | 36                      | 23                    | 32                                    | 7                                     | 7                      | 4                 | 0                                 | 1          |
| Visitors (once per 6 months)                       | 110           | 12                      | 10                    | 12                                    | 4                                     | 0                      | 3                 | 0                                 | 0          |
| Tourists (visit once)                              | 62            | 12                      | 23                    | 10                                    | 5                                     | 4                      | 2                 | 0                                 | 6          |
| <b>Total</b>                                       | <b>1043</b>   | <b>298</b>              | <b>265</b>            | <b>205</b>                            | <b>83</b>                             | <b>83</b>              | <b>75</b>         | <b>5</b>                          | <b>29</b>  |

Table A.3 – Response of people questioned on street, 26<sup>th</sup> November 2016

| Category   | Total numbers | Restrict vehicle access | More pedestrian areas | Different car parking charges by area | More electric vehicle charging points | Workplace parking levy | Congestion charge | Increase residents parking permit | Do nothing |
|--|---------------|-------------------------|-----------------------|---------------------------------------|---------------------------------------|------------------------|-------------------|-----------------------------------|------------|
| Residents within Winchester                        | 284           | 85                      | 69                    | 35                                    | 33                                    | 18                     | 30                | 8                                 | 6          |
| Commuters  | 47            | 11                      | 10                    | 8                                     | 8                                     | 5                      | 4                 | 1                                 | 0          |
| Regular visitors or shoppers (e.g. weekly/monthly) | 126           | 41                      | 26                    | 17                                    | 14                                    | 14                     | 11                | 3                                 | 0          |
| Visitors (once per 6 months)                       | 88            | 22                      | 15                    | 16                                    | 18                                    | 14                     | 2                 | 0                                 | 1          |
| Tourists (visit once)                              | 40            | 9                       | 8                     | 12                                    | 7                                     | 2                      | 2                 | 0                                 | 0          |
| <b>Total</b>                                       | <b>585</b>    | <b>168</b>              | <b>128</b>            | <b>88</b>                             | <b>80</b>                             | <b>53</b>              | <b>49</b>         | <b>12</b>                         | <b>7</b>   |



## Appendix B: Reasons for Not Pursuing Action Plan Measures

**Table B.1 – Action Plan Measures Not Pursued at this time and the reasons for that decision**

| Action category    | Action description                  | Reason action is not being pursued (including Stakeholder views)  |
|--------------------|-------------------------------------|---|
| Traffic Management | Congestion Charging                 | This is a national policy so it is unlikely to be considered unless it was to be introduced by the Government.  |
| Traffic Management | Car park charges applying on Sunday | Political decision not to consider this measures at present due to potential negative impact on economy.  |
| Traffic Management | Changes to one-way streets          | These would need to be part of the City of Winchester Movement study which is being led by County and supported by WCC. The measures may be considered in future annual updates |

## Appendix C: Modelling of short list scenarios

As part of the development of this action plan and to assist in the identification of measures, Winchester City Council worked with TRL with to determine a short list of measures and scenarios to take forward for emissions modelling.

A long list of measures was filtered by weighing up those with the greatest potential to improve air quality against acceptability and therefore political risk. The following three types of scenarios, each with three individual potential action plan measures were chosen for further testing as part of the short list:

**Scenario 1** = those actions where it is believed will realise the highest AQ benefits regardless of political risk;

**Scenario 2** = those actions where it is believed will realise modest AQ benefits taking into account high/medium levels of public popularity;

**Scenario 3** = those actions where it is believed will realise marginal AQ benefits taking into account high levels of public popularity

### 1. Scenario Testing

#### 1.1 2020 Reference

Whilst the purpose of the action plan is to focus on NO<sub>x</sub> emissions and subsequently NO<sub>2</sub> concentrations as this is the statutory requirement under the LAQM process, the emission assessment also considered emissions of PM<sub>10</sub> and CO<sub>2</sub> for informative purposes. It is noted that the modelling approach taken was relatively simplistic given the data available and therefore a number of assumptions needed to be made which means there are uncertainties in the results presented in the plan. In order to assess these impacts in more detail to take into account factors such as congestion, it is recommended that further data and detailed dispersion modelling is undertaken in the future.

Assumptions were made for the future year of 2020 to determine a reference case (i.e. with no action plan in place). To do this, the most up-to-date traffic and fleet data were collated for roads within and radiating to the city centre. Data from traffic counts were provided by the County Council and additional data were taken from the recent Detailed Assessment (WCC, 2016) including information on the local vehicle fleet. The baseline data are provided in Appendix 2 and the assumptions made for 2020 are summarised below:

- Traffic flows were adjusted to 2020 from the relevant reference year using factors calculated from the DfT Temproware software which takes into account regional development. The traffic growth from 2016-2020 is predicted to be 9% and from 2014-2020 it is 12%.
- Speed data were assumed to be the same as the current data

- 2014 local fleet data from an ANPR camera survey were factored to 2020 in line with a scaling factor determined from the projections in the Emission Factor Toolkit (EFT) v7.
- For CO<sub>2</sub> emissions, a local fleet composition cannot be specified within the EFT. Therefore these emissions were calculated using the default 2020 fleet and an adjustment was made based on the ratio between NO<sub>x</sub> emissions.
- In 2015, a background NO<sub>2</sub> concentration of 20 µg/m<sup>3</sup> was used from the urban background monitoring site at Godson House. By 2020, this background is assumed be lower as vehicle emissions decline and a value of 14.5 µg/m<sup>3</sup> was used, based on an adjustment in line with Defra's background maps.<sup>14</sup>
- Recent evidence from real-world driving measurements has shown that NO<sub>x</sub> emissions from Euro 6/VI diesel vehicles are higher than published emission factors which are set under controlled test conditions<sup>15</sup>. To take these into account the emission factors within the EFT were scaled up according to the multipliers given in the CURED spreadsheet V2A.<sup>16</sup> These scaling factors resulted in overall NO<sub>x</sub> emissions being on average 30-40% higher.

In addition to the emissions modelling, to provide an indication on likely ambient NO<sub>2</sub> concentrations in 2020, the emissions were input into the dispersion model ADMS-Roads which was run for St. George's Street only at selected monitoring sites. To represent the impact congestion has on air quality, traffic queues were integrated into the dispersion modelling based on local observation made by the client.

The specific modelling assumptions made for each scenario are explained in further detail in the tables below.

---

<sup>14</sup> <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

<sup>15</sup> Evidence from ICCT at <http://www.theicct.org/nox-europe-hdv-ldv-comparison-jan2017>

<sup>16</sup> <http://www.aqconsultants.co.uk/News/March-2016/New-Calculator-to-Support-Vehicle-Emissions-Sensit.aspx>

## 1.2 Scenario 1

| Action # | Lead authority | Theme                          | Measure description                                      | Emission benefit | Public acceptability | Modelling assumptions for individual measures   |
|----------|----------------|--------------------------------|--|------------------|----------------------|---|
| 1        | WCC            | Parking Strategy               | Parking surcharges for diesel vehicles in city car parks | M/H              | L                    | The direct emissions impact of this action is practically impossible to model without journey based screenline surveys and preference information. In this case, the impact of a target to switch 5% of car park users from diesel to petrol cars was tested. The test assumed car parking fleets are analogous to the fleet on the roads. The average cars parked on weekday, weekend has been provided in each car park. It was assumed that each vehicle travels a minimum of 2 km to access and leave the car park within the centre (estimated to be Winchesters locally driven distance impact factor). |
| 2        | HCC            | City Centre Traffic Management | Changes to the existing one-way system                   | H                | L/M                  | Based on Options 1a and 1b in the Winchester Traffic Management Study, it was predicted there would be small reductions in daily vehicle flow of 5% (reduction of approx. 700 vehicles per day) on St George's St, Jewry St, North Walls and a 5% increase on High St, Upper High St (50 vehicles per day increase)   |
| 3        | WCC            | City Centre Traffic Management | Congestion charging to restrict access to all vehicles   | M/H              | L                    | Based on a £5 daily charge, this measure would aim to take out around half of the through traffic. Given a conservative estimate of through traffic of 20%, this would equate to a 10% reduction in traffic and associated 5% increase in speed   |

**Combined modelling assumptions for scenario 1:**

**Measure (3)** Reduction in daily traffic flow (all vehicles) by 10% on all modelled city centre roads with a 5% increase in speed

**Measure (2)** Further reduction of 2% (all vehicles) on St George's Street, Jewry Street, North Walls, 2% increase in Upper High Street and High Street

**Measure (1)** Petrol and diesel split of cars is adjusted according to the weight of the car park patronage compared to the total traffic.

**An additional scenario 1a was modelled without measure 34 (congestion charging).**

## 1.3 Scenario 2

| Action # | Lead authority | Theme                          | Measure description   | Emission benefit | Public acceptability | Modelling assumptions for individual measures   |
|----------|----------------|--------------------------------|---|------------------|----------------------|---|
| 4        | WCC            | Goods delivery strategy        | Restricting and enforcing deliveries by time of day   | M                | H                    | Traffic flow is unlikely to change during the 24 hour period, but there would be reduced congestion at peak time. To represent this as an annual mean, it was assumed that average speed increases by 5%  |
| 5        | WCC            | Parking Strategy               | 2018 Parking Strategy to increase car park prices by geographical area (outer, middle, inner) | L/M              | L                    | The updated parking strategy would increase car park charges in the centre, lower charges in the outer area and introduce charges on Sunday. This would reduce traffic flows but considered to be a marginal impact as people will still drive. The optimistic impact is assumed to be a reduction of 5% in cars. |
| 6        | HCC            | City Centre Traffic Management | Gating controls at traffic lights to manage congestion  | M/H              | L/M                  | Holding traffic back will not reduce traffic volumes in the city centre but will allow traffic to flow quicker in the centre. It was assumed that there will be an increase in average speed for all vehicles by 5%   |

**Combined modelling assumptions for scenario 2:**

**Measure (4)** 7.5% speed increase on all modelled central roads (owing to the traffic reduction from (23&32)).

**Measure (5)** 5% reduction in cars on all modelled central roads

## 1.4 Scenario 3

| Action # | Lead authority | Theme                          | Measure description  | Emission benefit | Public acceptability | Modelling assumptions for individual measures   |
|----------|----------------|--------------------------------|--|------------------|----------------------|---|
| 7        | HCC            | Sustainable Travel             | Additional Park and Ride site in the North   | L/M              | H                    | A new P&R site is likely to result in a reduction in car traffic in this city centre from routes coming from north (primarily Andover Rd or possibly Stockbridge Rd). Assuming a car park of approx. 800 spaces, this may contribute to a conservative reduction of 4.5% on the daily flow on all city centre roads. e.g approx. 500 cars. Evidence from this has been based on park and ride schemes in other cities (e.g. Oxford and Leicester) and information on the number of cars using South P&R in Winchester (at current capacity)                               |
| 8        | WCC            | Parking Strategy               | Regulated and greenhouse gas emission based parking surcharge/discount for residents in CPZs | L/M              | L/M                  | In consultation with WCC, TRL has assumed a conservative 20% through traffic, 60% commuter traffic and 20% local traffic. This policy would affect this local proportion. It is assumed that the application of discounts and surcharges would result in 10% of the local diesel cars uplifted to Euro 5 petrol cars (applied to 20% of the fleet). This assumption is in line with sensitivity testing undertaken by TRL for Merton. It is noted that it is very difficult to understand how residents will actually react to tariff changes without preference surveys. |
| 9        | LAs            | City Centre Traffic Management | Regional LES or CAZ to restrict vehicles based on type/ emissions                            | L/M              | L/M                  | This measure assumes that all heavy duty vehicles (lorries and buses) need to be a minimum of Euro VI in line with Defra's CAZ proposals  |

**Combined modelling assumptions for scenario 3:**

**Measure (7)** Reductions in daily traffic flow by 4.5% on all modelled central roads over the day

**Measure (8)** 10% of the diesel cars to be changed to Euro 5 equivalent petrol cars in the fleet applied to 20% of the fleet

**Measure (9)** All heavy duty vehicles to be Euro VI in the fleet

## 2. Results

### 2.1 2020 Reference

The results of the reference emissions modelling are given in Table 1, Table 2 and Table 3 for NO<sub>x</sub>, PM<sub>10</sub> and CO<sub>2</sub> respectively for each individual modelled road. These results show that the largest contribution to emissions of both pollutants is from the light duty vehicles (LDVs), i.e. the cars and vans as there are a much larger proportion of these vehicles in the fleet. Heavy duty vehicles (HDVs), i.e. buses and lorries contribute around 20-25 percent of emissions of all pollutants.

Table 1: NO<sub>x</sub> road link emission rates, 2020 reference

| Road                                   | Total NO <sub>x</sub> g/km/s | LDV NO <sub>x</sub> g/km/s | % LDV contribution | HDV NO <sub>x</sub> g/km/s | % HDV contribution |
|--|------------------------------|----------------------------|--------------------|----------------------------|--------------------|
| <b>St Georges Street</b>               | 0.069                        | 0.051                      | 73%                | 0.018                      | 27%                |
| <b>St Cross Rd N</b>                   | 0.016                        | 0.014                      | 88%                | 0.002                      | 12%                |
| <b>St Cross Rd S</b>                   | 0.015                        | 0.013                      | 88%                | 0.002                      | 12%                |
| <b>Romsey Rd W</b>                     | 0.019                        | 0.013                      | 69%                | 0.006                      | 31%                |
| <b>Romsey Rd E</b>                     | 0.018                        | 0.013                      | 69%                | 0.006                      | 31%                |
| <b>Upper High St</b>                   | 0.041                        | 0.029                      | 71%                | 0.012                      | 29%                |
| <b>Sussex St</b>                       | 0.022                        | 0.019                      | 86%                | 0.003                      | 14%                |
| <b>Jewry St</b>                        | 0.060                        | 0.043                      | 71%                | 0.018                      | 29%                |
| <b>North Walls</b>                     | 0.065                        | 0.044                      | 68%                | 0.021                      | 32%                |
| <b>Union St</b>                        | 0.079                        | 0.054                      | 69%                | 0.025                      | 31%                |
| <b>Friarsgate</b>                      | 0.060                        | 0.048                      | 80%                | 0.012                      | 20%                |
| <b>Chesil St</b>                       | 0.054                        | 0.036                      | 68%                | 0.017                      | 32%                |
| <b>Wales St S</b>                      | 0.019                        | 0.017                      | 89%                | 0.002                      | 11%                |
| <b>Wales St N</b>                      | 0.023                        | 0.018                      | 80%                | 0.005                      | 20%                |
| <b>Worthy Lane S</b>                   | 0.025                        | 0.020                      | 81%                | 0.005                      | 19%                |
| <b>Worthy Lane N</b>                   | 0.013                        | 0.010                      | 73%                | 0.004                      | 27%                |
| <b>Alresford Rd E</b>                  | 0.012                        | 0.008                      | 69%                | 0.004                      | 31%                |
| <b>Alresford Rd W</b>                  | 0.014                        | 0.010                      | 69%                | 0.004                      | 31%                |
| <b>Andover St</b>                      | 0.041                        | 0.035                      | 85%                | 0.006                      | 15%                |
| <b>Bridge Street</b>                   | 0.040                        | 0.027                      | 68%                | 0.013                      | 32%                |
| <b>The Broadway</b>                    | 0.090                        | 0.046                      | 51%                | 0.044                      | 49%                |
| <b>City Road</b>                       | 0.066                        | 0.046                      | 71%                | 0.019                      | 29%                |
| <b>Eastgate St (before Friarsgate)</b> | 0.064                        | 0.052                      | 80%                | 0.013                      | 20%                |
| <b>Eastgate St (after Friarsgate)</b>  | 0.047                        | 0.040                      | 85%                | 0.007                      | 15%                |
| <b>Middle Brook St</b>                 | 0.008                        | 0.006                      | 80%                | 0.002                      | 20%                |
| <b>Southgate St</b>                    | 0.047                        | 0.038                      | 81%                | 0.009                      | 19%                |
| <b>Stockbridge St</b>                  | 0.028                        | 0.025                      | 86%                | 0.004                      | 14%                |
| <b>Upper Book St</b>                   | 0.009                        | 0.007                      | 76%                | 0.002                      | 24%                |
| <b>Hyde St</b>                         | 0.018                        | 0.017                      | 94%                | 0.001                      | 6%                 |



Table 2: PM<sub>10</sub> road link emission rates, 2020 reference

| Road                            | Total PM <sub>10</sub> g/km/s | LDV PM <sub>10</sub> g/km/s | % LDV contribution | HDV PM <sub>10</sub> g/km/s | % HDV contribution |
|---------------------------------|-------------------------------|-----------------------------|--------------------|-----------------------------|--------------------|
| St Georges Street               | 0.006076                      | 0.004972                    | 82%                | 0.001104                    | 18%                |
| St Cross Rd N                   | 0.001857                      | 0.001696                    | 91%                | 0.000161                    | 9%                 |
| St Cross Rd S                   | 0.001708                      | 0.00156                     | 91%                | 0.000148                    | 9%                 |
| Romsey Rd W                     | 0.001773                      | 0.001375                    | 78%                | 0.000399                    | 23%                |
| Romsey Rd E                     | 0.001698                      | 0.001316                    | 78%                | 0.000382                    | 22%                |
| Upper High St                   | 0.003587                      | 0.00282                     | 79%                | 0.000767                    | 21%                |
| Sussex St                       | 0.002255                      | 0.002033                    | 90%                | 0.000222                    | 10%                |
| Jewry St                        | 0.005334                      | 0.004208                    | 79%                | 0.001125                    | 21%                |
| North Walls                     | 0.006097                      | 0.004603                    | 75%                | 0.001494                    | 25%                |
| Union St                        | 0.007281                      | 0.00539                     | 74%                | 0.00189                     | 26%                |
| Friarsgate                      | 0.006012                      | 0.005113                    | 85%                | 0.000899                    | 15%                |
| Chesil St                       | 0.005449                      | 0.004086                    | 75%                | 0.001363                    | 25%                |
| Wales St S                      | 0.002003                      | 0.001835                    | 92%                | 0.000168                    | 8%                 |
| Wales St N                      | 0.002469                      | 0.00209                     | 85%                | 0.000379                    | 15%                |
| Worthy Lane S                   | 0.002481                      | 0.00209                     | 84%                | 0.000391                    | 16%                |
| Worthy Lane N                   | 0.001471                      | 0.001147                    | 78%                | 0.000324                    | 22%                |
| Alresford Rd E                  | 0.001381                      | 0.001041                    | 75%                | 0.00034                     | 25%                |
| Alresford Rd W                  | 0.001627                      | 0.001226                    | 75%                | 0.000401                    | 25%                |
| Andover St                      | 0.004645                      | 0.004134                    | 89%                | 0.000511                    | 11%                |
| Bridge Street                   | 0.004347                      | 0.003262                    | 75%                | 0.001084                    | 25%                |
| The Broadway                    | 0.004655                      | 0.00344                     | 74%                | 0.001216                    | 26%                |
| City Road                       | 0.006246                      | 0.004874                    | 78%                | 0.001372                    | 22%                |
| Eastgate St (before Friarsgate) | 0.006511                      | 0.005561                    | 85%                | 0.000949                    | 15%                |
| Eastgate St (after Friarsgate)  | 0.004914                      | 0.004387                    | 89%                | 0.000527                    | 11%                |
| Middle Brook St                 | 0.000881                      | 0.00075                     | 85%                | 0.000131                    | 15%                |
| Southgate St                    | 0.00523                       | 0.00445                     | 85%                | 0.00078                     | 15%                |
| Stockbridge St                  | 0.003299                      | 0.002963                    | 90%                | 0.000335                    | 10%                |
| Upper Book St                   | 0.00095                       | 0.000774                    | 81%                | 0.000176                    | 19%                |
| Hyde St                         | 0.002175                      | 0.002081                    | 96%                | 0.000093                    | 4%                 |

Table 3: CO<sub>2</sub> road link emission rates, 2020 baseline

| Road              | Total CO <sub>2</sub> g/km/s | LDV CO <sub>2</sub> g/km/s | % LDV contribution | HDV CO <sub>2</sub> g/km/s | % HDV contribution |
|-------------------|------------------------------|----------------------------|--------------------|----------------------------|--------------------|
| St Georges Street | 38.9                         | 31.2                       | 80%                | 8.1                        | 21%                |
| St Cross Rd N     | 9.7                          | 8.6                        | 89%                | 1.0                        | 11%                |
| St Cross Rd S     | 8.9                          | 7.9                        | 89%                | 0.9                        | 11%                |
| Romsey Rd W       | 10.7                         | 8.0                        | 74%                | 2.8                        | 26%                |
| Romsey Rd E       | 10.3                         | 7.6                        | 74%                | 2.7                        | 26%                |
| Upper High St     | 26.1                         | 17.7                       | 68%                | 8.8                        | 34%                |

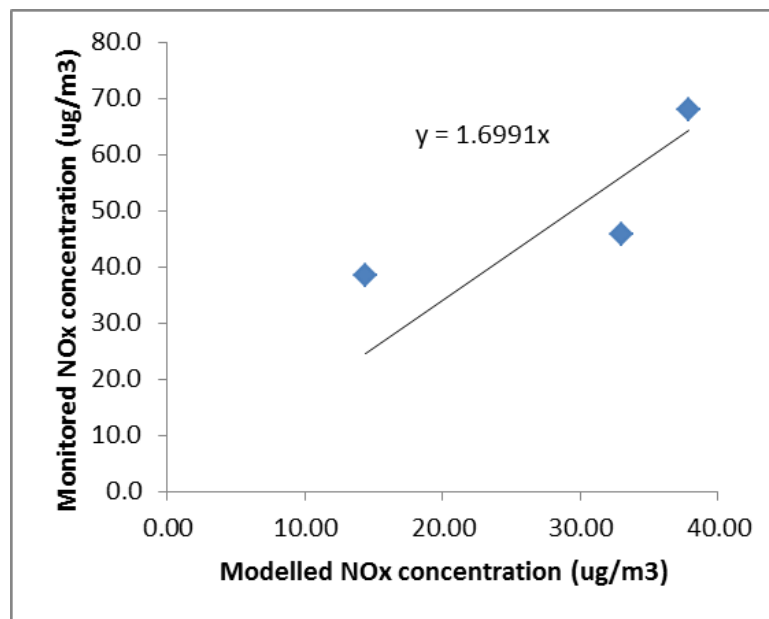
|  |      |      |     |      |     |
|--|------|------|-----|------|-----|
| <b>Sussex St</b>                               | 13.4 | 11.5 | 86% | 1.9  | 14% |
| <b>Jewry St</b>                                | 32.6 | 25.9 | 79% | 7.4  | 23% |
| <b>North Walls</b>                             | 34.1 | 26.1 | 77% | 8.7  | 26% |
| <b>Union St</b>                                | 45.6 | 31.5 | 69% | 14.1 | 31% |
| <b>Friarsgate</b>                              | 33.1 | 28.4 | 86% | 5.2  | 16% |
| <b>Chesil St</b>                               | 31.2 | 21.7 | 69% | 9.5  | 31% |
| <b>Wales St S</b>                              | 11.4 | 9.9  | 87% | 1.6  | 14% |
| <b>Wales St N</b>                              | 14.5 | 10.9 | 75% | 3.9  | 27% |
| <b>Worthy Lane S</b>                           | 14.3 | 11.9 | 83% | 2.5  | 18% |
| <b>Worthy Lane N</b>                           | 8.1  | 5.9  | 72% | 2.3  | 28% |
| <b>Alresford Rd E</b>                          | 7.4  | 5.1  | 69% | 2.3  | 31% |
| <b>Alresford Rd W</b>                          | 8.7  | 6.0  | 69% | 2.7  | 31% |
| <b>Andover St</b>                              | 23.7 | 20.9 | 89% | 2.8  | 12% |
| <b>Bridge Street</b>                           | 23.7 | 16.4 | 69% | 7.3  | 31% |
| <b>The Broadway</b>                            | 57.0 | 39.1 | 69% | 17.6 | 31% |
| <b>City Road</b>                               | 34.2 | 27.6 | 81% | 7.5  | 22% |
| <b>Eastgate St<br/>(before<br/>Friarsgate)</b> | 35.5 | 30.7 | 86% | 5.4  | 15% |
| <b>Eastgate St (after<br/>Friarsgate)</b>      | 27.1 | 24.0 | 89% | 3.2  | 12% |
| <b>Middle Brook St</b>                         | 4.5  | 3.8  | 85% | 0.7  | 16% |
| <b>Southgate St</b>                            | 27.3 | 22.9 | 84% | 4.5  | 17% |
| <b>Stockbridge St</b>                          | 17.3 | 14.9 | 86% | 2.4  | 14% |
| <b>Upper Book St</b>                           | 4.9  | 4.0  | 80% | 1.0  | 20% |
| <b>Hyde St</b>                                 | 11.1 | 10.5 | 94% | 0.6  | 6%  |

To assess whether the NO<sub>2</sub> annual mean objective of 40 µg/m<sup>3</sup> is likely to be exceeded in 2020 at a typical roadside location within the AQMA without any interventions, the emission rates for NO<sub>x</sub> were used to model NO<sub>2</sub> concentrations in St George's Street. This modelling exercise was not conducted for PM<sub>10</sub> as there are no current exceedances of the air quality objectives in Winchester.

The model was set up with a generic meteorological data file which assumed a dominant wind direction from the southwest. Queueing at junctions was applied in the morning and afternoon peaks on weekdays. The model was run to output NO<sub>x</sub> concentrations from the road source only (referred to as "road NO<sub>x</sub>") at selected monitoring sites. Background concentrations were used in the model outputs, as taken from the 2015 measured data from the background site at Godson House and adjusted for 2020 in line with Defra's predictions.

The model road-NO<sub>x</sub> outputs were verified against the 2015 monitoring data and an adjustment factor of 1.6991 was applied (see Figure 1) using Defra's NO<sub>x</sub>-NO<sub>2</sub> calculator. This was also used to convert the verified model outputs into annual mean NO<sub>2</sub> concentrations.<sup>17</sup>

<sup>17</sup> <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>

Figure 1: Comparison of modelled and monitored road NO<sub>x</sub> concentrations

The results of this modelling are given in Table 4. These results suggest that by 2020, concentrations at these three monitoring sites (site 8, site 5 and site XDT5 in St George's St) would be below the objective of 40  $\mu\text{g}/\text{m}^3$ . However, there are a number of reasons why models under or over predict measured data, including under representing the environmental factors such as the emission sources and weather conditions to whether or not building factors have been adequately accounted for. These results should be treated with caution for the reasons outlined below the table.

Table 4: Modelled annual mean NO<sub>x</sub> and NO<sub>2</sub> concentrations, St Georges Street

| Site ID       | x      | Y      | Height (m) | Distance from road (m) | Annual mean modelled concentrations (µg/m <sup>3</sup> ) |                                     |                                    |                               |                               |
|---------------|--------|--------|------------|------------------------|--|-------------------------------------|------------------------------------|-------------------------------|-------------------------------|
|               |        |        |            |                        | 2015 monitored NO <sub>2</sub>                           | 2015 monitored road NO <sub>x</sub> | 2015 modelled road NO <sub>x</sub> | 2015 modelled NO <sub>2</sub> | 2020 modelled NO <sub>2</sub> |
| <b>Site 8</b> | 448106 | 129541 | 2.5        | 4                      | <b>50.2</b>  | 68.0                                | 37.9                               | 48.8                          | 36.9                          |
| <b>Site 5</b> | 448213 | 129504 | 1.7        | 3                      | 38.2   | 38.4                                | 14.4                               | 32.0                          | 23.7                          |
| <b>XDT5</b>   | 448158 | 129526 | 1.2        | 2                      | <b>41.4</b>  | 45.9                                | 33.0                               | 45.6                          | 34.1                          |

- The uncertainty of this modelling was calculated as approximately 25 percent of the objective being assessed (i.e. +/- 10 µg/m<sup>3</sup>). This is known as a systematic error and this may be due to a number of factors including data uncertainty and the variability of measurements. In this case, there are only three measurement points that were compared.
- The model was only run for a single road, and therefore contributions from emissions from other roads will not have been taken into account.

Taking into account these caveats, the results suggest that annual mean NO<sub>2</sub> concentrations are likely to exceed the objective in 2020 as they may be 10 µg/m<sup>3</sup> higher than predicted in the model. This means that if the concentration at site 8 was actually 46.9 µg/m<sup>3</sup> in 2020, then based on the methodology in LAQM.TG16, a reduction of NO<sub>2</sub> by 6.9 µg/m<sup>3</sup> and road NO<sub>x</sub> by 17.4 µg/m<sup>3</sup> (25 percent) would be required to meet the objective. Further intervention would therefore be required at many roadside locations such as Site 8 (St. Georges St TC) and Site XDT5 (Café Centro) as well as other receptors at similar distances from roads, including St. George's Street and Romsey Road within the Winchester AQMA.

## 2.1 2020 scenarios

The results of the emissions modelling for the following scenarios are given in Table 5, 6 and 7 for NO<sub>x</sub>, PM<sub>10</sub> and CO<sub>2</sub> respectively.

- Scenario 1
  - Action 1 Parking surcharges for diesel cars in city centre car parks
  - Action 2 Changes to the one-way system on Friarsgate
  - Action 3 City wide congestion charging scheme.
- Scenario 1a
  - Action 1 Parking surcharges for diesel cars in city centre car parks
  - Action 2 Changes to one-way system on Friarsgate
- Scenario 2
  - Action 4 Restricting deliveries outside of peak hours
  - Action 5 Higher parking prices in central car parks
  - Action 6 Gating controls to manage congestion into city
- Scenario 3
  - Action 7 Opening of a Northern Park and Ride,
  - Action 8 Emission based discounts and surcharges on residents parking
  - Action 9 Introduction of a Clean Air Zone (CAZ) for heavy duty vehicles (Euro VI)

The modelling results show that all four scenarios are predicted to lead to a reduction in emissions of all pollutants on all roads in 2020. Scenario 3 has the greatest benefit on NO<sub>x</sub> emissions, with reductions ranging from 8 percent to just over 20 percent on certain roads. Scenario 1 with congestion charging in place provides an average reduction of 13 percent. Without congestion charging, the impact is lower at between 2-6 percent (Scenario 1a). It is worth mentioning that the impacts on PM<sub>10</sub> emissions are lower than the NO<sub>x</sub> impacts for all scenarios. For this pollutant, Scenario 1 results in the greatest reductions of around 10 percent. The reductions in CO<sub>2</sub> emissions are significant for all scenarios tested, particularly Scenario 2 and 3.

Table 5: NO<sub>x</sub> emission rates, 2020 scenarios and % change from reference

| Road                                   | S1 NO <sub>x</sub> g/km/s | % change | S1a NO <sub>x</sub> g/km/s | % change | S2 NO <sub>x</sub> g/km/s | % change | S3 NO <sub>x</sub> g/km/s | % change |
|--|---------------------------|----------|----------------------------|----------|---------------------------|----------|---------------------------|----------|
| <b>St Georges Street</b>               | 0.058                     | -15%     | 0.065                      | -6%      | 0.064                     | -8%      | 0.056                     | -18%     |
| <b>St Cross Rd N</b>                   | 0.014                     | -12%     | 0.016                      | -2%      | 0.015                     | -7%      | 0.014                     | -11%     |
| <b>St Cross Rd S</b>                   | 0.013                     | -12%     | 0.015                      | -2%      | 0.014                     | -7%      | 0.013                     | -11%     |
| <b>Romsey Rd W</b>                     | 0.017                     | -12%     | 0.019                      | -3%      | 0.018                     | -8%      | 0.015                     | -20%     |
| <b>Romsey Rd E</b>                     | 0.016                     | -12%     | 0.018                      | -3%      | 0.017                     | -8%      | 0.015                     | -20%     |
| <b>Upper High St</b>                   | 0.037                     | -9%      | 0.040                      | -2%      | 0.038                     | -7%      | 0.032                     | -22%     |
| <b>Sussex St</b>                       | 0.019                     | -13%     | 0.021                      | -4%      | 0.021                     | -7%      | 0.019                     | -13%     |
| <b>Jewry St</b>                        | 0.051                     | -15%     | 0.057                      | -6%      | 0.056                     | -7%      | 0.049                     | -19%     |
| <b>North Walls</b>                     | 0.055                     | -15%     | 0.061                      | -5%      | 0.060                     | -7%      | 0.052                     | -19%     |
| <b>Union St</b>                        | 0.067                     | -14%     | 0.075                      | -5%      | 0.074                     | -7%      | 0.063                     | -21%     |
| <b>Friarsgate</b>                      | 0.051                     | -15%     | 0.056                      | -6%      | 0.055                     | -7%      | 0.051                     | -14%     |
| <b>Chesil St</b>                       | 0.047                     | -12%     | 0.052                      | -2%      | 0.050                     | -7%      | 0.042                     | -21%     |
| <b>Wales St S</b>                      | 0.017                     | -12%     | 0.018                      | -2%      | 0.017                     | -7%      | 0.017                     | -11%     |
| <b>Wales St N</b>                      | 0.020                     | -12%     | 0.022                      | -2%      | 0.021                     | -7%      | 0.019                     | -16%     |
| <b>Worthy Lane S</b>                   | 0.022                     | -12%     | 0.025                      | -2%      | 0.024                     | -6%      | 0.022                     | -14%     |
| <b>Worthy Lane N</b>                   | 0.012                     | -12%     | 0.013                      | -2%      | 0.013                     | -7%      | 0.011                     | -18%     |
| <b>Alresford Rd E</b>                  | 0.011                     | -12%     | 0.012                      | -2%      | 0.011                     | -7%      | 0.010                     | -19%     |
| <b>Alresford Rd W</b>                  | 0.013                     | -12%     | 0.014                      | -2%      | 0.013                     | -7%      | 0.012                     | -19%     |
| <b>Andover St</b>                      | 0.036                     | -12%     | 0.040                      | -2%      | 0.038                     | -7%      | 0.036                     | -12%     |
| <b>Bridge Street</b>                   | 0.035                     | -13%     | 0.038                      | -3%      | 0.037                     | -7%      | 0.032                     | -20%     |
| <b>The Broadway</b>                    | 0.080                     | -11%     | 0.088                      | -2%      | 0.085                     | -5%      | 0.070                     | -22%     |
| <b>City Road</b>                       | 0.057                     | -13%     | 0.063                      | -4%      | 0.061                     | -7%      | 0.054                     | -18%     |
| <b>Eastgate St (before Friarsgate)</b> | 0.056                     | -13%     | 0.062                      | -3%      | 0.060                     | -7%      | 0.055                     | -14%     |
| <b>Eastgate St (after Friarsgate)</b>  | 0.041                     | -13%     | 0.046                      | -4%      | 0.044                     | -7%      | 0.042                     | -12%     |
| <b>Middle Brook St</b>                 | 0.007                     | -13%     | 0.008                      | -3%      | 0.007                     | -7%      | 0.007                     | -14%     |
| <b>Southgate St</b>                    | 0.042                     | -12%     | 0.046                      | -2%      | 0.044                     | -7%      | 0.041                     | -14%     |
| <b>Stockbridge St</b>                  | 0.025                     | -12%     | 0.028                      | -2%      | 0.026                     | -7%      | 0.025                     | -12%     |
| <b>Upper Brook St</b>                  | 0.008                     | -13%     | 0.008                      | -4%      | 0.008                     | -7%      | 0.007                     | -15%     |
| <b>Hyde St</b>                         | 0.016                     | -12%     | 0.018                      | -2%      | 0.017                     | -7%      | 0.017                     | -8%      |

Table 6: PM<sub>10</sub> emission rates, 2020 scenarios and % change from reference

| Road                               | S1 PM10<br>g/km/s | % change | S1a PM10<br>g/km/s | % change | S2 PM10<br>g/km/s | % change | S3 PM10<br>g/km/s | % change |
|------------------------------------|-------------------|----------|--------------------|----------|-------------------|----------|-------------------|----------|
| St Georges Street                  | 0.0053            | -12%     | 0.0059             | -2.3%    | 0.0058            | -5%      | 0.0057            | -6%      |
| St Cross Rd N                      | 0.0017            | -10%     | 0.0019             | -0.2%    | 0.0018            | -4%      | 0.0018            | -5%      |
| St Cross Rd S                      | 0.0015            | -10%     | 0.0017             | -0.1%    | 0.0016            | -4%      | 0.0016            | -5%      |
| Romsey Rd W                        | 0.0016            | -10%     | 0.0018             | -0.2%    | 0.0017            | -5%      | 0.0017            | -6%      |
| Romsey Rd E                        | 0.0015            | -10%     | 0.0017             | -0.2%    | 0.0016            | -5%      | 0.0016            | -6%      |
| Upper High St                      | 0.0034            | -6%      | 0.0036             | 1.7%     | 0.0034            | -4%      | 0.0034            | -6%      |
| Sussex St                          | 0.0020            | -10%     | 0.0022             | -0.3%    | 0.0022            | -5%      | 0.0021            | -5%      |
| Jewry St                           | 0.0047            | -12%     | 0.0052             | -2.3%    | 0.0051            | -4%      | 0.0050            | -6%      |
| North Walls                        | 0.0054            | -12%     | 0.0060             | -2.3%    | 0.0058            | -4%      | 0.0057            | -6%      |
| Union St                           | 0.0064            | -12%     | 0.0071             | -2.2%    | 0.0070            | -4%      | 0.0068            | -6%      |
| Friarsgate                         | 0.0053            | -12%     | 0.0059             | -2.2%    | 0.0057            | -4%      | 0.0057            | -5%      |
| Chesil St                          | 0.0049            | -10%     | 0.0054             | -0.2%    | 0.0052            | -4%      | 0.0051            | -6%      |
| Wales St S                         | 0.0018            | -10%     | 0.0020             | -0.1%    | 0.0019            | -4%      | 0.0019            | -5%      |
| Wales St N                         | 0.0022            | -10%     | 0.0025             | -0.2%    | 0.0024            | -4%      | 0.0023            | -6%      |
| Worthy Lane S                      | 0.0022            | -10%     | 0.0025             | -0.2%    | 0.0024            | -4%      | 0.0023            | -5%      |
| Worthy Lane N                      | 0.0013            | -10%     | 0.0015             | -0.1%    | 0.0014            | -4%      | 0.0014            | -6%      |
| Alresford Rd E                     | 0.0012            | -10%     | 0.0014             | -0.1%    | 0.0013            | -4%      | 0.0013            | -6%      |
| Alresford Rd W                     | 0.0015            | -10%     | 0.0016             | -0.1%    | 0.0016            | -4%      | 0.0015            | -6%      |
| Andover St                         | 0.0042            | -10%     | 0.0046             | -0.2%    | 0.0044            | -5%      | 0.0044            | -5%      |
| Bridge Street                      | 0.0039            | -10%     | 0.0043             | -0.3%    | 0.0042            | -4%      | 0.0041            | -6%      |
| The Broadway                       | 0.0042            | -10%     | 0.0046             | -0.3%    | 0.0045            | -4%      | 0.0043            | -7%      |
| City Road                          | 0.0056            | -10%     | 0.0062             | -0.3%    | 0.0060            | -4%      | 0.0059            | -6%      |
| Eastgate St (before<br>Friarsgate) | 0.0058            | -10%     | 0.0065             | -0.2%    | 0.0062            | -4%      | 0.0062            | -5%      |
| Eastgate St (after<br>Friarsgate)  | 0.0044            | -10%     | 0.0049             | -0.3%    | 0.0047            | -5%      | 0.0047            | -5%      |
| Middle Brook St                    | 0.0008            | -10%     | 0.0009             | -0.2%    | 0.0008            | -4%      | 0.0008            | -5%      |
| Southgate St                       | 0.0047            | -10%     | 0.0052             | -0.2%    | 0.0050            | -4%      | 0.0050            | -5%      |
| Stockbridge St                     | 0.0030            | -10%     | 0.0033             | -0.2%    | 0.0031            | -5%      | 0.0031            | -5%      |
| Upper Brook St                     | 0.0009            | -10%     | 0.0009             | -0.2%    | 0.0009            | -4%      | 0.0009            | -5%      |
| Hyde St                            | 0.0020            | -10%     | 0.0022             | -0.2%    | 0.0021            | -5%      | 0.0021            | -5%      |

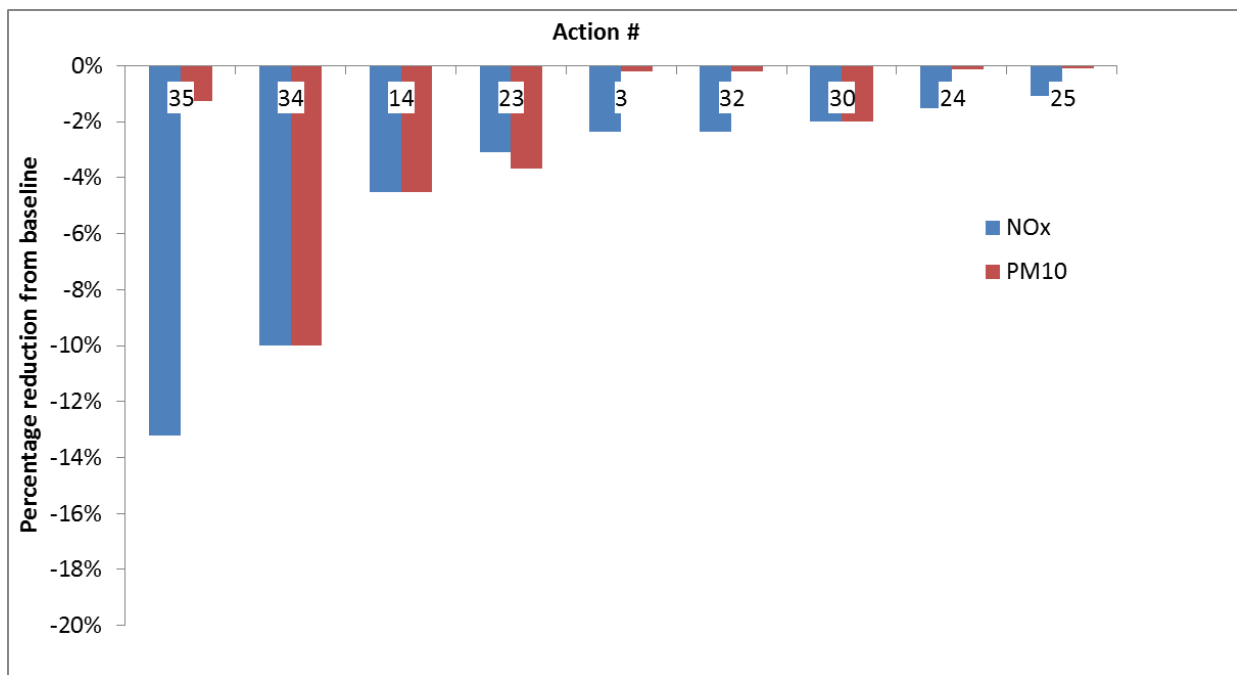
Table 7: CO<sub>2</sub> emission rates, 2020 scenarios and % change from reference

| Road                            | S1 CO <sub>2</sub><br>g/km/s | % change | S1a CO <sub>2</sub><br>g/km/s | % change | S2 CO <sub>2</sub><br>g/km/s | % change | S3 CO <sub>2</sub> g/km/s | % change |
|---------------------------------|------------------------------|----------|-------------------------------|----------|------------------------------|----------|---------------------------|----------|
| St Georges Street               | 26.3                         | -32%     | 29.2                          | -11%     | 28.2                         | -27%     | 25.3                      | -35%     |
| St Cross Rd N                   | 6.5                          | -40%     | 7.3                           | -6%      | 0.8                          | -28%     | 6.6                       | -31%     |
| St Cross Rd S                   | 6.0                          | -40%     | 6.7                           | -6%      | 0.7                          | -28%     | 6.1                       | -31%     |
| Romsey Rd W                     | 7.4                          | -36%     | 8.2                           | -8%      | 2.3                          | -27%     | 6.8                       | -37%     |
| Romsey Rd E                     | 7.1                          | -36%     | 7.9                           | -8%      | 2.2                          | -27%     | 6.5                       | -37%     |
| Upper High St                   | 18.1                         | -42%     | 19.5                          | 2%       | 5.1                          | -30%     | 15.5                      | -41%     |
| Sussex St                       | 9.0                          | -42%     | 10.0                          | -4%      | 1.2                          | -29%     | 9.0                       | -33%     |
| Jewry St                        | 21.9                         | -38%     | 24.3                          | -13%     | 6.3                          | -28%     | 20.9                      | -36%     |
| North Walls                     | 22.9                         | -37%     | 25.5                          | -14%     | 7.3                          | -28%     | 21.6                      | -37%     |
| Union St                        | 29.2                         | -47%     | 32.5                          | -6%      | 9.1                          | -31%     | 27.0                      | -41%     |
| Friarsgate                      | 22.1                         | -39%     | 24.5                          | -11%     | 4.5                          | -28%     | 22.1                      | -33%     |
| Chesil St                       | 21.2                         | -40%     | 23.5                          | -6%      | 6.8                          | -28%     | 19.2                      | -38%     |
| Wales St S                      | 7.5                          | -44%     | 8.4                           | -3%      | 0.8                          | -30%     | 7.7                       | -33%     |
| Wales St N                      | 9.7                          | -44%     | 10.7                          | -1%      | 1.9                          | -29%     | 9.3                       | -36%     |
| Worthy Lane S                   | 9.4                          | -44%     | 10.4                          | -6%      | 1.8                          | -31%     | 9.2                       | -36%     |
| Worthy Lane N                   | 5.4                          | -43%     | 6.0                           | -4%      | 1.5                          | -29%     | 5.1                       | -38%     |
| Alresford Rd E                  | 5.0                          | -40%     | 5.5                           | -5%      | 1.5                          | -28%     | 4.6                       | -38%     |
| Alresford Rd W                  | 5.9                          | -40%     | 6.5                           | -5%      | 1.8                          | -28%     | 5.4                       | -38%     |
| Andover St                      | 16.1                         | -38%     | 17.9                          | -8%      | 2.4                          | -28%     | 16.2                      | -32%     |
| Bridge Street                   | 16.1                         | -40%     | 17.8                          | -5%      | 5.1                          | -28%     | 14.7                      | -38%     |
| The Broadway                    | 37.3                         | -43%     | 41.5                          | -7%      | 18.0                         | -32%     | 33.7                      | -41%     |
| City Road                       | 23.5                         | -35%     | 26.1                          | -13%     | 6.8                          | -27%     | 22.1                      | -35%     |
| Eastgate St (before Friarsgate) | 24.1                         | -38%     | 26.8                          | -10%     | 4.7                          | -28%     | 23.8                      | -33%     |
| Eastgate St (after Friarsgate)  | 18.4                         | -39%     | 20.4                          | -8%      | 2.7                          | -28%     | 18.5                      | -32%     |
| Middle Brook St                 | 3.1                          | -38%     | 3.4                           | -8%      | 0.6                          | -28%     | 3.0                       | -33%     |
| Southgate St                    | 18.5                         | -39%     | 20.5                          | -7%      | 3.6                          | -28%     | 18.1                      | -34%     |
| Stockbridge St                  | 11.7                         | -40%     | 13.0                          | -5%      | 1.6                          | -28%     | 11.8                      | -32%     |
| Upper Brook St                  | 3.3                          | -38%     | 3.7                           | -8%      | 0.8                          | -28%     | 3.2                       | -35%     |
| Hyde St                         | 7.5                          | -40%     | 8.3                           | -5%      | 0.4                          | -29%     | 7.8                       | -29%     |



Predicted changes in emissions from the individual actions within each of the scenarios were considered in more detail at St George's Street. Figure shows that the individual action that results in the greatest reduction in NO<sub>x</sub> emissions is action 9 – a Clean Air Zone that restricts entry to all HDVs (buses and lorries) that do not meet the Euro VI emission standard. This action has a lower impact on PM<sub>10</sub> emissions as there is little difference between Euro V and Euro VI PM<sub>10</sub> emissions. The other actions that have a significant impact on emissions are the introduction of a congestion charge zone (action 3) and Park and Ride (action 7). The predicted reductions in traffic flow (10 percent and 4.5 percent respectively) result in a corresponding reduction in emissions of both pollutants.

Figure 2: Percentage change in emissions from proposed actions compared to the reference situation in 2020, St George's Street.



### 3. Discussion

Based on the emission modelling results and taking into account the uncertainty of the dispersion modelling predictions for the small-scale scenario conducted, it is clear that actions need to be taken forward to ensure that the annual mean NO<sub>2</sub> objective is met at roadside locations in 2020. It is likely that the actions within Scenario 1a and Scenario 2 would **not** provide sufficient reductions in emissions (i.e. predicted to be up to 8 percent) to achieve the objective at the worst case sites. If actions within both Scenario 1 and 3 are both implemented, then these would go some way to providing the NO<sub>x</sub> emissions improvements and lower traffic congestion to achieve the 25 percent road NO<sub>x</sub> reduction required at the roadside. For example, when both these scenarios are modelled at St George's Street, the modelled annual mean NO<sub>2</sub> concentration is reduced by around 4-5 µg/m<sup>3</sup>. Within these scenarios the individually most effective actions in reducing emissions are considered to be a CAZ based on heavy duty vehicles, a congestion charging zone, expansion of the Park and Ride to the north of Winchester and introducing higher parking charges in the city.