



Bath Clean Air Plan

Bath and North East Somerset Council

Full Business Case

674726.BR.042.FBC | 4

January 2020



Bath Clean Air Plan

Project No: 674726.BR.042
Document Title: Full Business Case
Document No.: 674726.BR.042.FBC
Revision: 4
Date: January 2020
Client Name: Bath and North East Somerset Council

Jacobs

1 The Square, Temple Quay
2nd Floor
Bristol, BS1 6DG
United Kingdom
T +44 (0)117 910 2580
F +44 (0)117 910 2581
www.jacobs.com

© Copyright 2019 Jacobs. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Document history and status

Revision	Date	Description	By	Review	Approved
1	14.06.2019	Initial FBC draft for comment	GW, ML, LC	DC, RR	RR
2	15/12/2019	Updated FBC draft	GW, ML, LC	DC	RR
3	07/01/2020	Updated FBC draft	GW, ML, LC	DC	RR
4	17.01.2020	Final FBC	GW, ML, LC	DC	RR

Contents

Acronyms and Abbreviations.....	iv
Executive Summary.....	7
1. Full Business Case Introduction	12
1.1 Overview of Study	12
1.2 Purpose of this Report.....	13
1.3 Structure of this Report	13
2. Strategic Case	14
2.1 Introduction	14
2.2 Air Quality: Background and Context.....	14
2.3 Transport, Business and Air Quality: Policy Context	18
2.4 Assessment of Baseline Transport and Air Quality Conditions	22
2.5 Spending Objectives and Success Factors	32
2.6 Case for Change.....	33
2.7 Option Assessment Process.....	34
2.8 Benefits, Risks, Constraints and Inter-Dependencies.....	42
2.9 Stakeholder Engagement.....	47
2.10 Logic Map	53
3. Economic Case	54
3.1 Introduction	54
3.2 Assessment of Charging Measures	54
3.3 Assessment of Mitigation Measures	59
3.4 Economic Modelling Approach	59
3.5 Economic Impacts.....	60
3.6 Sensitivity Analysis.....	68
3.7 Distributional and Equalities Impact Assessment.....	69
3.8 Economic Impact of the Clean Air Fund Measures.....	72
3.9 Summary	73
4. Commercial Case	75
4.1 Introduction	75
4.2 Output Based Specification	75
4.3 Procurement Options	76
5. Financial Case.....	83
5.1 Introduction	83
5.2 Project Costs	83
5.3 Financial Model.....	86
5.4 Summary	91
6. Management Case.....	93
6.1 Introduction	93
6.2 Previous Experience and Lessons Learned	93
6.3 Project Management	94

6.4	Financial Management	98
6.5	Project Plan	100
6.6	Assurance Framework	101
6.7	Communication and Stakeholder Management.....	102
6.8	Risk Management Strategy	103
6.9	Monitoring and Evaluation Plan and Benefits Realisation Strategy.....	104

Appendix A. Scheme Documents and Related Documentation to Systems Set Up

Appendix B. Stakeholder Management and Engagement Plan

Appendix C. Options Assessment Report

Appendix D. Air Quality Reports

Appendix E. Transport Modelling Reports

Appendix F. E1: Economics Appraisal Methodology Report

Appendix G. Distributional and Equalities Impact Analysis

Appendix H. Clean Air Plan Procurement Strategy

Appendix I. Explanatory Note on CAZ System Cost Estimates

Appendix J. Draft Charging Order

Appendix K. Bath CAP Infrastructure Work Programme

Appendix L. Stated Preference Survey Report

Appendix M. Quantified Risk Assessment

Appendix N. Sensitivity Testing Technical Note

Appendix O. Engagement Summary Report

Appendix P. Environmental Assessment

Appendix Q. Consultation Report

Appendix R. Evaluation, Monitoring and Benefits Realisation Plan

Appendix U. Letter from S151 Officer

Appendix V. Memorandum of Understanding for Emergency Service Vehicles

Appendix W. Financial Report

Appendix Y. Clean Air Fund Report

Acronyms and Abbreviations

ANPR	Automatic Number Plate Recognition
AQMA	Air Quality Management Area
AQ Mesh	Air Quality (Mesh) wireless communications monitoring device
AQO	Air Quality Objective
ATC	Automatic Traffic Counter
B&NES	Bath and North East Somerset Council
BEIS	Department for Business, Energy and Industrial Strategy
BoQ	Bill of Quantities
BT	British Telecom
CAF	Clean Air Fund
CAP	Clean Air Plan
CAPEX	Capital Expenditure
CAZ	Clean Air Zone
CCS	Crown Commercial Services
CO ₂	Carbon Dioxide
COBALT	Cost and Benefit to Accidents – Light Touch
CSF	Critical Success Factor
Defra	Department for the Environment, Food and Rural Affairs
D-IRP	Delivery Independent Review Panel
DfT	Department for Transport
DVLA	Driver and Vehicle Licensing Authority
EFT	Emissions Factor Toolkit
EMF	Early Measures Fund
EU	European Union
EV	Electric Vehicle
FBC	Full Business Case
GAB	Getting Around Bath
GHG	Greenhouse Gas
GUL	Go Ultra Low Cities Funding
GVA	Gross Value Added
HD	High Definition
HE	Highways England
HM	Her Majesty's
HGV	Heavy Goods Vehicle
IF	Implementation Fund
ITS	Intelligent Transport Systems
JAQU	Joint Air Quality Unit
JSP	Joint Spatial Plan ¹
JTS	Joint Transport Strategy

¹ Or other regional partnership arrangements with respect to spatial planning

LAQM	Local Air Quality Management
LEP	Local Enterprise Partnership
LEV	Low Emissions Vehicle
LGV	Light Goods Vehicle
MEV	Mobile Enforcement Vehicle
NAEI	National Atmospheric Emission Inventory
NEC3	New Engineering Contract (version 3)
NO	Nitrogen Oxide
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NPV	Net Present Value
OBC	Outline Business Case
OJEU	Official Journal of the European Union
OPEX	Operational Expenditure
P&R	Park and Ride
PCM	Pollution Climate Mapping
PCN	Penalty Charge Notice
PHEV	Plug-in Hybrid Electric Vehicle
PM	Particulate Matter
PM _{2.5}	Particulate Matter with particles less than 2.5 micrometers diameter
PM ₁₀	Particulate Matter with particles less than 10 micrometers diameter
PMP	Placemaking Plan
PV	Present Value
RPZ	Residents Parking Zone
RTI	Real Time Information
QRA	Quantified Risk Assessment
SCOOT	Split, Cycle and Offset Optimisation Technique
SME	Small and Medium-sized Enterprise
SOC	Strategic Outline Case
SRN	Strategic Road Network
SRO	Senior Responsible Officer
TEE	Transport Economic Efficiency
T-IRP	Technical Independent Review Panel
TM	Traffic Management
TRO	Traffic Regulation Order
TPT	Traffic Penalty Tribunal
TUBA	Transport User Benefits Assessment
TUPE	Transfer of Undertakings (Protection of Employment) Regulations
UK	United Kingdom
ULEV	Ultra-Low Emission Vehicle
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTMC	Urban Traffic Monitoring and Control

VEAT	Voluntary Ex Ante Transparency
VMS	Variable Message Sign
WECA	West of England Combined Authority
WebTAG	Web Transport Analysis Guidance
WoEITS	West of England Intelligent Transport Systems

Executive Summary

Background

The United Kingdom (UK) has in place air quality legislation, passed down from the European Union (EU), to ensure that certain standards of air quality are met. The legal limit for concentrations of NO₂ is 40 µg/m³ as an annual mean. This is breached across the UK, including at several locations in Bath.

In 2017 Bath and North East Somerset Council (B&NES) was directed by Minister Therese Coffey and Minister Jesse Norman to produce a Clean Air Plan (CAP) to achieve air quality improvements in Bath in the shortest possible time. In line with Government guidance, as part of the Plan, B&NES is proposing implementation of a Clean Air Zone, in order to achieve sufficient improvement in air quality and public health. This report sets out the Full Business Case (FBC) for the CAP, building on the preferred option identified in the final Outline Business Case (OBC)². It has been produced in line with the Inception, Evidence and Options Appraisal packages of Guidance issued by the JAQU in 2017, and Her Majesty's (HM) Treasury Green Book³. It details the rationale and justification for securing funding from central government to deliver the plan outlined in the FBC.

The FBC details the preferred option (package of measures) which achieves two primary objectives:

- 1) To deliver a scheme that leads to compliance with NO₂ concentration Limit Values⁴ in the shortest time possible.
- 2) To deliver a scheme which leads to compliance with the Local Air Quality Management (LAQM) Air Quality Objectives (AQOs)⁵ for NO₂ concentrations.

Key Health Benefits

Achieving compliance with air quality standards across Bath will result in widespread public health improvements. Specific health impacts for NO₂ include:

- Long-term exposure to air pollution is linked to increases in premature death, associated with lung, heart and circulatory conditions.
- Short term exposure can contribute to adverse health effects including exacerbation of asthma, effects on lung function and increases in hospital admissions.
- Other adverse health effects including diabetes, cognitive decline and dementia, and effects on the unborn child⁶ are also linked to air pollution exposure.

Transport is widely acknowledged as a key driver of air quality issues. It is estimated in B&NES that around 92% of all Nitrogen Oxide (NO_x) emissions are attributable to road traffic. Consequently, the Bath Clean Air Plan has been developed with an understanding of the wider transport, business and air quality strategies in B&NES and beyond, in order to accord with these policies wherever possible. Whilst the objectives of the CAP overlap with other local and regional strategies, and its delivery could be beneficial to achieving the objectives within these strategies, the CAP has its own specific objectives (resulting from the legal direction on B&NES) and therefore cannot achieve all other local transport objectives.

² Jacobs (05.03.2019) *Bath and North East Somerset Clean Air Plan – Outline Business Case*

³ HM Treasury (2018) *The Green Book: Central Government Guidance on Appraisal and Evaluation*.
<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

⁴ European Union (2008) *Directive 2008/50/EC: on ambient air quality and cleaner air for Europe Annex III*, Official Journal of the European Union. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32008L0050>

⁵ Set out in the Air Quality (England) Regulations (SI 2000/ 928 as amended)

⁶ Royal College of Physicians (2016) *Every breath we take: the lifelong impact of air pollution*.
www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

Existing and Forecast Air Quality Exceedances

Annual mean concentrations of NO₂ continued to show exceedances of both the Limit Values and Air Quality Objectives in 2017 across Bath, and this is predicted to continue by 2021 if no action was taken. Reductions between 2017 and 2021 are expected to occur naturally through the gradual improvement of the fleet as vehicles are replaced but are not expected to happen quickly enough to achieve compliance across the city.

Stakeholder Engagement

Engagement with the public and stakeholders is an important part of developing the CAP for Bath. The Council has made a commitment to communicate and engage with both the public and stakeholders throughout the various business case stages, development of the Plan and implementation of the measures required to reduce emissions. The feedback received has been used to inform the technical work and shape the design of the CAP detailed within this FBC.

The engagement process began in February 2018 and is ongoing. A detailed summary of the comments received to date is provided within this FBC.

Option Assessment

Initially the analysis undertaken in the draft OBC found that compliance in the shortest possible time, in 2021, was only achieved at all locations with a Class D CAZ with a £9 charge for cars/taxis/PHVs/LGVs and £100 charge for buses/coaches/HGVs. This option was consulted upon in Autumn 2018.

Further technical refinement of the baseline air quality modelling was undertaken following the Autumn 2018 consultation, which subsequently enabled a Class C CAZ with a £9 charge for taxis/PHVs/LGVs and £100 charge for buses/coaches/HGVs with a local traffic management scheme to be developed. When assessed this was also found to achieve compliance in the shortest possible time. As such there were two equally effective schemes in terms of compliance alone.

On the basis of the economic assessment and the Critical Success Factors (CSFs) identified for the scheme, the final OBC determined the Class C CAZ with traffic management to be the preferred option. The B&NES Cabinet Members were presented with both options of a Class D CAZ and a Class C CAZ with traffic management in March 2019 and voted to support the Class C CAZ option. This option has been further developed within the FBC.

As well as the core charging zone, the following supporting measures are also required to achieve compliance:

- Bus replacement or retrofitting; and
- A traffic management scheme at Queen Square, where a Class C CAZ without traffic management showed a continued exceedance at A4 Gay Street, between George Street and Queen Square. This involves additional signal control in the north west and south west corners of Queen Square to reduce traffic flow through Gay Street.

Updates to the Preferred Option

Figure 1-1 shows the proposed CAZ boundary in Bath. Further changes were made following completion of the OBC, primarily for public and political acceptability of the scheme based on feedback from the initial consultation.

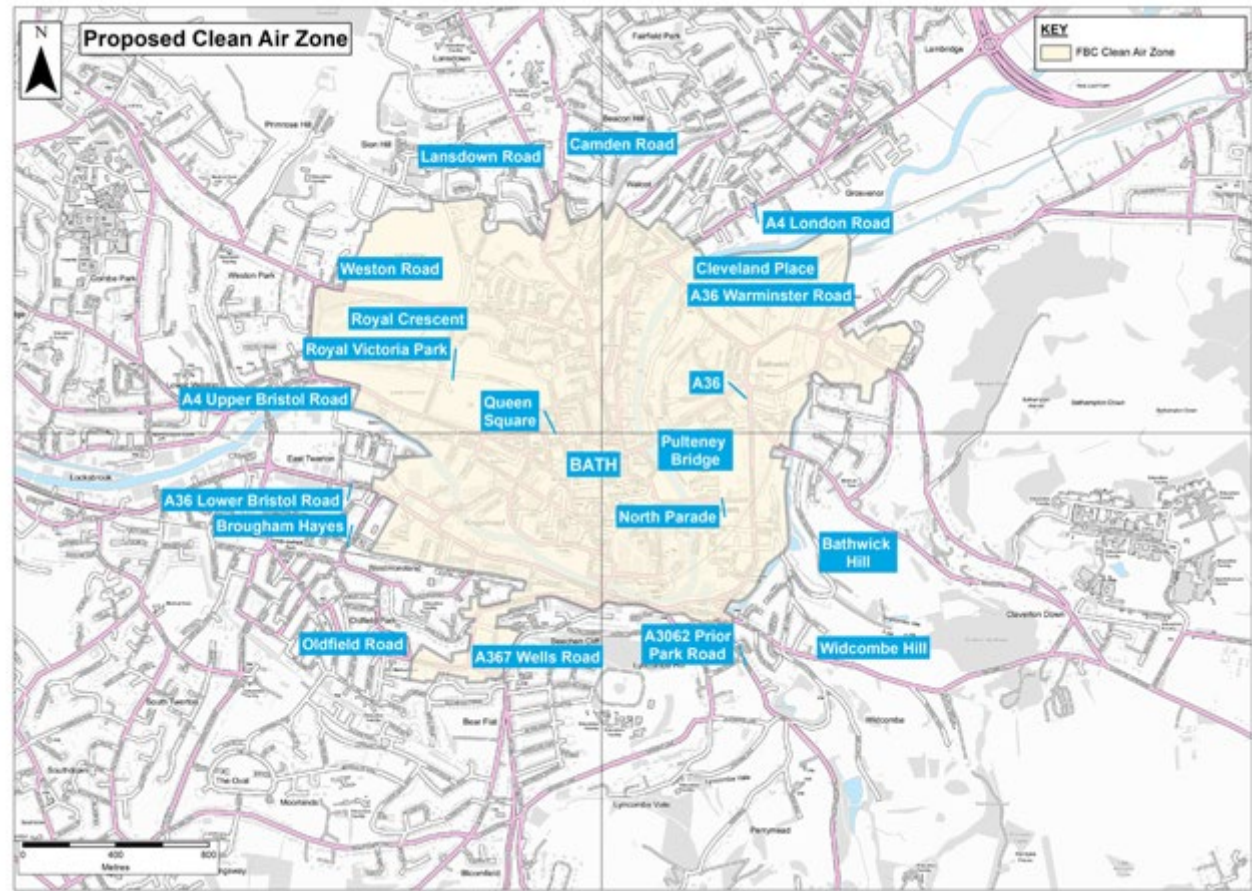


Figure 1-1: Proposed Bath Clean Air Zone Boundary

Enforcement, Concessions and Exemptions

The CAZ area will be enforced with Automatic Number Plate Recognition (ANPR) cameras, both internally and at the boundary crossing points; the cameras will capture the number plate details every time a vehicle passes. Drivers of non-compliant vehicles will be required to pay the CAZ charge using an online system. Charges will apply once in every 24-hour period (midnight – midnight), 7 days a week, 365 days a year. They will apply to higher emission taxis, PHVs, LGVs, buses, coaches and HGVs. A letter and eventually a fine will be issued to those who fail to pay.

Local exemptions and concessions (i.e. time-limited exemptions or sunset periods) are proposed for the CAZ, but only where they are not expected to affect compliance from being achieved in 2021. The proposed concessions/exemptions have been established through technical analysis and feedback from the ongoing engagement work.

Mitigation Measures

A number of non-charging measures were identified in the OBC to support the delivery of the CAP. For the preferred option, these included measures that assist in the improvement of air quality, and those that mitigate impacts on key local groups including local businesses.

For the FBC, this package of measures was revisited to ensure it is fully targeted as mitigation for those impacted by the preferred scheme option, based on the Distributional and Equalities Impact Assessment.

Funding is sought from the Clean Air Fund (CAF) to deliver the following mitigation measures alongside the proposed CAZ scheme:

- Expanding the existing Clean Bus Technology Fund (CBTF) programme by providing additional funding for retrofitting registered, local Euro 3/4/5 buses. This measure is also needed for compliance.
- Financial support for replacing pre-Euro 6 diesel and pre-Euro 4 petrol non-compliant vehicles with compliant ones. This combines:
 - Financial support (grants) for replacing pre-Euro 6 diesel and pre-Euro 4 petrol vehicles and taxis/PHVs with compliant ones;
 - Financial support (interest free loans) for replacing pre-Euro 6 diesel and pre-Euro 4 petrol vehicles and taxis/PHVs with compliant ones;
 - Complementary financial support for installing electric charging points on private land in order to encourage the uptake of electric vehicles; and
 - Complementary financial support for retrofitting in order to allow cheaper, non-compliant vehicles to be made compliant.
- Provide support and facilities for alternative delivery and servicing options for businesses. This combines:
 - Delivery and servicing plans for businesses;
 - Increased utilisation of the car/van club in Bath, with an emphasis on increasing the number of LGVs/vans available to businesses; and
 - Expanding the proposal (included in Go Ultra Low package) to introduce 'last mile' electric cargo bike hire to the city.
- Provide a sustainable travel and transport team to facilitate the use of the mitigation schemes by the impacted groups and ensure uptake.

Economic Impact

For the FBC, the economic assessment for the preferred option was revisited to reflect the boundary changes since OBC, in accordance with the CSFs.

The economic assessment has been undertaken in accordance with JAQU guidance and the HM Treasury Green Book to monetise the CAP's impact based on the value to society. The assessment resulted in a significant negative net present value (NPV), which is as concluded by the OBC, indicating that the economic costs for the proposed scheme outweigh the benefits. The main contributors to economic costs are the loss in consumer welfare associated with the change in travel patterns and behaviours, set up and operational costs of the scheme and vehicle upgrade costs for users.

Projected Costs and Funding

The total request to central government for the delivery and operation of B&NES' Clean Air Plan is around £22.0 million (nominal prices, exclusive of the £5.95 million has already been secured), split as follows:

- £18.3million in capital grant funding, of which:
 - £4.1 million from the Implementation Fund (exclusive of the £5.95 million of funding already secured);
 - £14.2 million from the Clean Air Fund.
- £3.7 million in revenue grant funding, of which:
 - £1.7 million from the Implementation Fund, required to cover:

- The initial operational costs (pre-implementation) for those scheme components required to achieve compliance; and
 - The potential operational deficit that could materialise in the first six months of 2021, in the event that worst case scenario assumptions apply.
- £2.0 million from the Clean Air Fund required to cover selected operational costs of scheme components required to mitigate against potential adverse impacts of the Clean Air Plan on local residents and businesses.

Procurement Strategy

A large range of works and services are being procured for delivery of the CAP. Where possible, these are being procured through existing arrangements. The main advantages of using these current relationships are to achieve the timescales required, while being able to fully align with existing operations and maintain high quality standards of work. If it is not possible to procure through existing arrangements, a tendering process has been followed in accordance with Contract Standing Orders.

However, in many cases, B&NES has previously tested the market and value for money has already been established. Supplier engagement is in progress with the detailed design, scope of works and costs now predominantly confirmed.

Management of the Scheme

B&NES has a proven track record of delivering recent transport and environmental projects of a similar type and scale to the proposed CAP. This practical experience of delivering schemes of a similar size and nature means B&NES has a thorough understanding of the challenges, and associated solutions, that could materialise during implementation and operation of the CAP. Examples include the Bath Transportation Package and Bus Lane and Parking Enforcement projects.

The project will continue to be managed in accordance with the PRINCE2 principles set out in the B&NES Corporate Project Management System. Key roles have been defined, and a structure for the management of the project in line with best practice is proposed. This structure will ensure the project is well managed, including management of risks and change control.

A comprehensive monitoring and evaluation plan will support the process of benefits realisation of the CAP. Local data from the monitoring and evaluation process will also be used to support the central evaluation work being undertaken by Defra.

1. Full Business Case Introduction

1.1 Overview of Study

The United Kingdom (UK) has in place legislation passed down from the European Union (EU), to ensure that certain standards of air quality are met by setting Limit Values on the concentrations of specific air pollutants. In common with many EU member states, the EU Limit Value for annual mean Nitrogen Dioxide (NO₂) is breached in the UK and there are on-going breaches of the NO₂ Limit Value in Bath. The UK Government is taking steps to remedy this breach in as short a time as possible, with the aim of reducing the harmful impacts on public health. Within this objective, the Government published a UK Air Quality Plan⁷ and a Clean Air Zone Framework⁸ in 2017, the latter document provides the expected approach for local authorities when implementing and operating a Clean Air Zone (CAZ).

Due to forecast air quality exceedances, Bath and North East Somerset Council (B&NES) has been directed by Minister Therese Coffey of The Department for the Environment, Food and Rural Affairs (Defra) and Minister Jesse Norman of The Department for Transport (DfT) to produce a Clean Air Plan (CAP) to achieve air quality improvements in the shortest possible time. In line with Government guidance, as part of the Plan, B&NES is considering implementation of a CAZ, including both charging and non-charging measures, in order to achieve sufficient improvement in air quality and public health. Jacobs has been commissioned by B&NES to produce a Full Business Case (FBC) for the delivery of a package of measures which will bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Bath.

The focus of this CAP is on achieving air quality and public health improvements in the shortest time possible in accordance with the High Court Order in November 2016⁹. In the legal case of *Client Earth vs the UK Government*, Mr Justice Garnham of the High Court found that *'I reject any suggestion that the state can have any regard to cost in fixing the target date for compliance or in determining the route by which the compliance can be achieved where one route produces results quicker than another. In those respects, the determining consideration has to be the efficacy of the measure in question and not their cost. That, it seems to me, flows inevitably from the requirements in the Article to keep the exceedance period as short as possible'*. Hence the assessment presented within this document focuses on achieving compliance in the shortest possible time and will only consider cost when comparing between two packages of measures which are equivalent in terms of their timescales for compliance.

Achieving compliance with air quality standards across Bath will result in public health improvements at all locations where exceedances are currently recorded, as well as reducing harm across the entire city.

To support delivery of the plan, the Joint Air Quality Unit (JAQU) have made three core funding streams available:

- Implementation Fund (IF) – provided on a needs basis to deliver measures required to achieve compliance with air quality standards in the shortest possible time.
- Clean Air Fund (CAF) – provided via a competitive bid process, to deliver measures designed to mitigate any adverse distributional impacts expected to fall upon disadvantaged groups (low-income households and businesses in particular).
- Early Measures Fund (EMF) – provided via a competitive bid process, to support small, ambitious, good value for money and highly deliverable measures that catalyse air quality improvements at an advanced stage.

⁷ Defra & DfT (July 2017) *UK plan for tackling roadside nitrogen dioxide concentrations: details plan*.
<https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>.

⁸ Defra & DfT (May 2017) *Clean Air Zone Framework: Principles for setting up Clean Air Zones in England*.
<https://www.gov.uk/government/publications/air-quality-clean-air-zone-framework-for-england>

⁹ November 2016 in R (ClientEarth) (NO₂) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin)

B&NES has already successfully received funding from the EMF application, relating to a parking permit scheme for low emission vehicles. Following acceptance of the OBC, B&NES has also received funding from the Implementation Fund to implement the key infrastructure for the proposed charging zone.

Note that there are also other funding streams that may be available to support the principles and objectives of the Plan. Whilst not directly established by JAQU to support Local Plans, funding opportunities such as the Taxi Infrastructure Fund, Go Ultra Low Cities Funding (GUL), Plug-In Taxi Grants and Clean Vehicle Technology Fund could all play a role in supporting the delivery of elements of the Plan. These other relevant funds are discussed in more detail in the Financial Case, Section 5.2. That said, the primary focus of this FBC is the case for securing the remaining IF and CAF monies to deliver the Plan.

1.2 Purpose of this Report

This report sets out the FBC for the CAP, building on the preferred option identified in the final OBC (March 2019), which will bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Bath. It has been produced in line with the Inception, Evidence and Options Appraisal packages of Guidance issued by the JAQU in 2017, and Her Majesty's (HM) Treasury Green Book. It details the rationale and justification for securing Implementation Funding and Clean Air Funding from JAQU to deliver the plan outlined in the OBC, and how this will be implemented and operated.

1.3 Structure of this Report

This report details the FBC and the preferred option for the Bath Clean Air Plan, which was identified within the OBC following traffic and air quality modelling, economic and social distributional impact assessments. This report builds on the OBC to provide details on any changes to the core scheme, updated procurement and financial information, and a detailed management plan for the implementation and operation of the CAP. Revised proposals for mitigation measures, to support those affected by the preferred option, are also presented.

Within this context, the remainder of this report is structured around the five cases, namely:

- **Strategic Case**, Section 2 – sets out the case for change and the spending objectives of the Plan. For this FBC this includes updates from the OBC options assessment and stakeholder engagement.
- **Economic Case**, Section 3 – assesses the preferred option that achieves compliance in the shortest possible time from a value for money perspective, as well as identifying distributional impacts of the preferred option. The section has been updated from the OBC for the latest scheme costs and mitigation measures.
- **Commercial Case**, Section 4 – provides details on the selected procurement routes and progress, with the recommended delivery approach.
- **Financial Case**, Section 5 – provides updated costings for the Plan, updated where possible following procurement, and available funding sources.
- **Management Case**, Section 6 – provides the governance and management arrangements to deliver the preferred option.

2. Strategic Case

2.1 Introduction

In the case of air quality in Bath, the current problem that needs to be addressed is the identified exceedance of the legal annual mean Limit Value for NO₂. The UK government's monitoring station on London Road in Bath reported an exceedance in 2017 and forecasts based on the Pollution Climate Mapping (PCM) model predicted that this exceedance would remain until 2021. More detailed, local monitoring data shows greater and more widespread exceedances than are indicated within the PCM model (for European regulations) in Bath, and also widespread exceedances of the Local Air Quality Management (LAQM) Air Quality Objectives (AQOs) which has resulted in the declaration of an Air Quality Management Area (AQMA). Further, the two public consultations have demonstrated that the existence of an air quality problem in Bath is recognised by the majority of local people. In the absence of suitably targeted interventions, the exceedances are expected to persist, meaning an improvement in public health will not be accelerated in Bath. Therefore, B&NES would fail to comply with its regulatory responsibilities as publicly-acknowledged air quality problems would continue.

Building on the findings of the SOC, the purpose of the CAP Strategic Case in the OBC was to establish the latest case for change and preferred way forward by:

- Identifying B&NES' statutory and regulatory air quality obligations;
- Presenting existing air quality conditions based on updated air quality and traffic modelling; and
- Outlining the desired goals of this CAP.

Within this context, and in accordance with JAQU's latest guidance, this Strategic Case now considers the following:

- The strategic context, underpinned by European, national and local policies that are pertinent to the project.
- Presentation of the results of the latest baseline air quality and transport modelling.
- Based on these findings, reconsideration of the Strategic Case put forward as part of the SOC; with the case for change and preferred way forward.
- The process and outcome of the options assessment undertaken for the OBC.
- Understanding of the project's benefits, risks, constraints and dependencies.
- Evidence from detailed stakeholder engagement, and the key messages.
- Presentation of a detailed logic map (or theory of change).

2.2 Air Quality: Background and Context

Poor air quality is the largest known environmental risk to public health in the UK¹⁰ and investing in cleaner air along with doing more to tackle air pollution are priorities for the EU and UK governments as well as B&NES. To this end, legislative bodies at all levels are motivated to implement air quality standards to be achieved through actions and policies, with the health of local people at the heart of the measures implemented. As a result, this section presents some of the key policy drivers influencing EU and UK Government policy for achieving air quality compliance. This CAP is concerned with both the EU and UK definitions of compliance.

¹⁰ Public Health England (2014) *Estimating local mortality burdens associated with particular air pollution*.
<https://www.gov.uk/government/publications/estimating-local-mortality-burdens-associated-with-particulate-air-pollution>

2.2.1 Public Health Impacts

A range of public health issues are linked to poor air quality, as detailed below. These issues are believed to disproportionately affect 'at-risk' groups such as older people, children and people with pre-existing respiratory and cardiovascular conditions¹¹:

- Long-term exposure to air pollution is linked to increases in premature death, associated with lung, heart and circulatory conditions.
- Short term exposure can contribute to adverse health effects including exacerbation of asthma, effects on lung function and increases in hospital admissions.
- Other adverse health effects including diabetes, cognitive decline and dementia, and effects on the unborn child¹² are also linked to air pollution exposure.
- Exposure can exacerbate lung and heart disease in older people¹³.
- Between 28,000 and 36,000 deaths can be attributed to NO₂ and fine particulate matter (PM) pollution in England every year.

The primary driver for NO₂ regulations is public health concerns associated with NO₂. Specific health impacts for NO₂ include¹⁴:

- High concentrations of NO₂, that can lead to inflammation of the airways in lungs.
- Long-term exposure can increase symptoms of bronchitis in asthmatic children and reduced lung development and function.

2.2.2 European Requirements

The European air quality reporting regime is underpinned by European Air Quality Limit Values¹⁵. The UK Government has an obligation to achieve European Air Quality Limit Values. The relevant Limit Value relates to NO₂ which must not exceed 40 µg/m³ as an annual mean (i.e. measured over a calendar year).

In light of the public health issues outlined in Section 2.2.1, the UK government is legally responsible for ensuring that it complies with the provisions of the EU Air Quality Directives. The Government assesses air quality compliance with the European Directive in 43 areas across the country at single locations, using both monitoring and modelling. It uses Defra's PCM model to forecast exceedances, which is adjusted based on the monitored data. This is the approved means of reporting air quality information to assess legal compliance with the European legislation.

In 2015, 37 of the 43 monitored areas across the country were in exceedance of the annual mean Limit Value for NO₂. One such area includes a monitoring station on London Road Bath, where the Government has forecast that exceedances will remain until 2021. Local assessments based on a more comprehensive local dataset and more detailed modelling tools, suggest that compliance would not naturally occur until 2025. Between 28,000 and 36,000¹⁶ deaths can be attributed to NO₂ and fine PM pollution in England every year (previously estimated to be 40,000) and hence there is an urgent need to reduce pollution in Bath, and specifically to comply with the Limit Values and Air Quality Objectives (AQOs). The UK Government has discretionary powers to pass on this responsibility (and associated

¹¹ World Health Organization (2013) *Review of evidence on health aspects of air pollution – REVIHAAP Project: final technical report*. <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/review-of-evidence-on-health-aspects-of-air-pollution-revihaap-project-final-technical-report>

¹² Royal College of Physicians (2016) *Every breath we take: the lifelong impact of air pollution*. www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

¹³ Simoni et al., January 2015, *Adverse effects of outdoor pollution in the elderly*, Journal of Thoracic Disease, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4311079/>

¹⁴ World Health Organisation (2016) *Ambient (Outdoor) Air Quality and Health Fact Sheet* [http://www.who.int/en/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](http://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

¹⁵ European Union (2008) *Directive 2008/50/EC: on ambient air quality and cleaner air for Europe Annex III*, Official Journal of the European Union. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32008L0050>

¹⁶ Committee on the Medical Effects of Air Pollutants (2018), *Associations of long-term average concentrations of nitrogen dioxide with mortality*

legal outcomes) to local authorities. As a result of this, B&NES has been directed to develop a CAP to achieve compliance with the legal limit in the shortest possible time. Hence, there are public health and regulatory imperatives for improving air quality in Bath.

2.2.3 UK Government Requirements

To meet UK Government regulations, local authorities must demonstrate that they are working towards the National AQOs. The objective level for concentrations of NO₂ within the national legislation are the same as the European regulations (annual mean of 40 µg/m³) but are applied and assessed differently. AQOs only apply where people are exposed for the averaging period of the objective (i.e. for a year) and therefore, compliance with AQOs is assessed most commonly at building facades (where people are regularly present) including around busy major junctions.

The Government's LAQM regime requires all local authorities to regularly review and assess whether AQOs have been achieved at relevant locations. Where the assessment shows exceedances at relevant locations, the authority must declare an AQMA and prepare an action plan which identifies appropriate measures in pursuit of the objectives.

The difference between the EU and LAQM reporting regimes are further explained by Table 2-1 below:

Table 2-1: Comparison Between Limit Value and Objective Compliance

	Limit Value	Objective
Obligation	Legal obligation on UK Government.	Obligation on Local Authority to act in pursuit of the objective.
Relevant Exposure	Limit Values apply everywhere there is public access.	Annual mean objectives only apply at locations where public exposure is relevant to the averaging period, e.g. at residential building facades.
Treatment of Junctions	Monitoring is not carried out within 25 metres of a major junction and the same constraint is applied to the modelling	Junctions are specifically considered in both monitoring and modelling
Microscale	Excludes micro-environments and focuses on locations representative of 100m lengths of roads	Focuses on "hot-spot" locations
Roadside Modelling	Modelled using the PCM model. Concentrations apply to a distance of 4m from kerbside of the national road network. Local roads are excluded from the model.	Range of models can be used. Focus is on concentrations at the building façade, whatever distance from the kerb and alongside any road.
Monitoring	Restricted to monitoring stations in the national network, operated to meet the Data Quality Objectives of the Directive	Based on both automatic and passive diffusion samplers

2.2.4 Local Assessment

As defined in detail in Section 2.4.2.1, substantial air quality assessment and monitoring activities already take place in Bath, with an AQMA having been declared in the city in 2002. The local monitoring data collected through the air quality assessment activities shows greater and more widespread exceedances than are indicated within the PCM model (for European regulations) in Bath. Figure 2-1 shows the PCM modelled concentrations in Bath (required to meet European regulations), and the local monitoring data recorded by B&NES (required to meet UK Government regulations) as recorded in 2017.

In light of this evidence and following the publication of the UK Government's latest air quality plan (July 2017), B&NES was directed to produce a Local CAP to address the air quality exceedances within Bath.

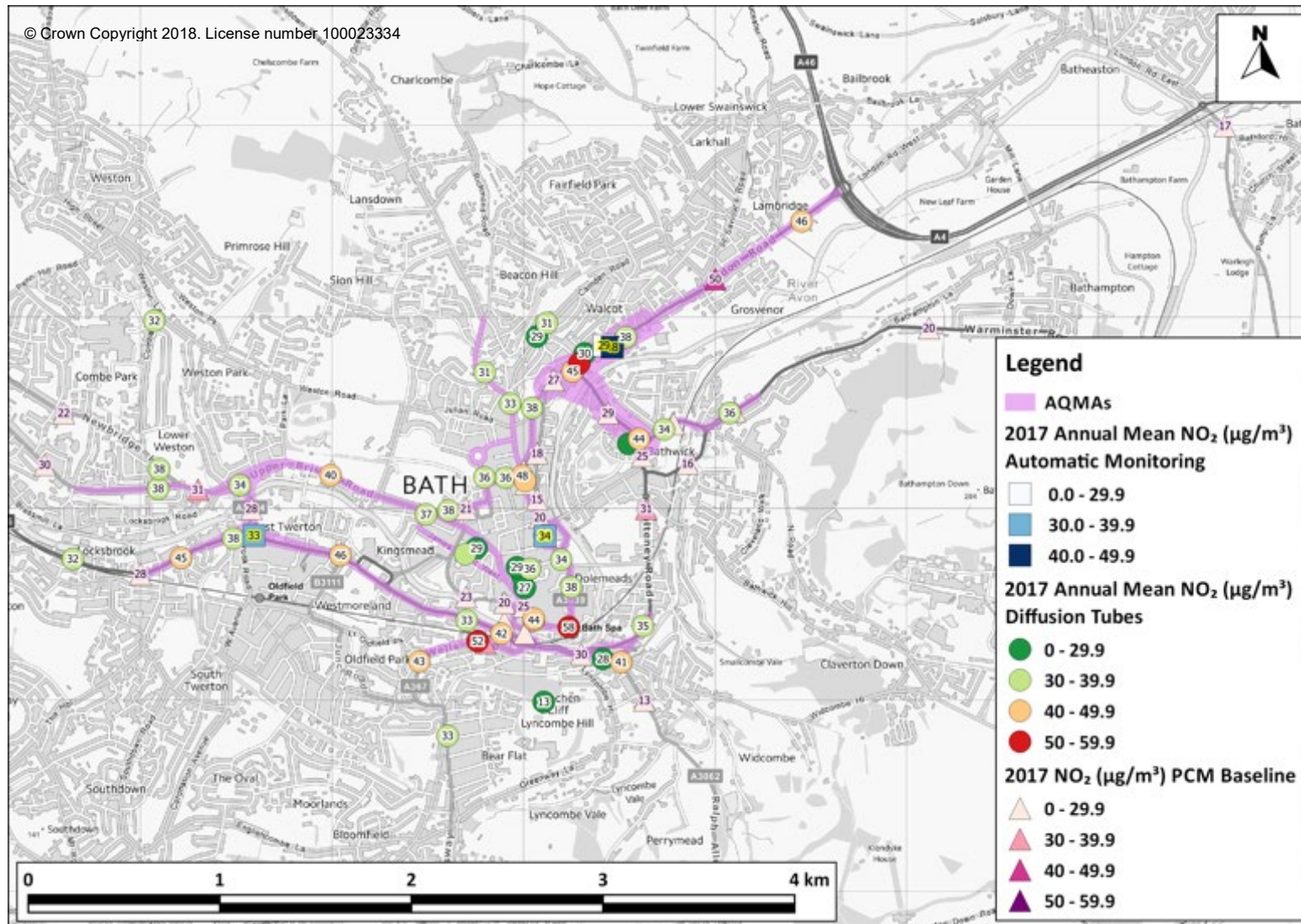


Figure 2-1: Comparison of annual nitrogen dioxide concentrations measured at monitoring sites in Bath

2.3 Transport, Business and Air Quality: Policy Context

2.3.1 Links Between Transport, Business and Air Quality

Transport is widely acknowledged as a key driver of air quality issues, with highway traffic problems such as congestion and fleet composition considered as a primary source of air pollution. For example, The UK National Atmospheric Emissions Inventory (NAEI) estimates that around one-third of all UK Nitrogen Oxides (NO_x) emissions were attributable to road traffic (especially diesel vehicles) in 2015¹⁷. NO_x is a generic term which includes both Nitrogen Oxide (NO) and NO₂. The causal link between road transport and air quality is even more marked in B&NES, given that vehicle movements are thought to be responsible for up to 92% of total NO_x concentration¹⁸.

Growth in vehicular traffic is tied to economic development and growth. As part of the West of England's emerging Joint Spatial Plan (JSP), B&NES is forecast to accommodate additional homes and jobs projected for the West of England over the period 2016 to 2036. This scale of economic development will not only increase traffic on the highway network, it will also increase the number of people likely to be subjected to any ongoing air quality issues in Bath.

Further, despite the long-term shift towards less-polluting road vehicles, background traffic growth associated with economic development could delay the betterment of, or even worsen, traffic-related air quality issues. Therefore, even though the fleet composition may become more environmentally friendly over time, absolute growth of vehicles on the network could suppress the air quality benefits that improved fleet composition would be expected to provide.

Within this context, it is critical to understand the interactions between transport, economic development and air quality policy.

2.3.2 Sub-regional Policy and Strategy

Air quality considerations are at the heart of transport and business planning policy and strategy at the sub-regional level. Key documents looking to address air quality in the West of England include:

- The West of England Local Enterprise Partnership's (LEPs) Strategic Economic Plan (2015-30), which establishes the economic vision for the sub-region.
- The West of England LEPs Local Industrial Strategy, which identifies the region's industrial strengths and challenges and presents plans to solidify the foundations upon which the region will thrive.
- The West of England Joint Local Transport Plan (2011-26), which sets out the transport priorities for the sub-region.
- The West of England JSP¹⁹, which identifies the economic development and growth projections for the sub-region²⁰.
- The West of England Joint Transport Study (JTS), which provides a clear direction for the long-term development of the transport system in the West of England to 2036 and beyond.

In support of the above policies and strategies, West of England Combined Authority (WECA) has been awarded £7 million of GUL Funding to spend over 5 years to encourage the wider use of ultra-low emission transport.

The specific policy objectives of the various development and transport strategies pertinent to the Local Air Quality Plan are outlined in Table 2-2.

¹⁷ NAEI (October 2017), *Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015*. http://naei.beis.gov.uk/reports/reports?report_id=895

¹⁸ B&NES, <http://www.bathnes.gov.uk/services/your-council-and-democracy/local-research-and-statistics/wiki/air-quality>

¹⁹ Or other regional partnership arrangements with respect to spatial planning

²⁰ At the time of writing, the JSP has been submitted to the Government's Planning Inspectorate for consideration, with aspirations for adoption in early 2019

2.3.3 Local Policy and Strategy

B&NES has also published local policies and transport plans, as well as contributing to the development and delivery of wider plans for the West of England. Key documents attempting to influence air quality in B&NES include:

- **B&NES Corporate Strategy** - the overarching plan which sets out the Council's strategic direction for the next four years.
- **B&NES Placemaking Plan (PMP)** - guides development up until 2029 and ensures that any developments within this timeframe are high quality, sustainable, well located and supported by appropriate infrastructure.
- **B&NES Getting Around Bath (GAB) Transport Strategy** - aims to 'enhance Bath's unique status by adopting measures that promote sustainable transport and reduce the intrusion of vehicles, particularly in the historic core. This will enable more economic activity and growth, while enhancing its special character and environment and improving the quality of life for local people'.
- **The B&NES Parking Strategy** - sets out the need to reduce the intrusion of vehicles into urban centres, reflecting concerns surrounding the impact of high numbers of vehicle movements on air quality.
- **The B&NES Public Realm and Movement Strategy for Bath City Centre** - 'designed to give pedestrians, cyclists and public transport vehicles priority over cars, and deliver a network of beautiful, refashioned streets and public spaces'.

The key strategic themes and principles of the existing strategy documents are set out in Table 2-2.

It is also proposed that the Bath Clean Air Plan will be considered within any future relevant local plans, policies and strategies. In addition, in March 2019, B&NES declared a Climate Emergency and passed a motion recognising the urgent need to cut carbon emissions (as a result of burning fossil fuels) and become carbon neutral by 2030.

Table 2-2: Summary of relevant objectives and policies pertaining to air quality issues

Policy/Strategy Document	Relevant Policies and Objectives
Sub-Regional Policy/Strategy Document	
West of England LEP Strategic Economic Plan	• Recognises the need to improve and protect air quality. • Aims to achieve economic growth and development with no detriment to air quality.
West of England LEP Local Industrial Strategy	• Recognises that growth should be in a sustainable and low carbon way, addressing air quality and improving health. • Aims for infrastructure plans that address poor air quality and take action against climate change, with transport systems that improve quality of life and health outcomes for all residents.
West of England Joint Local Transport Plan (2011-26)	• Highlights improving air quality as a key aim in existing AQMA areas within the sub-region (including parts of Bath). • Identifies a strategy to improve air quality, underpinned by three core themes: – Information, promotion, awareness and alternatives: in order to raise public consciousness about air quality issues and the linkages between traffic and air quality. – Network management: to reduce congestion. – Emission management: to reduce fuel consumption patterns through use of 'cleaner' vehicles and modes.
West of England JTS	• Recognises that poor air quality, caused by highway traffic, is a major challenge contributing to ill health and premature death, and as a result, recommends an air quality objective (SH2), that seeks to address poor air quality generated by transport sources. • Supports economic growth. • Promotes reduction in carbon emissions. • Promotes improvement in quality of life and a healthy natural environment. • Seeks to contribute to better safety, health & security. • Promotes accessibility.
West of England JSP: Towards the Emerging Spatial Strategy Document	• Identifies the need to improve air quality as a wider sustainability objective, simultaneous to unlocking economic growth and development. • Aims to ensure that the JSP benefits all sections of our communities.
Local Policy/Strategy Document	
The District PMP	• Policy PCS3 states that developments will only be permitted if they meet certain air quality requirements (for example if situated within an AQMA then the development should comply with the local air quality action plan). • Prevents new developments from exacerbating air quality issues in the area and ensures that air quality issues are fully considered.

Policy/Strategy Document	Relevant Policies and Objectives
	• Encourages economic development, diversification and prosperity. • Invests in our city, town and local centres. • Pursues a low carbon and sustainable future in changing climate. • Plans for development that promotes health and well-being.
B&NES Corporate Strategy	• Recognises that parts of the local authority area suffer from poor air quality and highlights the need for an Air Quality Action Plan to ameliorate these issues.
GAB: A Transport Strategy for Bath	• Improving air quality & health, reducing vehicle carbon emissions. • Supporting and enabling economic growth, competitiveness and jobs. • Promoting sustainable mobility. • Widening travel choice. • Safeguarding and enhancing the unique historic environment and World Heritage Site status.
Parking Strategy	• Seeks to contribute to air quality improvements through recommendations such as: – Introducing standards for EVs and car club bays in new developments. – Reducing off-street parking provision in the city centre. – Amending the charging strategy. – Reducing traffic in the most congested areas and improving air quality.
Public Realm and Movement Strategy for Bath City Centre	• Aims to transform Bath into a pedestrian friendly city, reducing vehicle movements and air pollution. • Contributes to a revitalised economy. • Redefines Bath as a healthy, ethical and sustainable city. • Creates the canvas for public life and well-being. • Enhances the potential of Bath as a place, to benefit visitors, businesses, and the community through enjoyment, health and wellbeing. • Improvement of public information and presentation of the city's heritage. • Addresses traffic movement within and around the city centre of Bath. Working towards a walkable city and becoming the UK's most pedestrian friendly city.

2.4 Assessment of Baseline Transport and Air Quality Conditions

2.4.1 Transport Conditions in Bath

2.4.1.1 Modelled Scenarios

This section of the FBC discusses the results of the modelling without the CAP in place, in order to understand what level the problem would be in the future without any positive interventions. This forms part of a wider set of modelled scenarios which are described below for clarity. The modelled scenarios are as follows:

- Current and base models representing 2017 conditions.
- Baseline model representing 2021 conditions without a CAP in place.
- CAZ scenario models representing 2021 conditions with a CAP in place.

2.4.1.2 Traffic Model Specification

Road transport is recognised to be a key driver of air quality issues at both the national, and even more markedly, at the local level in the context of Bath. Changes in transport conditions are therefore, a key driver of the air quality modelling and baseline results outlined below.

In order to determine current and baseline transport conditions across B&NES, traffic modelling was undertaken using a SATURN highway model, the extent of which is shown in Figure 2-2.



Figure 2-2: Bath model extent

To be consistent with the air quality model, which is verified using the most recent air quality monitoring data, the base year for transport modelling is 2017. This model was developed from an existing model of Bath based on a comprehensive set of traffic surveys, following DfT guidance. The development of the original model is summarised in FBC-12, FBC-13 and FBC-17 in Appendix E of this FBC.

A second year is modelled, representing the year in which compliance is expected to be achieved, and known as the baseline year. Based on the outcomes of the modelling, and an understanding of the time taken to deliver each proposed scheme, a baseline year of 2021 has been modelled. This model takes into account housing and economic growth in B&NES and the wider West of England, which are expected to contribute to an overall growth in traffic flows and changes to highway infrastructure. The schemes and developments included are summarised in FBC-13 'T3 Methodology Report' in Appendix E of this FBC.

The 2017 traffic modelling was informed by Automatic Number Plate Recognition (ANPR) surveys undertaken in November 2017. Details of these surveys are provided in FBC-13 'T3 Methodology Report' in Appendix E of this FBC. The base year vehicle fleet information was determined from the 2017 ANPR sites directly and this has been adjusted to 2021 and 2031 using the Defra forecasts.

The core transport modelling inputs and outputs are outlined in FBC-12, FBC-13 and FBC-17 in Appendix E of this FBC. Outputs including traffic volumes and speeds are adopted as key inputs into the air quality modelling process summarised in the following section.

2.4.2 Air Quality in Bath

Section 2.2 establishes that the key drivers for improving air quality in B&NES are public health and the obligation to achieve European Air Quality Limit Values and national AQOs. Non-compliance with the EU's Limit Values and the UK Government's AQOs for NO₂ represents a significant threat to public health and B&NES legal and regulatory responsibilities. As such, it is essential that a robust understanding of the current and future, scale and extent of exceedances is established under the reference case informed by baseline air quality modelling.

2.4.2.1 Monitoring Data in Bath

B&NES declared an AQMA in 2002 in Bath for the annual mean NO₂ objective which covers the main arterial routes and city centre roads. The designation of an AQMA does not require that a CAZ be put in place; but it does require the local authority to take action and work towards reducing levels of pollution.

Air quality monitoring in Bath is comprehensive and long standing. Bath's monitoring network is focused on NO₂, Particulate Matter (PM_{2.5}) and (PM₁₀). The air quality situation in Bath in 2017 was previously presented in Figure 2-1 showing concentrations of NO₂ at locations within the city.

B&NES operates four automatic monitoring stations within its area, two of which are located on or close to London Road. The Council also operates a large number of diffusion tube sites across its area, with 41 of these sites being used in the analysis presented in this report. In January 2018 a further 23 diffusion tubes were deployed in and around Bath, this was followed by a further 20 in August/September 2018 in 'areas of concern'. In 2019 4 sites were removed due to low recorded concentrations, with 44 new sites added and 39 sites in total made triplicate. Some adjustments were also made to the locations of existing tubes, to add to the evidence base on which this study is undertaken.

The highest measured concentrations of NO₂, adjusted to a relevant receptor, were recorded on London Road (Lambridge DT55 and Anglo Terrace DT90) and Dorchester Street (DT42), where annual mean NO₂ concentrations in 2017 were all above 50 µg/m³. Details of the monitoring sites, along with adjusted modelled concentrations of NO₂, are shown in Table 2-3.

Table 2-3: Monitoring sites and adjusted NO₂ concentrations

Monitoring Site ID	Location	Distance from kerb (m)	In Canyon?	On gradient?	Measured NO ₂ Concentration 2017 (µg/m ³)	Adjusted Modelled Concentration 2017 (µg/m ³)
CM1	London Road	5.00	Yes	No	44.8	42.5
CM2	Guildhall	4.60	Yes	No	30.3	35.1
CM3	Windsor Bridge	2.00	No	No	32.7	37.9

Monitoring Site ID	Location	Distance from kerb (m)	In Canyon?	On gradient?	Measured NO2 Concentration 2017 (µg/m³)	Adjusted Modelled Concentration 2017 (µg/m³)
DT01	High Street	3.60	Yes	No	36.0	35.9
DT03	Broad Street	3.50	Yes	Yes	47.5	44.2
DT04	George Street	2.20	Yes	No	35.7	30.3
DT05	Gay Street – Top	5.70	Yes	Yes	36.2	31.3
DT08	Windsor Bridge	4.00	No	No	34.4	35.9
DT09	Upper Bristol Road	1.00	Yes	No	40.2	35.5
DT11	London Road	1.80	Yes	No	38.1	41.9
DT14	Bathwick Street	2.20	Yes	No	43.6	46.5
DT15	Beckford Road	0.25	No	Yes	33.6	32.1
DT16	Warminster Road	1.95	No	Yes	36.0	34.0
DT17	Widcombe School	2.20	Yes	No	35.4	37.1
DT18	Widcombe High Street	3.90	Yes	No	28.2	25.0
DT20	Wells Road	4.50	Yes	No	51.7	45.2
DT21	Wells Road /Upper Oldfield Park	1.65	No	Yes	43.5	41.7
DT26	Upper Wellsway	3.80	No	No	32.1	25.4
DT34	Newbridge Road	1.96	Yes	No	37.6	37.6
DT35	Newbridge Hill	5.70	No	Yes	37.8	36.0
DT37	Charlotte Street	0.25	Yes	Yes	37.8	32.4
DT39	Manvers Street	1.90	Yes	No	38.4	42.7
DT42	Dorchester Street	0.35	Yes	No	58.2	54.0
DT43	St. James Parade	1.20	Yes	No	45.9	48.5
DT45	James Street West	2.10	Yes	No	39.9	37.9
DT46	Little Stanhope Street	0.35	Yes	Yes	36.6	39.8
DT47	Lansdown Crescent	3.30	No	Yes	30.7	29.1
DT48	Paragon	2.30	No	No	38.4	28.5
DT51	Cleveland Place West	0.40	Yes	Yes	44.6	40.1
DT52/53/54	Walcot Terrace	0.40	Yes	No	44.7	41.8
DT55	Lambridge	1.70	No	Yes	46.1	51.5
DT60	Victoria Terrace	2.20	Yes	No	46.2	45.8
DT61	Morley Terrace	1.70	No	No	38.5	39.0
DT62	Argyle Terrace	0.90	Yes	No	44.8	35.1
DT84	Bearflat	2.20	Yes	No	32.9	29.8
DT85	RUH North	0.90	Yes	No	32.0	27.7

Monitoring Site ID	Location	Distance from kerb (m)	In Canyon?	On gradient?	Measured NO2 Concentration 2017 (µg/m³)	Adjusted Modelled Concentration 2017 (µg/m³)
DT87	Oak Street	2.10	Yes	No	33.4	38.3
DT88	Angel Place	2.60	No	No	42.0	32.8
DT90	Anglo Terrace	1.30	Yes	No	56.6	62.9
DT93	Lower Camden Place, Camden Road	0.15	Yes	Yes	29.4	28.0
DT127	Gays Hill, Camden	0.45	Yes	Yes	30.6	29.7
DT142	Prior Park Road	1.20	Yes	Yes	40.5	37.6
DT143	Rackfield Place	3.90	No	No	32.3	28.7
DT145	Lansdown Road	0.45	Yes	Yes	33.3	37.9

The section below provides information on the source apportionment of emissions at key locations in central Bath, including the three locations mentioned above with the highest recorded concentrations of NO₂ (London Road: Lambridge DT55 and Anglo Terrace DT90; and Dorchester Street DT42).

2.4.2.2 Source Apportionment

Road transport is the main contributor of emissions of NO_x at roadside locations, and therefore the predominant cause in locations where NO₂ concentrations are not complying with Limit Values or AQOs. According to NAEI estimates, around a third of the UK NO_x emissions in 2015 arose from road transport, most of which came from diesel vehicles (NAEI, 2017).²¹ Contributions from transport to NO_x emissions in Bath are higher than the national average due to the high number of vehicles travelling in built-up areas.

No other major sources of NO_x (for example from energy production, domestic combustion or other industrial processes) have been identified within Bath. Other sources of NO_x are included in the background concentrations measured well away from any significant sources of pollution, such as busy roads, railway lines²² or industrial sites.

The 2017 source apportionment in key locations in central Bath, and an average across the city, is shown in Figure 2-3. For further information on the measured emission concentrations at these locations refer to Table 2-3 in the section above.

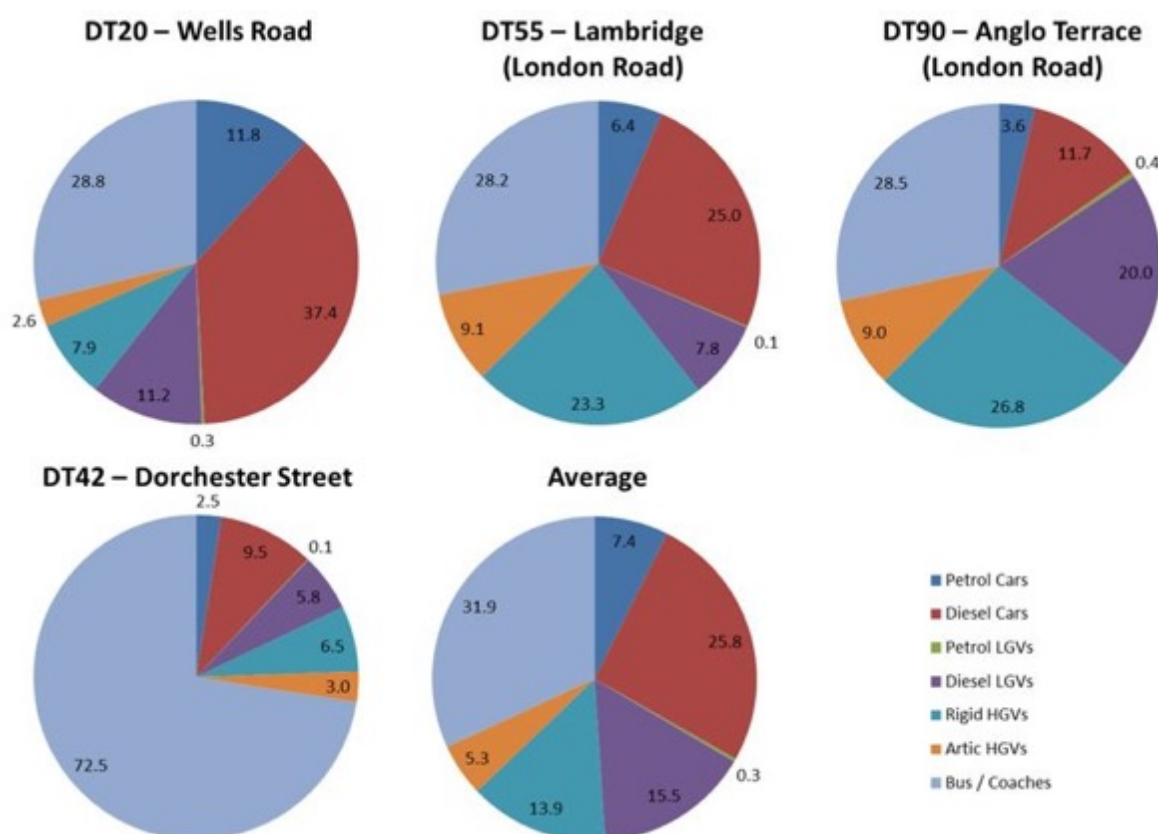


Figure 2-3: Source apportionment at key locations with average across the city (2017)

²¹ NAEI (October 2017), *Air Quality Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 1990-2015*.
http://naei.beis.gov.uk/reports/reports?report_id=895

²² Note that Appendix D considers diesel trains in the context of air quality concentrations in B&NES and concludes that in the context of locations relevant to the Limit Values or AQOs, the contribution from diesel trains is likely to be minimal. See Appendix X for more details.

2.4.2.3 Air Quality Model Specification

The air quality modelling is underpinned by the current Emissions Factor Toolkit (EFT) Version (v8.0.1a) for emissions modelling, and the Defra-approved ADMS-Roads (version 4.1) for dispersion modelling. The model covers a study area that includes Bath city centre, the entirety of the AQMA and the wider city. Figure 2-4 illustrates the study area, which incorporates all densely populated areas of the city, including those areas not covered by the proposed charging zone. This is because very small changes in concentrations applied across a large population base can account for significant health impacts.

The model is run at receptors representing both locations relevant for the AQOs (façades of residential buildings, schools, hospitals etc.) and locations designed to be comparable to the Government's PCM model, which is used to report compliance with the Limit Values. These receptors have been presented separately as there are important differences.

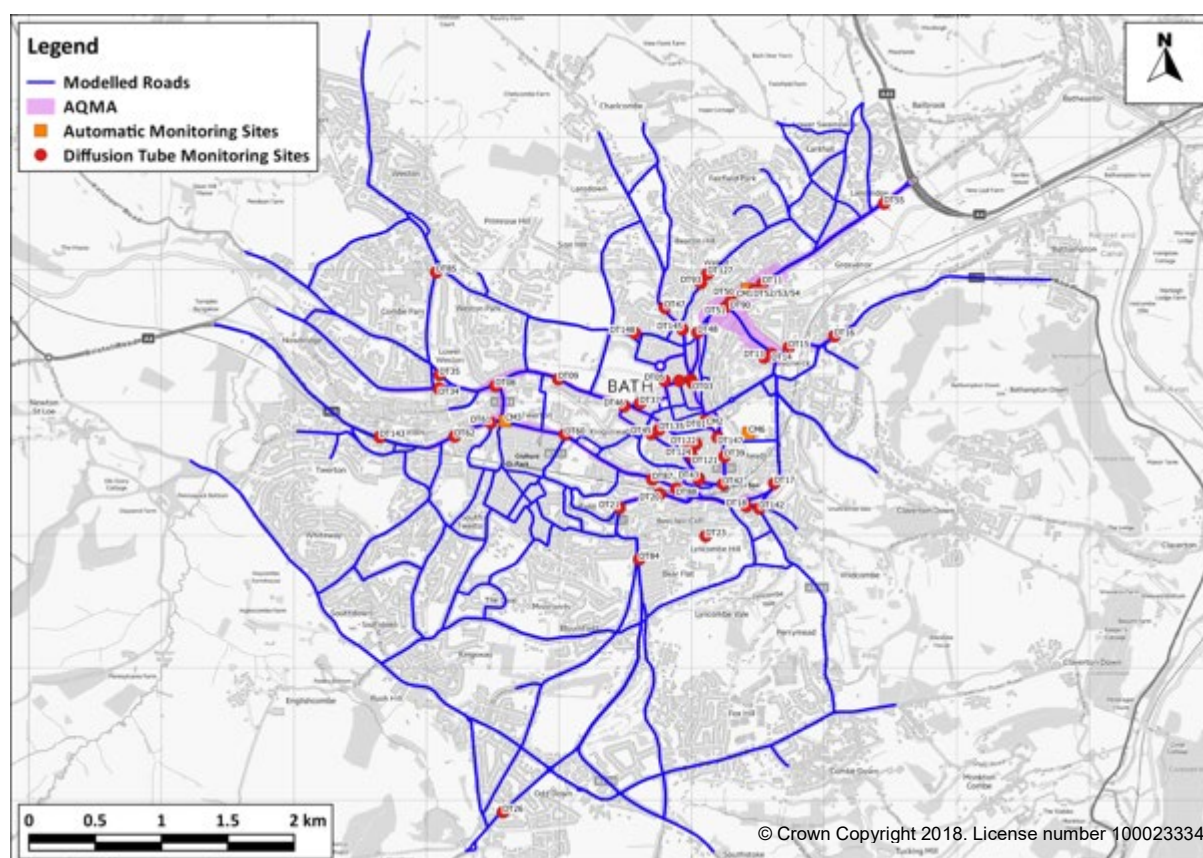


Figure 2-4: Study area, AQMA and 2017 monitoring sites

2.4.2.4 Baseline Results – Base Year (2017)

The predicted annual mean concentrations of NO₂ show exceedances in 2017 at locations relevant to the AQOs, Figure 2-5, and at each of the relevant receptor locations adjacent to roads within the PCM model, Figure 2-6. The exceedances are all along busy roads, particularly within street canyons (where a street is flanked by buildings on both sides) and close to junctions. The modelled results have been verified through comparison with monitored data.

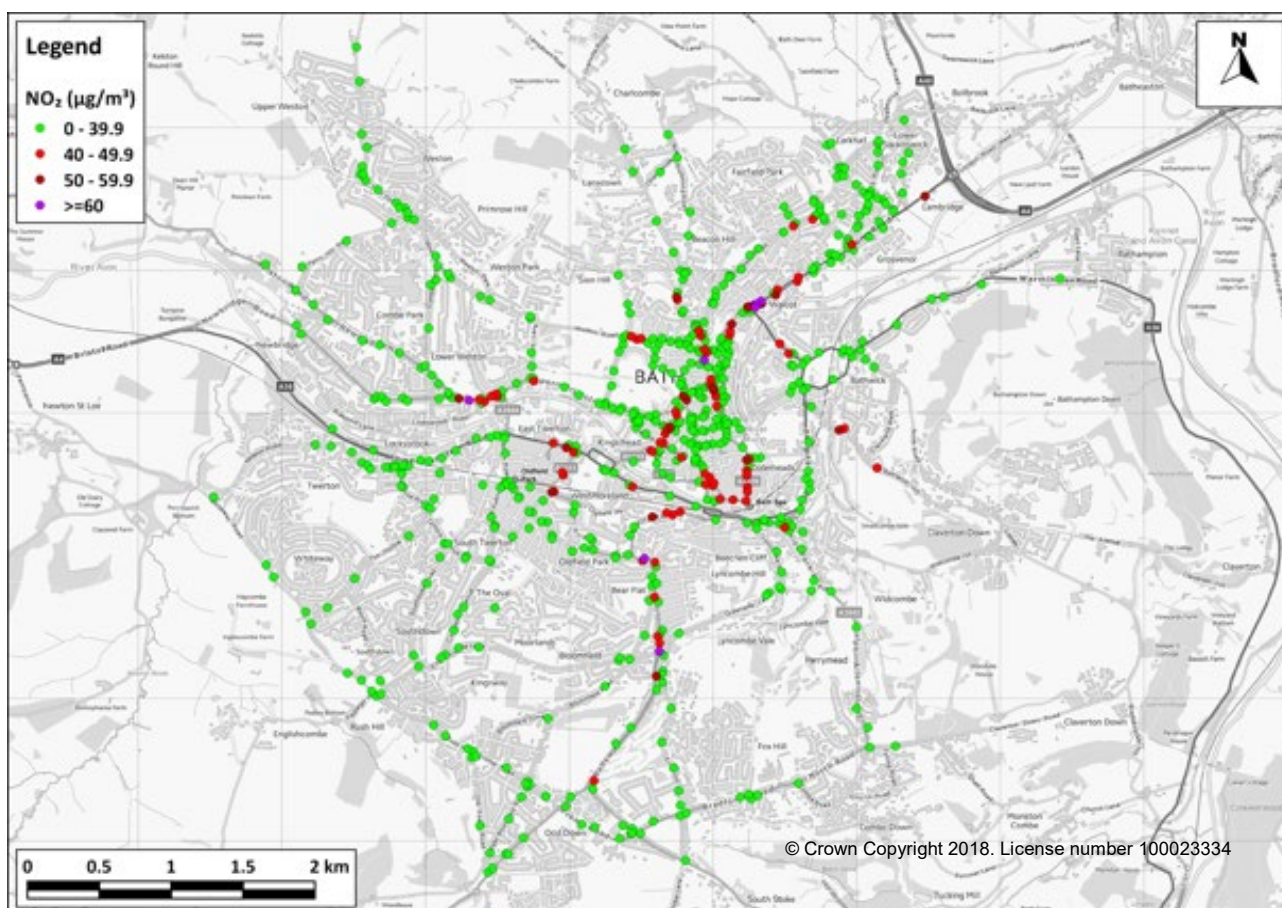


Figure 2-5: Predicted NO₂ concentrations in 2017 at receptor locations relevant to the national air quality objective

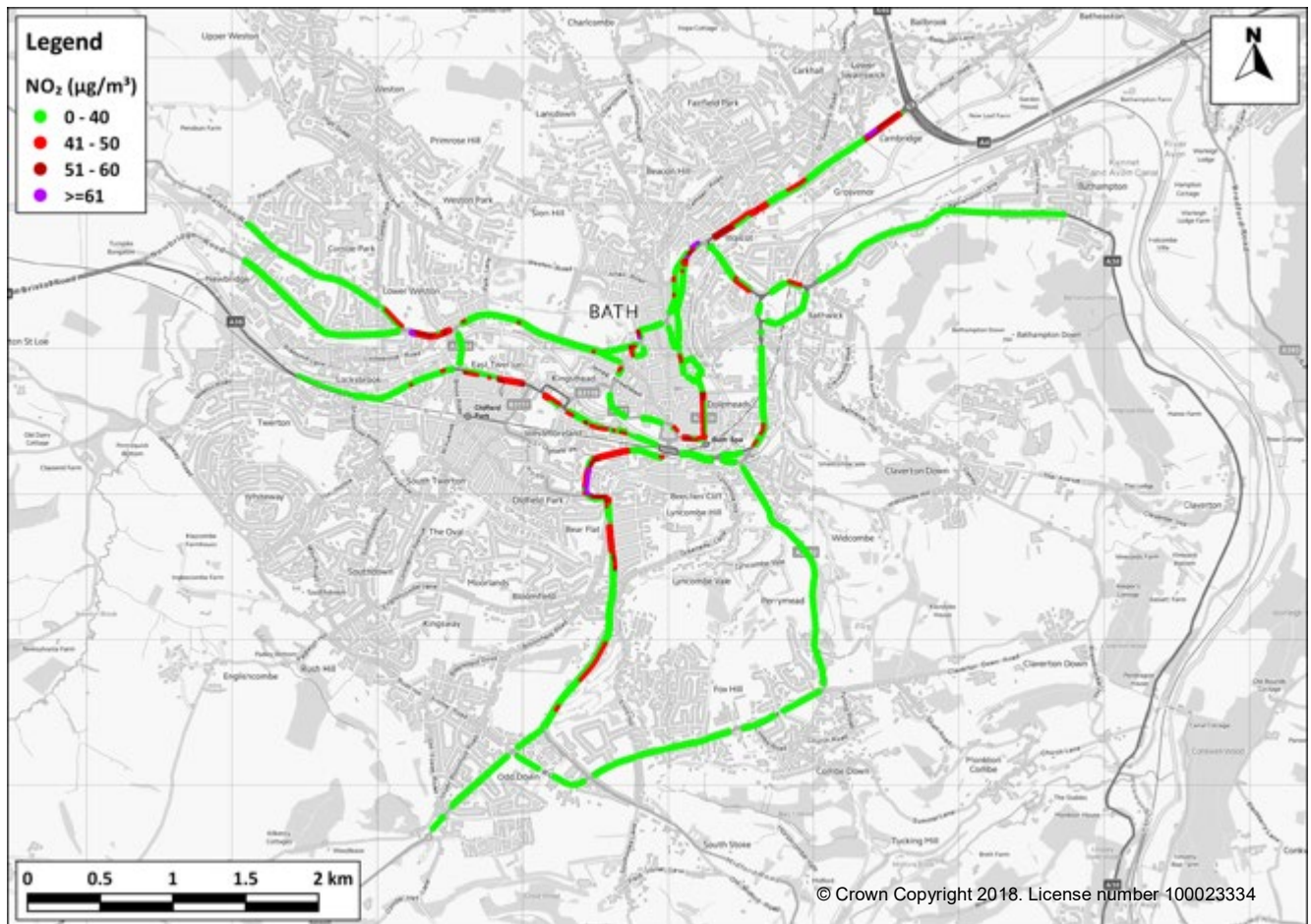


Figure 2-6: Predicted NO₂ concentrations in 2017 at PCM-equivalent receptor locations

2.4.2.5 Baseline Results – Compliance Year (2021)

The predicted annual mean concentrations of NO₂ still show exceedances in 2021 at locations relevant to the AQOs, shown in Figure 2-7, although these are fewer in number than in 2017. The exceedances are all along busy roads, particularly within street canyons and close to junctions.

The predicted annual mean concentrations of NO₂ at PCM-equivalent receptors still show exceedances of the annual mean Limit Value in 2021, shown in Figure 2-8, although these are fewer in number than in 2017.

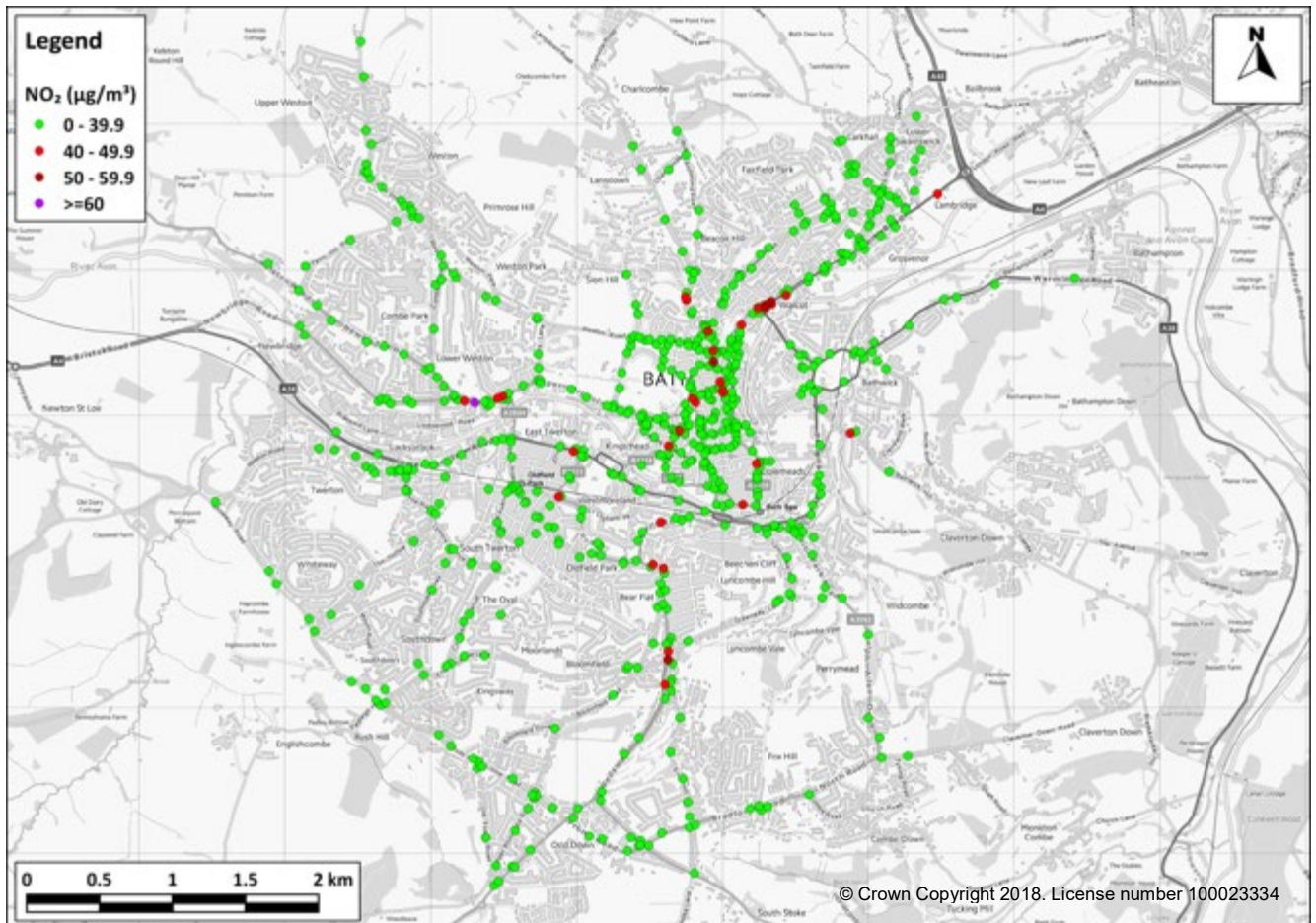


Figure 2-7: Predicted NO₂ concentrations in 2021 at receptor locations relevant to the national air quality objective

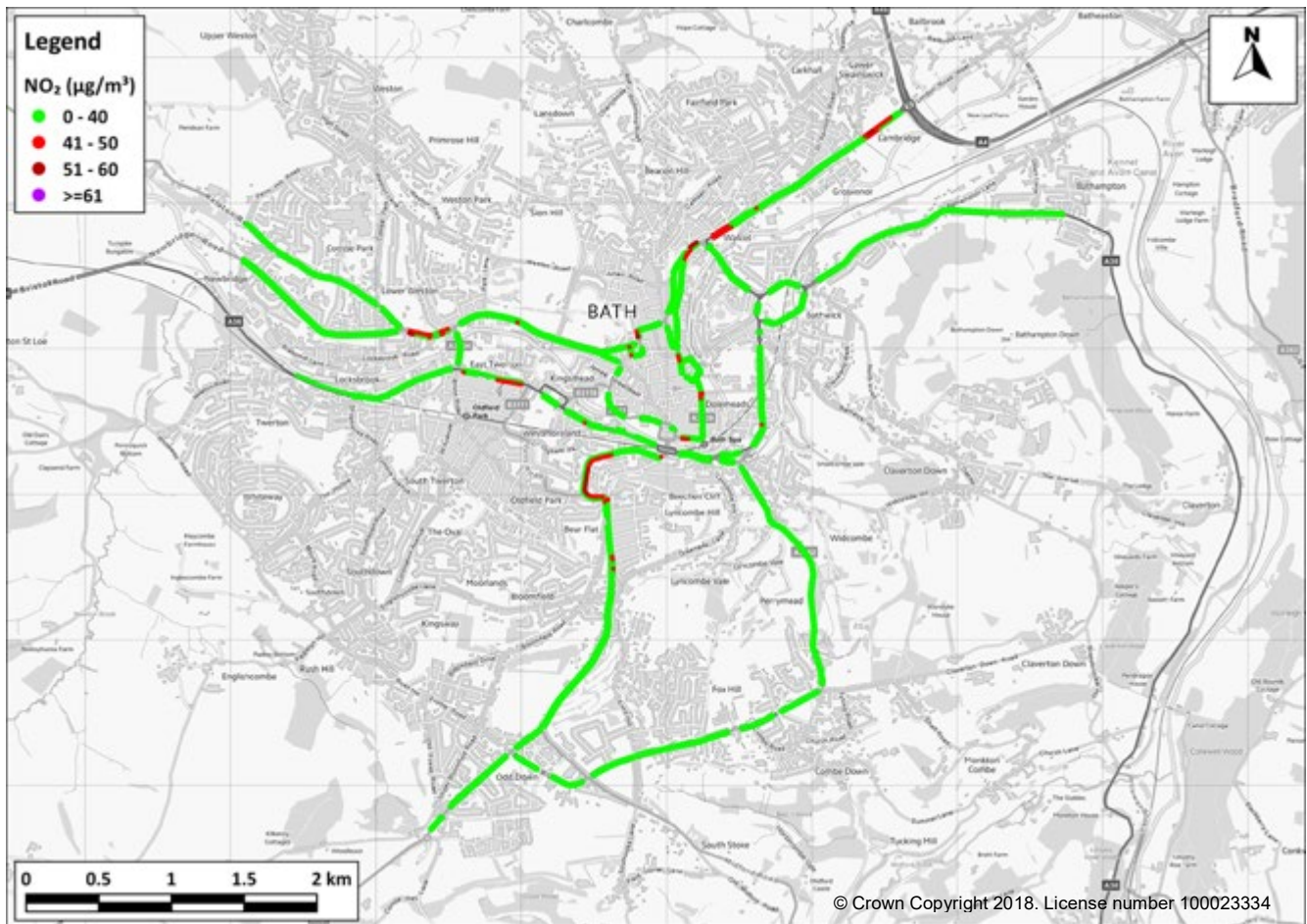


Figure 2-8: Predicted NO₂ concentrations in 2021 at PCM-equivalent receptor locations

2.4.2.6 Summary

Currently, levels of NO₂ are breaching legal limits in Bath, where national modelling suggests that, without intervention, the exceedance of the annual mean Limit Value for NO₂ on London Road would remain until 2021. Further local modelling, undertaken using the results of local ANPR and stated preference surveys and verified using local monitoring data, shows that there would be greater and more widespread exceedances within Bath in 2021 without intervention. Source apportionment attributes the main source of NO_x pollution in Bath to diesel vehicles.

Therefore, to achieve compliance with the annual mean Limit Value for NO₂, in the shortest possible time, or by 2021 at the latest, intervention in the form of measures to reduce air pollution from road traffic is required.

2.5 Spending Objectives and Success Factors

A robust case for change requires a thorough understanding of what the project is seeking to achieve. The objectives and success factors identified for the project need to be rooted in the local and strategic context as presented in Sections 2.2 and 2.3, and specific issues and problems identified in Section 2.4, which the project seeks to address.

Within this context the primary spending objective of the CAP is to deliver a scheme that leads to compliance with the EU's NO₂ concentration Limit Values in the shortest possible time. This is in accordance with JAQU's Options Appraisal Guidance and is in line with the issues raised in Section 2.2 above.

A secondary spending objective is also proposed; to deliver a scheme which leads to compliance with the LAQM AQOs as set out in the Air Quality (England) Regulations (SI 2000/928 as amended). The difference between Limit Values and LAQM AQOs are set out in Section 2.2.3 of this document.

Supplementary objectives for the preferred option include:

- Demonstrating value for money.
- Minimising the impacts on local residents and businesses, including disadvantaged groups such as low-income households.
- Minimising the impacts on economic growth and development in Bath, thus helping to accelerate the transition to a lower emission economy and creating a healthy place to live, visit and work.

To support the realisation of the spending objectives documented above, a number of Critical Success Factors (CSFs) were identified as part of the SOC process to appraise and refine the initial longlist into a shortlist of options considered at OBC stage. These CSFs can be differentiated into two groups:

- **Primary CSFs** – combining the primary and secondary spending objectives, the primary CSFs seek to deliver compliance with NO₂ air quality Limit Values and AQOs in the shortest possible timescales. At SOC stage, only those options that achieved this CSF (based on modelling available at that time) were shortlisted for further analysis. All options were reassessed against this CSF within the OBC, before being considered against the secondary CSFs listed below.
- **Secondary CSFs** – related to the supplementary spending objectives listed above, the following secondary CSFs were used at SOC stage to undertake a comparative assessment of shortlisted options, and to inform the identification of a preferred option at OBC stage:
 - Strategic:
 - All trip purposes treated equitably.
 - Compliance with Defra CAZ framework, including minimum requirements.
 - Economic:
 - Mitigate financial impact on low income groups.
 - Maximise health improvements of low income groups.
 - Net economic benefit.
 - Improve general public health.
 - Commercial:
 - Is the market able to supply in the time available?
 - Financial:
 - Likelihood of revenue equating to implementation/operational costs.
 - Upfront capital required for scheme.
 - Risk of financial penalty to B&NES.

- Management:
 - Public acceptability.
 - Local, regional and national political acceptability.

2.6 Case for Change

A compelling case for change requires:

- Identification of an existing problem(s) through reference to prevailing baseline conditions affecting Bath;
- Establishing a rationale for intervention based around resolving the identified problem(s); and
- Outlining the expected outcomes and impacts associated with intervening.

In the case of air quality in Bath, the current problem that needs to be addressed is the identified exceedance of the legal annual mean Limit Value for NO₂. At the UK government's monitoring station on London Road, B&NES reported an exceedance in 2017 and forecasts based on the PCM model predicted that this exceedance would remain until 2021. More detailed, local monitoring data shows greater and more widespread exceedances than are indicated within the PCM model (for European regulations) in Bath, and also widespread exceedances of the LAQM AQOs. This position is validated by baseline modelling presented in Section 2.4. Further, the existence of an air quality problem in Bath is recognised by the majority of local people, see Section 2.9. In the absence of suitably targeted interventions, the exceedances are expected to persist, meaning an improvement in public health will not be accelerated in Bath. Therefore, B&NES would fail to comply with its regulatory responsibilities as publicly-acknowledged air quality problems continue.

B&NES has received formal instruction from the Government to achieve compliance with the legal limit in the shortest time possible, in accordance with the High Court Order in November 2016²³. Therefore, an intervention is required to alleviate air quality issues that contribute to significant public health and environmental problems within Bath. B&NES is considering implementation of a CAZ, including both charging and non-charging measures, in order to achieve the required improvement in air quality and public health. Such a scheme represents the best intervention mechanism for achieving compliance, because it will directly facilitate changes in travel patterns and travel behaviour, thus reducing the influence of the primary cause of air quality problems - highway traffic. The rationale for a CAZ-led intervention is predicated on the ability of a CAZ scheme to quickly reduce the contribution of highway traffic to air quality, consequently leading to reduced air pollution and compliance with national and European limits for NO₂. As established in Section 2.9, local people generally accept and support a charging CAZ in principle. However, they also identify the need for complementary non-charging measures (including public transport improvements and congestion reduction measures/traffic flow improvements).

As noted above and discussed in Section 2.4.2.6, the primary outcome associated with the intervention is achieving compliance with national and European standards for air quality in the shortest possible timeframe. This is expected to maximise public health benefits associated with the scheme. A range of secondary outcomes and impacts can also be defined with reference to the other spending objectives and success factors listed in Section 2.4.2.6.

In light of the above, the case for change can be summarised as:

- B&NES currently fails to meet national and European standards for air quality, with existing exceedances for NO₂ expected to persist in the absence of intervention.
- Intervention is required to target traffic patterns and behaviour in Bath, given that road transport is recognised as the primary contributor to air quality issues that subsequently result in significant public health issues and the failure of B&NES to comply with its regulatory responsibilities.
- By intervening, B&NES is seeking to meet their legal obligations for air quality in the shortest possible time, thus maximising improvement to public health.

²³ November 2016 in R (ClientEarth) (NO₂) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin)

2.7 Option Assessment Process

2.7.1 Options Assessment Summary

The options assessment process from SOC through to FBC, including key stages and options, is summarised in Figure 2-10. Further details are presented in Sections 2.7.2 and 2.7.3.

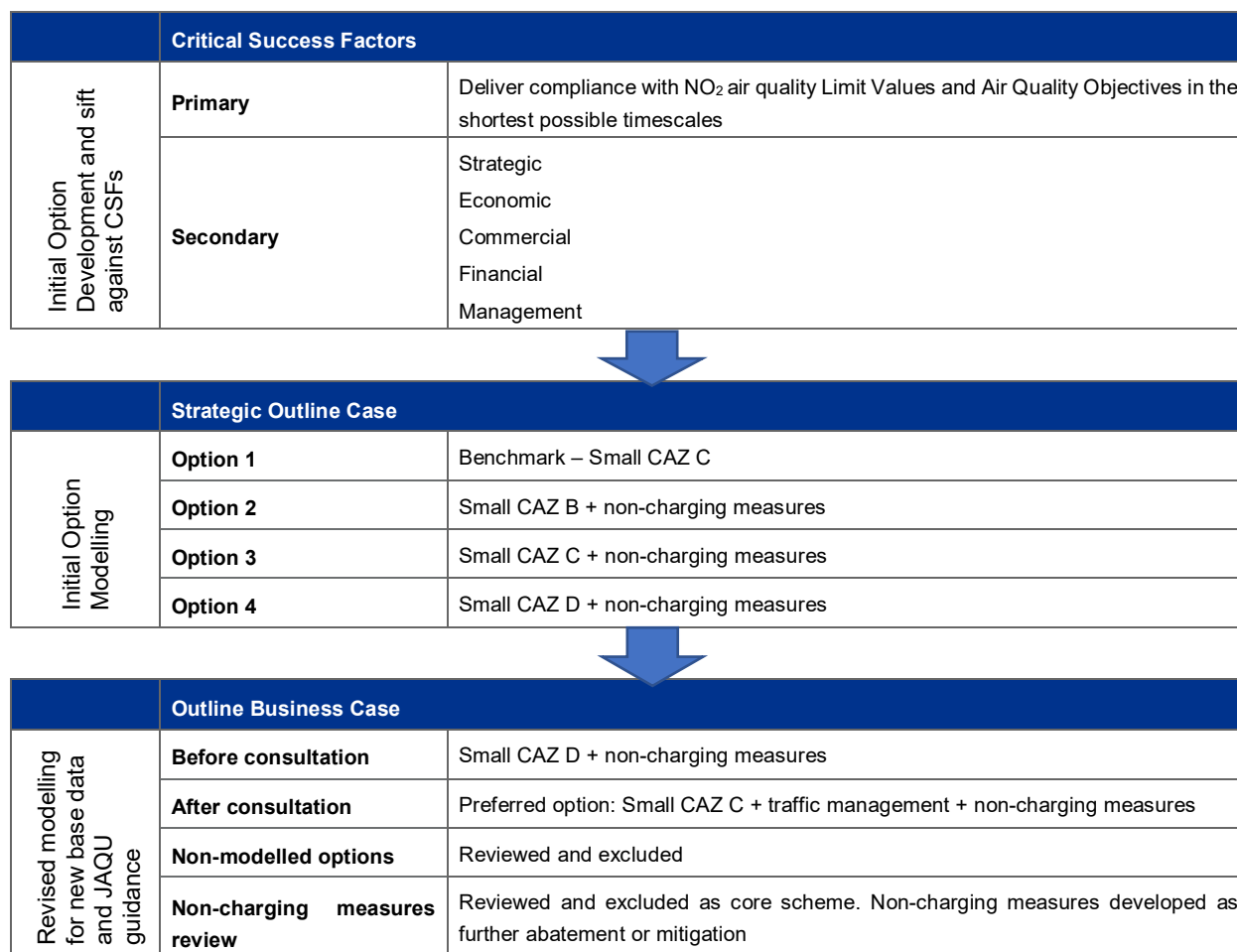


Figure 2-10: Options assessment process

2.7.2 SOC Options Analysis

In order to ameliorate the problems identified in Section 2.4 and driven by the spending objectives established in Section 2.4.2.6 (focused on achieving air quality compliance and public health improvements), the SOC established a long list of charging and non-charging measures. The charging measures were influenced by the recommendations of the national plan, which sets out actions to reduce concentrations of NO₂ to meet the Limit Values and AQOs in the shortest time possible. The national plan identifies that for the majority of non-complying areas, a CAZ is the most effective route to compliance of annual mean NO₂ with legal limits. Defra's vision for Clean Air Zones is: *"Clean Air Zones improve the urban environment to support public health and the local economy, making cities more attractive places to live, work, do business and spend leisure time. They support cities to grow and transition to a low emission economy thus ensuring these benefits are sustainable for the long term."*

A CAZ defines an area where targeted action is taken to improve air quality through the implementation of a charging mechanism that discriminates against those vehicles that contribute most to exceedances of air quality standards. As such, a charging system is established which charges vehicles, according to the vehicle emission

standards to enter or move within the defined CAZ area. Compliant vehicles will not be subject to charge. The intention of an intervention of this type is to accelerate change in the vehicle fleet by promoting the purchase of compliant vehicles. Further, the intervention seeks to transform travel behaviour by achieving mode shift towards public transport or other sustainable modes as an alternative to driving. The expected outcome is compliance with the identified air quality standards within the shortest possible time, as well as facilitating the transition to a lower emission economy.

The charging and non-charging measures were evaluated in line with the CSFs outlined in Section 2.4.2.6. Based on this evaluation process, underpinned by the primary spending objective, the long list of measures was reduced to a short list of both charging and non-charging measures that were combined into packages to take forward for further assessment. A total of 14 non-charging measures and 3 charging measures remained on the shortlist at SOC stage.

The assessment at SOC stage demonstrated that the most successful charging measures across both primary and secondary CSFs were the small Class B, C and D CAZ options. Further, the options assessment process enhanced the performance of the charging measures by supplementing these options with relevant non-charging measures. Based on this approach, the SOC recommended that the following four options should be taken forward in the OBC for more detailed assessment:

- **Option 1** – Benchmark Option – Small Class C CAZ. In line with JAQU's' Option Appraisal Guidance, the benchmark option is defined as the lowest class required to achieve compliance in the shortest possible timescales.
- **Option 2** – Small Class B CAZ (charging higher emissions buses, coaches, taxis and HGVs) with complementary non-charging interventions including walking/cycling priority schemes, cycle parking, public transport route improvements, increased use of variable message signage (VMS), targeted traffic management, some sunset periods, promotion of low emissions vehicles (LEVs).
- **Option 3** – Small Class C CAZ (charging higher emissions buses, coaches, taxis, PHVs, HGVs and LGVs) with complementary non-charging interventions (as listed above).
- **Option 4** – Small Class D CAZ (charging higher emissions buses, coaches, taxis, HGVs, LGVs and cars) with complementary non-charging interventions (as listed above, plus expanded GUL packages, car sharing priority parking, car club expansion).

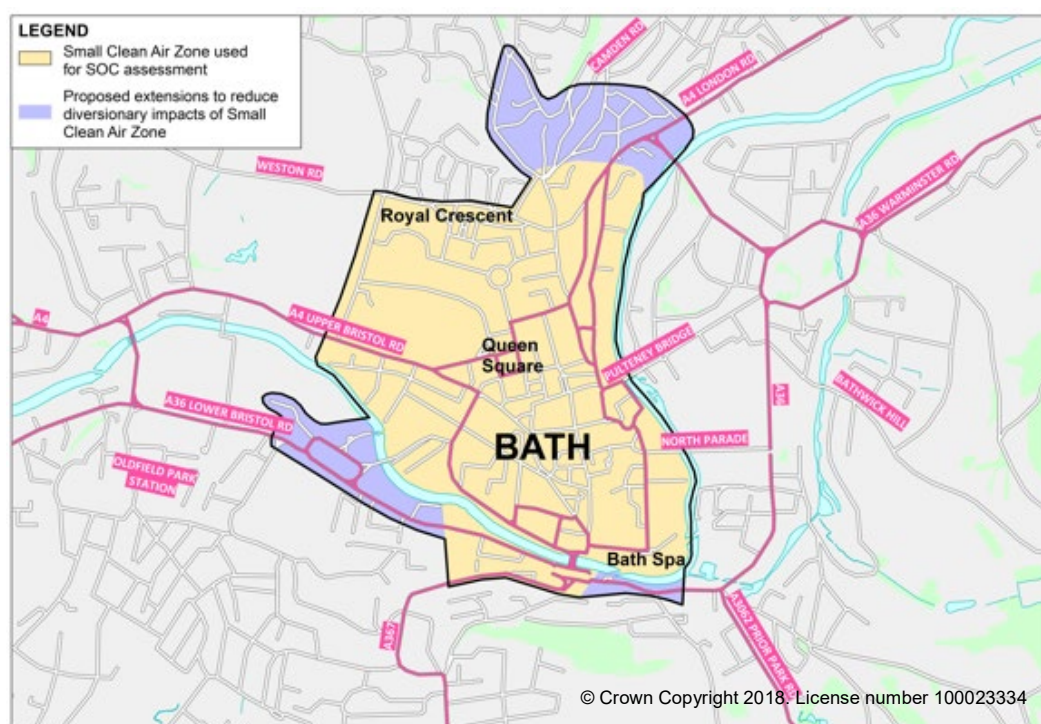


Figure 2-11: Small Zone Boundary in SOC**2.7.3 OBC Options Analysis****2.7.3.1 Options assessment**

The shortlisted options established at the SOC stage and described above were revisited and re-evaluated in the Economic Case within the OBC based on the availability of more detailed transport and air quality modelling. The options assessment continued to be driven by improving health as reflected in the primary spending objective (and related primary CSF) associated with delivering compliance with NO₂ air quality Limit Values and AQOs in the shortest possible timescales. The options assessment in relation to supplementary spending objectives and secondary CSFs were considered in more detail for those options that demonstrate that the primary spending objective is satisfied. In light of the key policy drivers and resulting national, sub-regional and local policies implemented as a result, it was identified that a CAZ is the most effective route to compliance in locations such as Bath.

More detailed and sophisticated modelling was undertaken as part of the OBC analysis, which garnered results that were significantly different to those generated at SOC stage. Modelling at OBC stage incorporated newly-available local data from ANPR and stated preference surveys, along with further refinements to the traffic modelling approach. Traffic data was derived following the same approaches outlined in Section 3.2.1 of this FBC. The shortlisted CAZ options were assessed through an iterative process of Transport Model / Air Quality Model scenario runs, pivoting from the following charging scenarios:

- 2020 CAZ Class D, with a £7.50 charge for Cars/LGVs/Taxis and £100 for HGVs/Coaches/Buses.
- 2021 CAZ Class D, with a £7.50 charge for Cars/LGVs/Taxis and £100 for HGVs/Coaches/Buses.
- 2021 CAZ Class C, with a £9.00 charge for LGVs/Taxis and £100 for HGVs/Coaches/Buses.
- 2021 CAZ Class D, with a £9.00 charge for Cars/LGVs/Taxis and £100 for HGVs/Coaches/Buses.

At this stage, all four shortlisted options identified as part of the SOC process were taken forward for more detailed assessment relating to the primary spending objective within the economic case. A CAZ Class D scheme (£7.50/£100) was tested for 2020 and found not to achieve compliance. The same scheme was tested for 2021 and also failed to achieve compliance, but with concentrations only marginally in exceedance of the Limit Values. As a result, no further schemes were tested in 2020 and instead the focus was on determining a scheme which could achieve compliance in 2021. A CAZ Class D with a higher charge for light vehicles (£9/£100) was tested for 2021 and this did achieve compliance. A CAZ Class C with the same charges was also tested to check whether this could provide sufficient air quality improvement, but the results demonstrated that it did not achieve compliance. As a result, a CAZ Class D with a £9 charge for light vehicles was presented for public consultation in Autumn 2018. A summary of the public consultation outcome is presented in Section 2.9.2 of this FBC.

Within this context, a CAZ Class D scheme with the higher charge for light vehicles (£9/£100) was found to be compliant with the primary spending objective and primary CSF, i.e. to deliver compliance with NO₂ air quality Limit Values and AQOs in the shortest possible timescales.

A CAZ Class C with the same charges was initially ruled out due to the difficulty of mitigating two exceedances with traffic management, however refinements to the baseline air quality modelling to improve how gradients are represented were made following public consultation on a Class D CAZ. FBC-11 'AQ3 Modelling Report' in Appendix D of this FBC provides details of the air quality modelling. Subsequently the revised assessment for a Class C CAZ indicated that a £9 charge for Taxis, PHVs and LGVs and £100 charge for HGVs/Coaches/Buses resulted in just a single exceedance at Gay Street. As the second exceedance at London Road was now no longer expected, it was considered that traffic management measures at the Gay Street location should be investigated further as a way to mitigate the one remaining exceedance.

Drawing on parallel work undertaken to look at the diversionary and air quality impacts of delivering a series of traffic management schemes in the City Centre as part of the B&NES 'Public Realm and Movement Strategy', it was found that targeted traffic management measures in Queen Square would reduce the traffic using the critical section of Gay Street and bring about compliance in this location. The traffic management measures, explored in

FBC-09 'Queen Square Traffic Management Scheme' in Appendix C of this FBC, include additional signal controls in the north west and south west corners of Queen Square. This enables the traffic using Gay Street to be restrained to a level capable of reducing the remaining NO₂ emission exceedance at Gay Street from 42µg/m³ to 36.9 µg/m³ (see Table 2.4).

Table 2.4: Comparison of air quality modelling results at Gay Street with and without traffic management measures

Location	2017 base (µg/m ³)	2021 base (µg/m ³)	2021 CAZ C (µg/m ³)	2021 CAZ C with TM (µg/m ³)	2021 CAZ D (µg/m ³)
Gay Street	60.1	50.9	42	36.9	40.4

The OBC identified that a Class D CAZ, or a Class C CAZ with traffic management at Queen Square, could both achieve compliance in 2021. As both options achieve the primary critical success factor of air quality compliance in the shortest possible time, they were taken forward for economic assessment and social distributional assessment.

2.7.3.2 Non-modelled options

The following options were not taken forward for modelling at the OBC stage:

- Medium or Large Class C CAZ
 - Exceedances within the boundary for small zone option meant that expanding the CAZ boundary would have no potential to further improve these locations.
- Class C CAZ with Further Increased Charge
 - Sensitivity testing indicated that, whilst a higher charge could achieve compliance this would be higher than precedence, which raises concerns about treatment of equitable trip purposes and is subject to uncertainty around the response rate of LGVs.
- Non-Charging Measures Only
 - The number and impact of non-charging measures that could be delivered would not achieve compliance within the timescales required.

2.7.3.3 Preferred option

The economic assessment in the OBC determined that the economic costs for both options outweighed the economic benefits by a considerable margin. This is primarily driven by the loss in consumer welfare associated with changing travel patterns and behaviours and the onerous capital and operational costs. The Class C CAZ achieved a marginally smaller negative net present value (NPV) compared to the Class D CAZ and was therefore the preferred option from a monetised cost-benefit perspective. Both options achieve compliance in 2021.

Further, the distributional and equalities impact assessment within the OBC demonstrated that both schemes would generate significant adverse distributional impacts for businesses within Bath. However, a Class C CAZ has a largely reduced impact on other socio-economic groups compared to a Class D CAZ.

Both schemes were also assessed against the secondary CSFs listed in Section 2.5; see Table 2-5 for an overview. A Class C CAZ was found to be marginally more successful overall at meeting the secondary CSFs, particularly in relation to public and political acceptability.

Table 2-5: Assessment of each option against the secondary CSFs

Secondary CSFs	Assessment of each Option against the Secondary CSFs	
	Class C CAZ with Traffic Management	Class D CAZ
Strategic		
All trip purposes treated equitably.	✓✓	✓✓
Compliance with Defra CAZ framework, including minimum requirements.	✓✓	✓✓
Economic		
Mitigate financial impact on low income groups.	✓✓	✓
Maximise health improvements of low income groups.	✓	✓✓
Net economic benefit.	-	-
Improve general public health.	✓✓	✓✓
Commercial		
Is the market able to supply in the time available?	✓✓	✓✓
Financial		
Likelihood of revenue equating to implementation/operational costs.	✓	✓✓
Upfront capital required for scheme.	✓	✓
Risk of financial penalty to B&NES.	✓	✓
Management		
Public acceptability	✓✓	✓
Local, regional and national political acceptability.	✓✓	✓
	Feasible – preferred option	Feasible

The CAZ C scheme with traffic management measures was selected as the preferred option in the OBC with the boundary presented in Figure 2-12 below. Refer to FBC-08 'Options Assessment Report' in Appendix C of this FBC for further details.

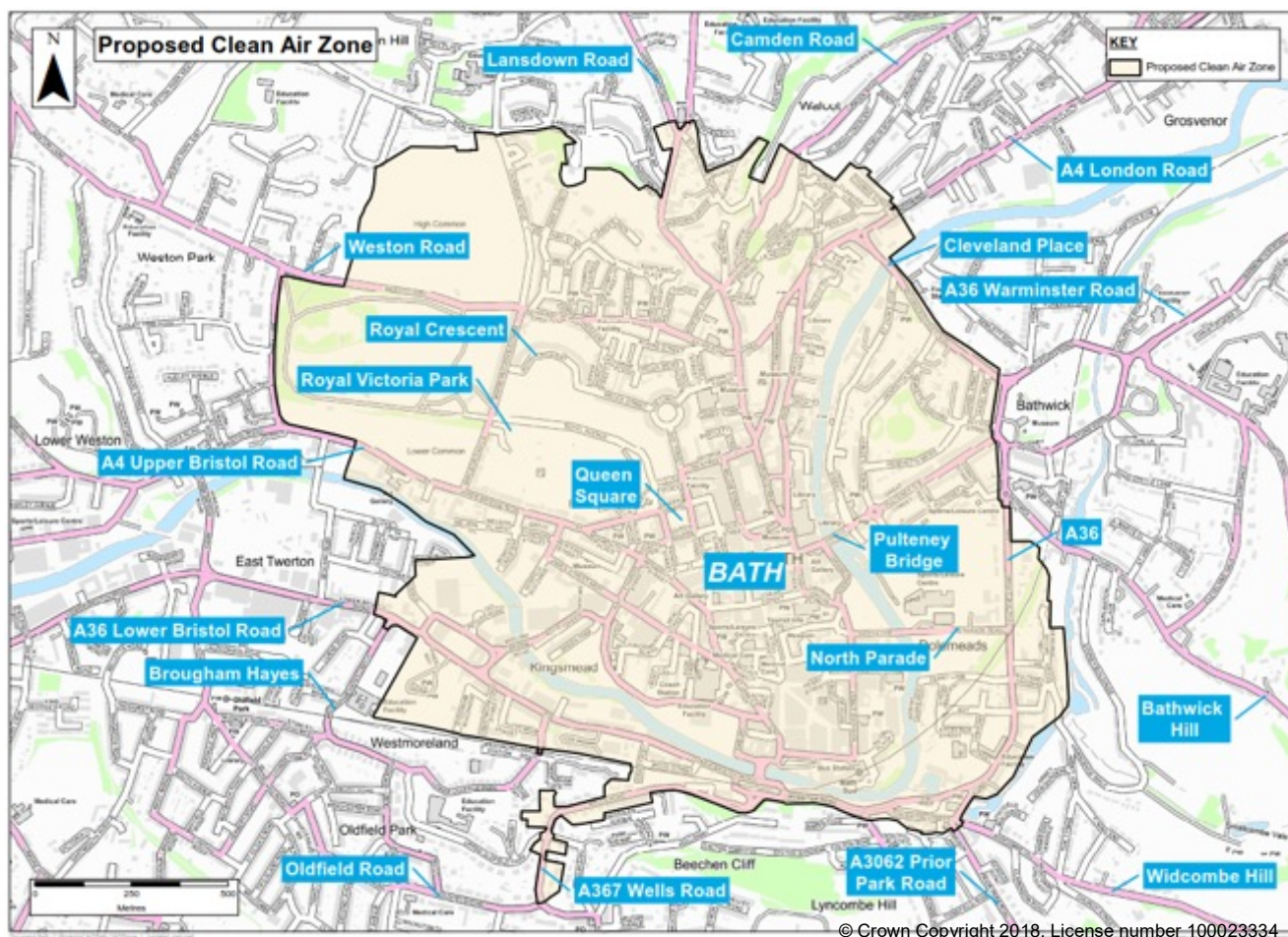


Figure 2-12: Revised Boundary in OBC

2.7.3.4 Supporting measures

All modelling assessments undertaken included only the impact of the CAZ charging scheme and bus retrofitting and, for a Class C CAZ, traffic management at Queen Square. The other non-charging measures set out within the shortlisted packages in the SOC were re-considered and refined in a separate assessment process focused on alleviating any adverse impacts of the charging scheme. These schemes are not intended to provide significant additional air quality improvements, nor any significant alterations to traffic flows, and hence are not included within the modelling assessment.

A longlist of non-charging measures was created during the SOC stage of the project. The longlist considers a broad range of options to both improve air quality and mitigate the negative impacts the CAP may have on certain groups. A number of measures were added to this list during the evolution of the project since the SOC, and the criteria against which the measures should be assessed was altered due to additional guidance from JAQU which set out the criteria that proposed mitigation measures must meet. Therefore, the revised longlist has been evaluated against a set of revised feasibility criteria, to establish which measures should be included in this project.

The consideration of non-charging measures and process for assessing the long list of non-charging options is shown in Figure 2-13 and described in more detail in FBC-08 'Options Assessment Report' in Appendix C of this FBC.

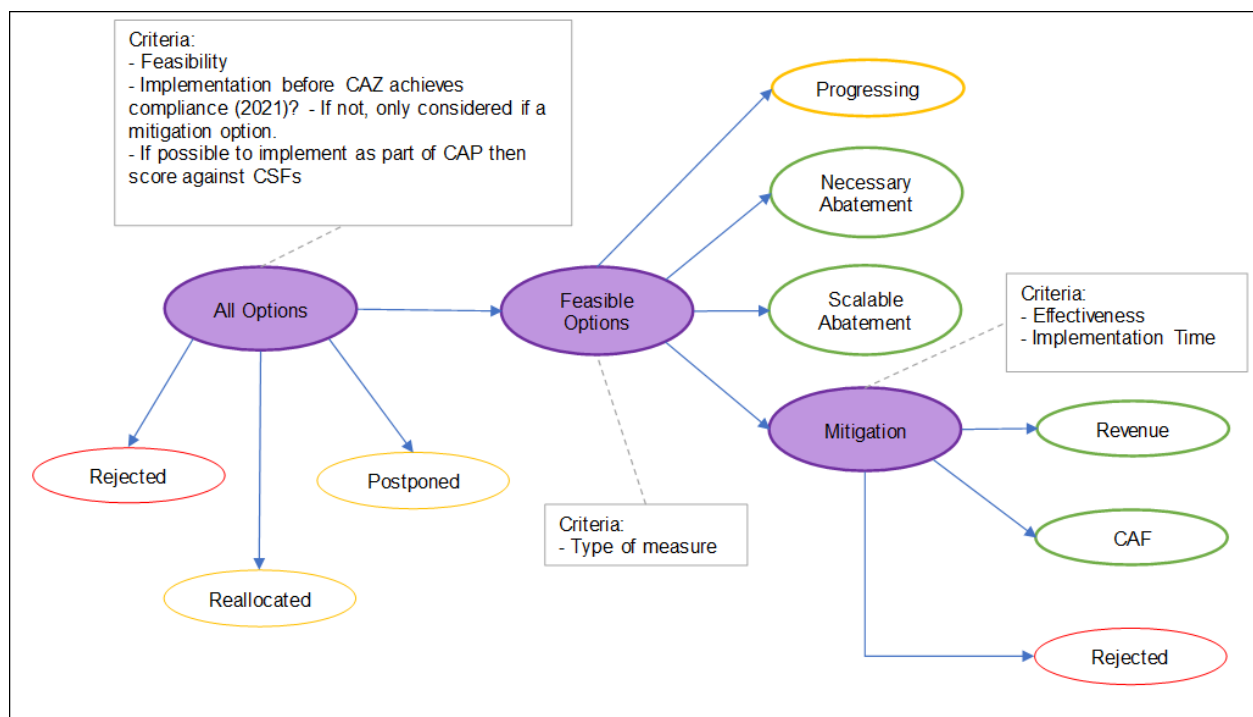


Figure 2-13: Non-charging measures shortlisting process

The non-charging measures were proposed either as abatement to support scheme compliance or as mitigation for the potential negative impacts of the charging scheme. Table 2-6 presents the OBC shortlist of non-charging options for the Class D CAZ and Class C CAZ with traffic management schemes.

With the exception of the Queen Square Traffic Management required for the Class C CAZ scheme only, the shortlists of options were the same for both options, however separated differently depending on the groups of people targeted by the measure. It was recognised at the OBC stage that, whilst cars would not be charged under a Class C CAZ, it would be beneficial to retain some of the measures targeted towards car drivers as this could also bring additional air quality improvements and wider local benefits.

Table 2-6: Summary of non-charging measures included in the OBC

Class C CAZ with traffic management	Class D CAZ
Abatement Schemes - currently progressing Reduced residents' parking permit cost for low emission vehicles (Early Measures Fund) Converting the experimental TRO for the bus lane on London Road at Lambridge to a permanent TRO Promote low emission vehicles for Hackney carriages/private hire through licensing	Abatement Schemes - currently progressing Reduced residents' parking permit cost for low emission vehicles (Early Measures Fund) Converting the experimental TRO for the bus lane on London Road at Lambridge to a permanent TRO Promote low emission vehicles for Hackney carriages/private hire through licensing
Abatement (necessary) – Implementation Fund Retrofit funding for registered, local Euro 4/5 buses. Anti-idling enforcement/publicity of impacts; school zig zag enforcement. Weight restriction enforcement Queen Square Traffic Management	Abatement (necessary) – Implementation Fund Retrofit funding for registered, local Euro 4/5 buses. Anti-idling enforcement/publicity of impacts; school zig zag enforcement. Weight restriction enforcement

Abatement (scalable) – Implementation Fund Provide additional cycle parking across the city centre in visible locations and pilot a management scheme to improve proper usage of cycle parking Options to improve cycling and walking experience, aimed at encouraging modal shift. Expand proposal (included in Go Ultra Low package) to increase the public electric car charging network and develop an on-street charging policy Provide 24 hr secure parking at all three P&R sites to encourage overnight use and facilitate extended operating hours Scoot/cycle to school initiative Financial support (grants) for replacing pre-Euro 4 cars with compliant ones, including a Mobility as a Service pilot Free park and ride concession Bus priority measures at traffic signals Mitigation Schemes - Clean Air Fund Financial support (interest-free loans) for pre-Euro 6 diesel commercial vehicles, including loans for electric charging points on private land Delivery and servicing plans for businesses Mitigation Schemes - Revenue from CAZ charges Provide additional cycle parking across the city centre in visible locations and pilot a management scheme to improve proper usage of cycle parking Options to improve cycling and walking experience, aimed at encouraging modal shift. Expand proposal (included in Go Ultra Low package) to introduce electric cycle hire to the city Expand proposal (included in Go Ultra Low package) to increase the public electric car charging network Increased utilisation of car/van club network in Bath. Implement public transport route improvements both on key corridors in/out of the city and within the CAZ Expand size of existing P&R sites. Provide additional P&R capacity at the university sites at weekends and during holiday periods. Retrofit funding for registered, local Euro 4/5 HGVs, once the technology becomes available Smaller P&R sites on existing bus routes. Credits for use in Mobility as a Service Scheme	Mitigation Schemes - Clean Air Fund Provide additional cycle parking across the city centre in visible locations and pilot a management scheme to improve proper usage of cycle parking Options to improve cycling and walking experience, aimed at encouraging modal shift. Expand proposal (included in Go Ultra Low package) to increase the public electric car charging network and develop an on-street charging policy Provide 24hr secure parking at all three P&R sites to encourage overnight use and facilitate extended operating hours Scoot/cycle to school initiative Financial support (grants) for replacing pre-Euro 4 cars with compliant ones, including a Mobility as a Service pilot Financial support (interest-free loans) for pre-Euro 6 diesel commercial vehicles, including loans for electric charging points on private land Free park and ride targeted at low-income households and families. Delivery and servicing plans for businesses Bus priority measures at traffic signals Mitigation Schemes - Revenue from CAZ charges Provide additional cycle parking across the city centre in visible locations and pilot a management scheme to improve proper usage of cycle parking Options to improve cycling and walking experience, aimed at encouraging modal shift. Expand proposal (included in Go Ultra Low package) to introduce electric cycle hire to the city Expand proposal (included in Go Ultra Low package) to increase the public electric car charging network Increased utilisation of car/van club network in Bath. Implement public transport route improvements both on key corridors in/out of the city and within the CAZ Expand size of existing P&R sites. Provide additional P&R capacity at the university sites at weekends and during holiday periods. Retrofit funding for registered, local Euro 4/5 HGVs, once the technology becomes available Smaller P&R sites on existing bus routes. Credits for use in Mobility as a Service Scheme
--	---

2.8 Benefits, Risks, Constraints and Inter-Dependencies

In accordance with the JAQU Inception Package guidance and the HM Treasury Green Book, the SOC and OBC set out the potential benefits, risks, constraints and dependencies associated with this CAP. Based on more detailed understanding of the baseline issues and intervention proposed, these considerations are reassessed below, with a view to informing the selection of measures that will maximise benefits and mitigate risks.

2.8.1 Benefits

The CAP could provide a wide range of quantifiable and non-quantifiable benefits across the following areas:

- Public health and the environment.
- Transport (reduced vehicle emissions, movements, journey times, accident rates).
- Financial revenue streams to re-invest in local transport.

The types of impacts are introduced below. A detailed assessment of the project options' economic impact is presented in the Economic Case, Section 3.

2.8.1.1 Public Health and the Environment

The public health issues associated with poor air quality are established in Section 2.2. In light of the causal link between poor air quality and poor public health, health experts believe that improvements in air quality can lead to a range of public health benefits, including:

- Reduced morbidity, leading to a reduction in public health expenditure (associated with hospital admissions and health care) and increased productivity through reduced work absenteeism.
- Reduced mortality, leading to a reduction in lost output and human costs.

In addition, an improvement in air quality can also lead to positive externalities associated with the natural and built environment, including:

- Reduced impact on ecosystems (nature conservation and green spaces in B&NES) through a reduction in emissions of NO_x.
- Reduced impact on climate change through a reduction in NO_x.
- Reduced damage to townscape and the built environment (particularly relevant in Bath given the city's United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site status), leading to a reduction in surface cleaning costs and amenity costs for residential, historical and cultural assets.

2.8.1.2 Transport

As suggested in Section 2.3.1 and validated in Section 2.4.1 and 2.4.2, road transport is the primary source of poor air quality in Bath. Hence the CAP will attempt to tackle this source, by reducing vehicle emissions through behavioural change and fleet change. It is possible that the behavioural and fleet change induced by the CAP could lead to a number of positive externalities, including:

- A small temporary reduction in vehicle movements through the centre of Bath, leading to:
 - Improvements in journey times and reliability for private and public vehicles;
 - A reduction in road traffic collisions and accident rates;
 - An improvement in noise pollution; and
 - A reduction in congestion, leading to a reduction in operating costs.
- Mode shift to sustainable and active modes, in particular walking and cycling leading to additional public health benefits related to reduced risk of premature death and reduced work absenteeism (NB: these public health impacts are additional to those associated directly with air quality improvements discussed above).

2.8.1.3 Financial Revenue Streams

Defra's Clean Air Zone Framework (May 2017) prevents Local Authorities from setting a charge as a revenue raising measure, but any charging scheme will need to be set at a level to produce a change in behaviour. Therefore, there is potential for charging schemes to generate revenue in excess of the operational costs of the scheme. In accordance with the Transport Act 2000 any net revenue should be re-invested to facilitate the achievement of local transport policies which aim to improve air quality and support the delivery of the ambitions of the Plan. As the shortlisted options identified at SOC stage and identified in Section 2.7 all contain a charging element, there may be potential for excess revenue generation that can be used to support transport policy. The likelihood and extent of a revenue surplus being generation is considered in more detail in the Financial Case, Section 5.

2.8.2 Risks

The CAP has the following risks associated with it, which are described in more detail in the following sections:

- Changes in carbon emissions;
- Changes in pm emissions;
- Economic impacts;
- Resource demand;
- Impacts on the vulnerable, particularly low-income groups;
- Impact on public transport services; and
- Social acceptance.

2.8.2.1 Carbon

The CAP is focused on one pollutant; NO₂. However, in an attempt to reduce NO₂ emissions, the CAP could inadvertently alter other pollutant emissions, such as Carbon Dioxide (CO₂). Change in CO₂ emissions at the same time as a reduction in NO₂ could be brought about by the transition from diesel vehicles (which produce high levels of NO₂) to petrol vehicles (which produce less NO₂ but more CO₂) or from adjustments to the number of trips made.

In addition, the creation of a charging zone or access restrictions, may result in some vehicles re-routing around the zone. This could increase fuel consumption and subsequently carbon emissions. The detailed assessment of the change in carbon emissions is presented in the Economic Case of this FBC.

2.8.2.2 Particulate Matter

Recent monitoring data has demonstrated that PM emissions in Bath have been under legal limits for several years. It is not anticipated that the CAP will produce an increase in PM emissions since choices which reduce NO₂ from vehicles are also likely to reduce vehicle-related PM.

2.8.2.3 Economic Impacts

The CAP has the potential to impact the local economy depending on the measures selected. A significant proportion of jobs in Bath are located within the city centre where some of the most significant exceedances are located. In other words, where the CAP will seek to impose most clean air measures. Measures that penalise travel into central Bath could limit the attractiveness of jobs within the city centre, putting employment opportunities, business viability and investment at risk. Further, the buoyant tourism industry in Bath, attracting 4.8 million day-visitors per year to the city as well as £411 million in tourist expenditure²⁴, could also be at risk

²⁴ B&NES, <http://www.bathnes.gov.uk/services/your-council-and-democracy/local-research-and-statistics/wiki/tourism-and-visitor-economy>

from any measures that deter travelling to the city centre. It is therefore desirable to select an option which has the least impact on the local economy, and if possible a neutral or positive impact.

Funding is available from central Government for non-charging measures to mitigate this impact should it materialise. Longer term benefits from a transition to a greener economy could include an increased attractiveness to businesses and tourism.

2.8.2.4 Resource Demand

This CAP is one of 15 similar CAPs being developed across the country within the same time frame. There are 28 local authorities involved, but some are grouped together to deliver a joint CAP. The objectives of all these CAPs is to achieve compliance with the NO₂ Limit Values. It is therefore likely that similar measures could be proposed in multiple locations, putting pressure on the market supply of particular items, such as ANPR cameras, compliant vehicles or retrofitting technology suppliers.

Similar resource availability risk could apply at local authority level. B&NES would need to ensure that there are economic and human resources available to fund and run the implementation of the CAZ and the posterior management, monitoring and enforcement of the required initiatives. The preferred option should seek to achieve a balance between these risks and the desired health improvements.

2.8.2.5 Vulnerable Groups

It is appropriate to consider the differential impacts of the CAP on low income households and businesses, in order to identify potential mitigation strategies that could be supported through the CAF. In particular, there is potential to disproportionately penalise vulnerable groups in society, depending on the geographic location, scale and the structure of vehicle compliance standards, through implementation of a charging scheme.

2.8.2.6 Impact on Public Transport Services

A significant proportion of the bus fleet in B&NES consists of older diesel vehicles that require upgrading, replacement or retrofitting to ensure vehicular, and overall scheme, compliance. In the absence of financial support to facilitate the required replacement or retrofitting, an increase in operational costs to bus service providers could be passed on to bus users, leading to adverse affordability affects for this group, and it may not be viable to continue operation of some local bus services which are vital in linking more rural locations with Bath. In addition, the ability to achieve compliance in the shortest possible time is likely to be affected if bus operators choose to pay the charge rather than replace or retrofit vehicles.

Funding is available from Central Government to mitigate this impact and support the compliance of the local bus fleet.

2.8.2.7 Social Acceptance

Public acceptance and understanding of the CAP are important to ensure successful implementation and operation. In an attempt to secure recognition and support from stakeholders and the public, the stakeholder engagement process and communications plan is underpinned by the promotion of the health and environmental benefits of the CAP.

2.8.3 Constraints

The following sections detail the constraints on the CAP including:

- Legal requirements to achieve compliance with the Limit Values in the shortest possible time
- Implementing the required local charging order in order to operate charging measures such as a CAZ
- Engineering and implementation of scheme infrastructure that enables compliance in the shortest possible time and;

- The level of resource required to operate a charging scheme.

2.8.3.1 Legal

The most significant constraint on the CAP is the legal situation through which it has materialised. Specifically, the requirement for the UK Government to achieve compliance with the Limit Values in the shortest time possible, and only considering cost when comparing between two equally quick schemes (Sections 1.1 and 2.2.3).

2.8.3.2 Planning/Consenting

A local charging order is required to allow the development and operation of charging measures such as a CAZ. The primary factor for approval of a charging order is whether the local traffic authority is satisfied that the local charging scheme appears desirable, for the purpose of, directly or indirectly facilitating the achievement of local transport plan policies, of both the local traffic authority/charging authority and any combined authority within whose area the proposed order will take effect. Other factors that need to be satisfied prior to bringing a local charging order into effect include:

- An adequate consultation process; failure to consult to the required standard could be seen to be legally challengeable.
- Public Sector Equality Duty and possible Human Rights Act issues which will need to be carefully and demonstrably considered.

2.8.3.3 Engineering

The most significant engineering constraint affecting attempts to improve air quality in Bath is the requirement to achieve legal compliance with air quality standards, in the shortest possible timescales. In light of the extensive design and development work required to realise large-scale projects such as the implementation of new highways, these projects are unlikely to be deliverable in the timeframe required, to achieve air quality compliance in the shortest possible timescales. This timescale factor limits the range of options available within the CAP.

2.8.3.4 Resources

The CAP will require significant recruitment to manage and operate any back-office and enforcement functions required to ensure successful delivery. The scale and form of staff resources required to deliver the CAP will vary depending on the management and operation processes selected (see Sections 4 and 5 for more details). In the event that back office and enforcement functions are retained in-house, B&NES could be required to recruit a large number of temporary and flexible staff, particularly to deal with contraventions. B&NES could struggle to fill the specific roles created as a result of the CAP. At the same time, existing functions such as Human Resources, Property and IT may be exposed to considerable pressure to ensure that the recruitment process is adequately resourced.

2.8.4 Dependencies

The delivery and success of the CAP is linked to a range of national, sub-regional and local stakeholders and statutory bodies, whose activities, programmes and policies could have significant implications on the transport and air quality context in B&NES. Further, various agencies hold a range of transport data (for example compliance, registration, taxi licensing, fleet databases) and air quality data (for example PCM/AQMA receptor information) that will be critical to ensuring the ongoing operation and monitoring of the CAP's intervention measures. Therefore, close collaboration across various partners is essential to ensuring timely progress of the CAP.

2.8.4.1 Highways England

Concerning national stakeholders, Highways England currently manage and operate the A46 and A36 which enter/exit Bath on the eastern side of the city. B&NES manage the route through the city between the A4/A46 and A36, but this section of the network forms a key link within the Highways England Strategic Road Network (SRN).

There are key exceedances of the NO₂ Limit Value on London Road, which forms part of this route through Bath. As such, the involvement of Highways England is required to implement the final CAP.

2.8.4.2 Low Emissions Vehicles

The CAP is also dependent on the ongoing nationwide roll-out and promotion of LEV uptake, by both the private and public sector. The opportunity for individuals to switch to new and used compliant vehicles is related to the availability of vehicles in the market, the provision of the appropriate infrastructure and facilities to support these type of vehicles, and promotional programmes and incentives to buy LEV.

2.8.4.3 West of England Combined Authority

At a sub-regional and local level, the CAP is dependent on the progression of B&NES and the West of England Combined Authority's (WECA) existing and proposed intervention programmes. A range of public transport initiatives, parking schemes and public realm/movement strategies may contribute to an improvement in air quality in advance of, or alongside, the CAP. Therefore, these programmes could have some influence over the CAP's ability to meet the required timescales or affect the overall outcome. The wider WECA and B&NES programmes typically have longer timescales for delivery and implementation, meaning that the overlap between the CAP and wider initiatives could be limited. However, this will need to be considered in the CAP.

Further, collaboration with WECA will be critical where the CAP is expected to interact with the (as yet not identified) Key Route Network. As such, discussions with WECA are ongoing to understand the interactions between the CAP and existing and future programmes undertaken by WECA.

2.8.4.4 Neighbouring Authorities

Neighbouring authorities including Wiltshire, Bristol, South Gloucestershire, Somerset and, further afield, South Wales, are also closely related to development of the CAP, in light of travel to work patterns for employees working in B&NES. Census 2011 data demonstrates that more than one-third of all employees in B&NES are sourced from these nearby authorities (c. 25,000 No.), of which, 82% commute via car or van (c. 20,000 No.). Commuting patterns from these source areas, along with the attractiveness of B&NES as a place to work, could be impacted or be fundamentally altered by the scheme.

Furthermore, transport and air quality conditions in Wiltshire are contingent on the CAP, not least because any measures targeted at reducing exceedances on London Road could directly impact on Wiltshire. For example, if any proposed measures make the highway routes through Bath less attractive, it is possible that traffic will find alternative routes through Wiltshire. The CAZ proposals are likely to be less punitive towards Heavy Goods Vehicle (HGVs) than previous measures proposed (for example HGV charging rather than prohibition of HGV movements in the city) and the CAP will be underpinned by legal requirements which differentiates it from previous circumstances. In addition, any accelerated improvement in fleet composition in Bath is likely to have positive spill over impacts on neighbouring local authorities such as Wiltshire. This could lead to more low-polluting vehicles at an earlier point in time in Wiltshire as well as Bath, resulting in positive air quality impacts across a wider area than Bath alone.

Bristol City Council have been directed to implement a CAP as part of the UK Air Quality CAP alongside B&NES. Therefore, there are some interdependencies and synergies between the two local authorities that may allow for joint market testing and procurement. Furthermore, the implementation of two CAP's in close proximity may reduce the potential for displacement of traffic and economic activity from one affected area to another, as both local authorities are subject to similar measures.

Other local authorities with economic and geographic ties are also embarking on the delivery of CAPs. South Gloucestershire were issued a Ministerial Direction by the Government to undertake a Targeted Feasibility Study to identify any measures that would achieve compliance with the relevant statutory NO₂ Limit Values in the shortest possible time. In South Gloucestershire, the PCM national model anticipates exceedances of the EU Limit Value to occur until 2019 alongside the A4174 between the M32 and A4017, with compliance predicted to be achieved in 2020. Further afield, Cardiff has also identified the need to improve air quality through changes in transport and travel behaviour, as part of their Transport and Clean Air Green Paper. Whilst the timeframes

associated with developing a CAP in Cardiff are likely to lag behind the Bath CAP, there is residual potential for interdependencies and synergies, as well as 'lessons learned', to be shared between the areas.

Discussion between B&NES and neighbouring authorities are ongoing to better understand the interactions between the CAP and existing and future programmes undertaken by proximate authorities.

2.9 Stakeholder Engagement

Engagement with the public and stakeholders is an important part of developing the CAP for Bath. The Council has made a commitment to communicate and engage with both the public and stakeholders throughout the various stages of development of the CAP and throughout implementation of the measures required to reduce emissions. This process began in February 2018 and is ongoing; Figure 2-14 presents a summary of the key stages.

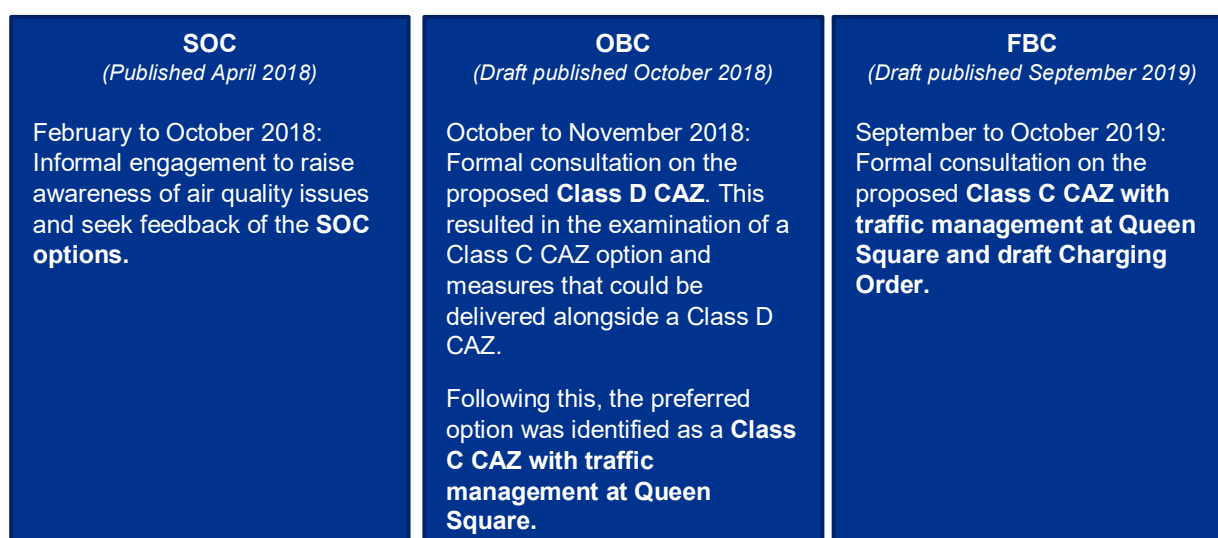


Figure 2-14: Key stages of stakeholder engagement

See FBC-07 'Stakeholder Management and Engagement Plan' in Appendix B of this FBC for further detail.

2.9.1 Period of informal Engagement February to October 2018

This first phase of engagement, undertaken between February and October 2018 was not a formal consultation. The aim was to engage as many people as possible in an ongoing conversation on air quality issues during the early stages of development of the Clean Air Plan. The style of engagement undertaken reflected this and, during this period, various information was published, a range of events and activities were held, and comments were continually invited. Whilst some of the engagement activities focused on specific audiences or issues, other activities were designed to more generally raise the profile of the air quality problem and the work being undertaken by the Council to address this.

Between February and June 2018, a total of thirty-seven engagement events were held and engagement continued until October. The scale and method of engagement events has varied in order to ensure as wide an audience as practically possible was reached. Types of engagement initiatives undertaken included:

- Eleven public engagement events, comprising eight drop-in sessions and three public surgeries, combining a mixture of formal and more structured formats;
- Engagement/communication with around two hundred organisations, including direct correspondence and attendance at engagement events, including twenty-six specifically for organisations in the area.

- As part of this process, key groups that were engaged with included government bodies (e.g. Public Health England, Highways England), local authorities, businesses (represented by bodies such as the Federation of Small Businesses), residents associations, transport operators, media outlets and campaign groups.
- The engagement methods utilised for discussion with these groups included briefings, workshops and face-to-face meetings.
- Additional engagement methods to induce feedback, including:
 - Online questionnaire – available at project web pages
 - Paper questionnaire – available at engagement events
 - Email correspondence – via a specific email account linked to the project website
 - Telephone conversations – direct with B&NES officers
 - Social Media – collation of comments on Facebook and Twitter.

The aim of the engagement process was to provide the public, and all interested parties and organisations, active in B&NES with an opportunity to express their views and share opinions. The two main objectives of the engagement activity were to:

- Have ongoing dialogue with stakeholders, residents and the wider community to:
 - Raise the profile of the air quality problem in Bath;
 - Generate an understanding of the associated health impacts and the proposed measures to improve air quality; and
 - The possible implications for travel choices.
- To seek feedback at a key stage (SOC stage) of the CAP and, where possible, utilise this in the technical assessment of the shortlisted CAZ options²⁵.

A detailed summary of responses received during this engagement period is provided in FBC-24 'SOC Engagement Summary Report' in Appendix O of this FBC. However, an overview of the common themes emerging from the feedback is provided below. These are intended to provide an overview of the nature of the feedback received and highlight information which will be relevant to the Council in taking forward proposals for the CAZ:

- There was a general and widespread recognition of the need to improve air quality in Bath. The quantitative analysis of the feedback form responses showed: 89% of respondents were aware that air pollution is a problem in Bath; 83% of respondents were concerned about air pollution in Bath; and 70% of respondents supported a charging zone in principle. The qualitative feedback also suggested that many respondents supported the principle of a CAZ and could identify a wide range of likely benefits.
- The qualitative analysis showed that relatively few respondents indicated a preference for a particular CAZ option, instead their comments focused on raising questions and identifying potential areas of concern. This reflects the early stage of engagement, and the fact that no specific scheme was put forward for comment. However, it is important to note that some respondents did not feel a CAZ was necessary, whereas others felt a CAZ did not go far enough.
- The feedback suggested some misunderstanding of where air quality improvements would be seen after CAZ implementation, highlighting the need to better explain that the positive impacts of a CAZ are not just felt within it.
- There was some concern among respondents regarding the possible impacts of a CAZ to the more vulnerable groups of society including: low income households, the elderly, and local tradesmen and businesses. A variety of methods were suggested to mitigate these impacts.

²⁵ B&NES, <http://www.bathnes.gov.uk/bath-breathes-2021>

- Potential difficulties initiating and maintaining long-term behaviour change was noted by some respondents to be a concern. This was mainly in relation to reducing air pollution and the effective operation of a CAZ. Respondents suggested incentive provision and inclusion of more “carrots” to support the necessary behaviour changes.
- Many respondents requested public transport improvements and the need to provide better and more attractive alternatives to car travel in Bath. This is supported by the quantitative feedback showing that the other measure to “*Implement public transport route improvements*” was supported by 75% of respondents. The feedback showed that respondents would like air quality improvements to happen alongside congestion reduction measures and traffic flow improvements.
- Parking charges were a common concern among respondents, with some concerned about the impact to local business of increased parking charges (which were revised in August 2018), alongside the implementation of a CAZ. There were requests for a more holistic approach to these policy areas.
- The feedback demonstrated that design details are an area of interest to many respondents, with several requests for further information about the charging system and financial processes of the CAP.
- The CAZ boundary was an area of concern for respondents, who suggested numerous changes/alterations. This was coupled with concerns over the diversionary impacts of the CAZ boundary and the potential associated air quality and congestion impacts for areas outside of the zone.
- Detailed and specific technical queries were received from some respondents, with some questioning the validity of the technical assessment of options and others seeking to better understand these processes.
- There were also many comments recommending improvements to existing infrastructure and highlighting areas where infrastructure improvements are required. These suggestions cannot be delivered within the Project timescales or extend beyond the scope of the project.
- Respondents were generally positive about the engagement process to date. Some suggested amendments to the engagement materials and event format to be considered in the upcoming engagement work.

2.9.2 Formal Consultation October and November 2018

Between 16 October and 26 November 2018 B&NES undertook formal consultation on a proposal to implement a Class D charging CAZ.

This consultation was undertaken in the context of a number of fixed constraints governing the actions of the Council, what is negotiable and the ability to act on feedback. The constraints included:

- B&NES is mandated by central Government to take action on air quality and to bring concentrations of NO₂ to below 40 µg/m³ as an annual mean in the shortest possible time and by 2021 at the latest.
- The Council may face potential fines or legal action if they do not put into place a package of measures to address air quality within this time frame.
- Technical work undertaken prior to the start of the consultation process showed that a charging CAZ is the only mechanism capable of reducing emissions to appropriate levels within the required timescale. Based on this evidence, a Class D CAZ was identified as the option most likely to achieve compliance.
- A CAZ would need to be implemented in line with the principles set out in the Government’s ‘Clean Air Zone Framework’. This document, published in 2017, explains the approach that Local Authorities should take when introducing a zone.
- Funding for a CAZ is dependent upon the Government’s JAQU approving the FBC. There are also strict rules on how the funding available can be spent.
- The final decision on the type of charging zone and the detail of this will be made by elected Cabinet members, taking account of feedback from JAQU.

In this context, the aim of the consultation process was to provide an opportunity for discussion between the Council and any persons concerned about the proposals or their impacts. It also provided a forum for the sharing

of information and ideas on how any issues could potentially be resolved. In particular, it focussed on seeking comments on how the proposed Scheme could be refined, in order to:

- Improve its effectiveness in tackling air quality issues;
- Help to mitigate any potential impacts either on specific groups or locations; and
- Better support the community and road users to adapt and adjust.

During the consultation period feedback was received from 8462 respondents and approximately 800 people attended a consultation event. The consultation attracted responses from a wide range of groups and organisations including Wiltshire Council, FoBRA, Town and Parish councils, Client Earth, Bath Preservation Trust, Bath Business Improvement District, Bath Chamber of Commerce and Age UK. Additionally, many businesses responded to the consultation including the RUH, Royal Mail, the RAC, the Freight Transport Association, Bath Spa University, transport operators, sole traders, independent retailers and a number of local schools and churches.

The feedback from the formal consultation is reported in the document FBC-25b 'OBC Report on Formal Consultation' in Appendix Q of this FBC. Feedback was varied and detailed. However, overall respondents showed an understanding of the need to address air quality in Bath. A wide range of comments were submitted by individuals, groups and businesses on many aspects of the proposed CAZ. In particular comments focused on the proposed boundary, who and what vehicles should be charged, potential economic impacts and the support that would be needed to drive behaviour change. Whilst some respondents did not support a charging zone many focused their feedback on identifying ways in which the proposed Class D CAZ proposal could be evolved to maximise its impact and reduce any unintended consequences. The main themes from the feedback are summarised as follows:

- Individuals, including residents and commuters wanted to see more support to help them comply with a Class D CAZ. Many suggestions were made including adjusting the operating hours of the CAZ, providing discounts or adjusting the charging structures through concessions and exemptions and altering the minimum emission standards.
- Businesses also highlighted a need for more support. This was particularly important for smaller businesses including sole traders and independent retailers, many of whom were concerned about the economic impacts to their business operations as a result of a CAZ. These concerns were extended to their customers, suppliers and employees.
- Opinions on the proposed zone boundary were mixed. Some respondents felt there should be no zone at all or wanted the zone to be smaller whilst others thought the zone should be larger. Requests ranged from a zone using the river as a boundary, to exclusion of through routes, specific streets and residential areas. Others felt the zone should be extended further to cover residential areas. There were also a number of specific inclusion requests covering areas from individual streets to neighbourhoods and even a city-wide boundary.
- Many respondents were concerned about the timescales of the proposed Scheme. Both individuals and businesses felt that a longer time was needed to minimise the economic impacts associated with changing vehicles and behaviour.
- Overall there was a call for public transport improvements to support behaviour change, ranging from reduced fares, extended bus services and operating hours and improved park and ride facilities across B&NES.
- There were concerns about the displacement impacts of a CAZ. These included concerns that traffic, congestion and rat running would increase in areas adjacent to the proposed zone boundary and that parking in residential areas would be used by those looking to avoid driving into the proposed Zone. Additionally, there were concerns that non-compliant vehicles would re-route and that this would worsen air quality and increase traffic and congestion in areas outside of the zone, both in neighbouring areas and in towns/locations further afield including Wiltshire.
- There were a number of suggestions for alternatives to the proposed Scheme, these included: a Class C CAZ, congestion charge, construction of a link road/bypass and charging of all diesel vehicles.

Following the analysis of consultation feedback additional technical work was undertaken to address the main comments raised. This included work to examine additional Class C CAZ options and further consideration of measures that could be delivered alongside a Class D CAZ to reinforce the effectiveness of the zone and support residents and businesses to adapt. This work is reported in FBC-25b 'OBC Consultation Response Report' in Appendix Q of this FBC.

2.9.3 Formal Consultation September and October 2019

A second formal consultation was held for four weeks between 23rd September and 20th October 2019. The aim of this consultation process was to:

- Provide an update on the proposals for a Class C CAZ and how these have changed since the first consultation phase.
- Provide details of how the Class C CAZ will operate and the basis of the charging order
- Seek feedback and provide an opportunity for discussion on:
 - The change from a Class D CAZ to a Class C CAZ;
 - The updated CAZ boundary;
 - The Queen Square traffic management proposals;
 - The proposals for supporting measures and reinvestment of revenue;
 - The proposals for signs and cameras; and
 - The details of the draft charging order.

A range of information was published on the Council's website to support the consultation period. This included a non-technical summary document providing an overview of the proposals, a series of frequently asked questions with responses and a range of technical documents. In addition, seven drop-in events and meetings with key stakeholders were held to provide members of the public, businesses and organisations with an opportunity to talk face to face with the project team about the proposals.

Feedback on the proposal was submitted via a questionnaire which received 597 responses. 65 letters and emails were also submitted direct to the Council.

Overall, respondents showed an understanding of the need to address air quality in Bath, with frequent reference to the government declared climate emergency.

Respondents commented on many aspects of the proposed scheme details. The main themes from the feedback were:

- Opinions on the Change from a Class D CAZ to a Class C CAZ were mixed. Respondents understood the justification for the change and agreed with it, in particular recognising that a Class C CAZ would have a lesser impact on low income groups. However, some were keen to see bolder action and felt that a Class C CAZ would not have the desired effect of sufficiently improving the air quality within Bath.
- Respondents gave opinions on the boundary. Overall, the amendments made to the boundary following the autumn 2018 consultation were welcomed. However, some respondents felt that further changes were required with key suggestions highlighting the need for a wider CAZ in order to incorporate and safeguard residential areas. The perceived need to include Sydney Buildings was frequently mentioned.
- Opinions on the Queen Square traffic management proposals were mixed. Some respondents suggested that this was a step in the right direction and some felt that the measures could go further, for example that the Square should be pedestrianised completely or the measures should be a permanent feature. Others expressed concern that the proposed measures would increase congestion within the area and result in more traffic using neighbouring residential streets and therefore increase emissions in these areas.

- Respondents highlighted that improving alternative modes of transport, including public transport, walking and cycling should be a key focus both in conjunction to the CAZ and as an alternative method of reducing emissions. There was particular concern that the Class C CAZ charges would mean that bus companies would pass costs to the customer which could deter them from use.
- Concern for the city of Bath including its residents and businesses. Concerns were raised over the movement of pollution into residential areas as vehicles try to avoid the CAZ, with specific mention of 'rat runs'. Concerns for business were also raised due to the impact that the Class C CAZ would have on the cost of deliveries (especially for the smaller traders) and for trades people / the self-employed whose livelihoods depend on the use of certain (often heavy) tools or equipment.
- Respondents made suggestions on boundary infrastructure including comments or suggestions on the placement of street signage and cameras. Queries were raised on the implementation and practicality of associated infrastructure.
- Opinions on the support packages and reinvestment of revenue were mixed. Respondents expressed support for those incentives or reinvestments that included requests for improvements to the public transport, walking or cycling experience (including tackling the school run), park & ride sites and increased provision of electric charging points. Respondents showed less support for initiatives associated with deliveries, particularly incentives for van drivers to use the park & ride sites.
- There was a general consensus in support of any scheme that tackles air quality, but some feeling that more should be done to combat emissions in Bath.
- There were a number of suggestions for alternatives to the proposed scheme, these included: building a ring road, improvements to traffic management and traffic calming measures within the city and a Park & Ride to the east of the city.

For further details see FBC-25c 'FBC Consultation Report' in Appendix Q of this FBC.

2.9.4 Post FBC Engagement

The remaining phases of engagement are:

- **Implementation** – At this stage, engagement with stakeholders and the public will split into two workstreams:
 - Engagement associated with installing the charging infrastructure, led by the community liaison team.
 - Engagement on the supporting measures, led by the travel advice team.
- **Operation** – continued conversations with interested parties, led by the travel advice team.

During this stage of the process the opportunity for the public and stakeholders to influence the process will be more limited. The focus of the engagement will be on:

- Continuing to raise awareness of the CAZ option taken forward and inviting comment on any changes to the Scheme since the previous consultation at draft OBC stage;
- Continuing to raise awareness of the wider air quality issue and the need for action;
- Helping people to get compliant in cost-effective ways, find alternative ways to travel around Bath, change their transport and travel habits and understand the important role that everyone can play in tackling air pollution;
- Preparing and supporting people for the implementation of the zone; and
- Ensuring that the statutory processes related to the advertising of Orders (and the associated ability for people to comment on these) are adhered to.

For more detail on the engagement plans for the next phases of the project see FBC-07 'Stakeholder Management and Engagement Plan' in Appendix B of this FBC.

2.10 Logic Map

The logic map presented in Table 2-7 highlights the theory of change underpinning the CAP. It demonstrates how inputs (in the form of programme expenditure) generate outputs (in the form of activities and scheme elements delivered) which drive outcomes (in the form of behavioural, transport and economic changes) leading to impacts (long-term societal changes).

Table 2-7: Logic Map

Inputs	Outputs	Outcomes	Impacts
Implementation Fund	Class C CAZ established (geography and price structure by vehicle category)	Behavioural change leading to:	
	Infrastructure to monitor and enforce the CAZ	Accelerated vehicle upgrading	
		Switch in preference for vehicles by fuel type	
		Reduction in non-compliant vehicle fleet	
		Increased mode share of public transport	Improved air quality
Clean Air Fund	Additional measures to assist in achieving compliance with Limit Values and AQOs including retrofit and upgrade of local buses and implementation of traffic management	Increased mode share of active travel modes	
		Diverted trips and trips avoiding zone	Increased physical activity
		Cancelled trips	
Other local funding		Businesses choosing to redeploy fleets	Improved human health
		Changed perception of low emission travel	
		Implications of behavioural change:	Loss of some economic activity
Local Plan	Additional measures to mitigate the impact of the CAZ on vulnerable groups, including travel advisors to provide guidance to non-compliant vehicle users	Cost of compliance	
		Reduction in local NO ₂ concentrations	
		Potential increase in CO ₂ concentrations	
Equality Duty		Changes to use of highway network across B&NES	
		Changes to the location of economic activity	
	Community and business engagement	'Neutralised' negative impacts on Small and Medium-sized Enterprises (SMEs) / micro businesses and disadvantaged groups	Bath is a cleaner more attractive place to live, work and visit

3. Economic Case

3.1 Introduction

Building on the OBC, Section 3, the Economic Case for the FBC considers all of the relevant costs and benefits arising from the Bath CAP in light of the changes to the preferred option identified by the final OBC.

The changes are summarised as:

- An extended boundary shown in Section 3.2.1;
- A revised package of mitigation measures; and
- The scalable abatement measures proposed at OBC (i.e. those supporting measures which are not required for compliance but would improve the likelihood of compliance), which are no longer under consideration.

The following sections are re-visited in light of the changes:

- Economic assessment of the preferred option that is demonstrably aligned with the CSFs; and
- Distributional analysis of the preferred option to identify any differential impacts across socio-economic groups.

For completeness, much of the background to the options assessment process within the OBC has been retained in the following sections, with further details on how this is or is not affected by the changes to the preferred option for the FBC.

3.2 Assessment of Charging Measures

3.2.1 Clean Air Zone Boundary

The SOC established that a charging zone would be necessary to achieve compliance. During the development of the OBC a number of changes were made to the small CAZ boundary identified in

Figure 2, for the following reasons:

- To reduce the potential impact of rat-running;
- To provide opportunities for vehicles to turn-around before they enter the CAZ; and
- To rationalise the boundary in order to minimise the impact of additional street clutter (primarily signage and cameras).

Further changes were made following completion of the OBC, primarily for public and political acceptability of the scheme based on feedback from the public consultation.

Full details of these boundary changes are provided in FBC-04 'Technical Note on Boundary Changes' in Appendix A of this FBC. The revised boundary is shown in Figure 3-1.

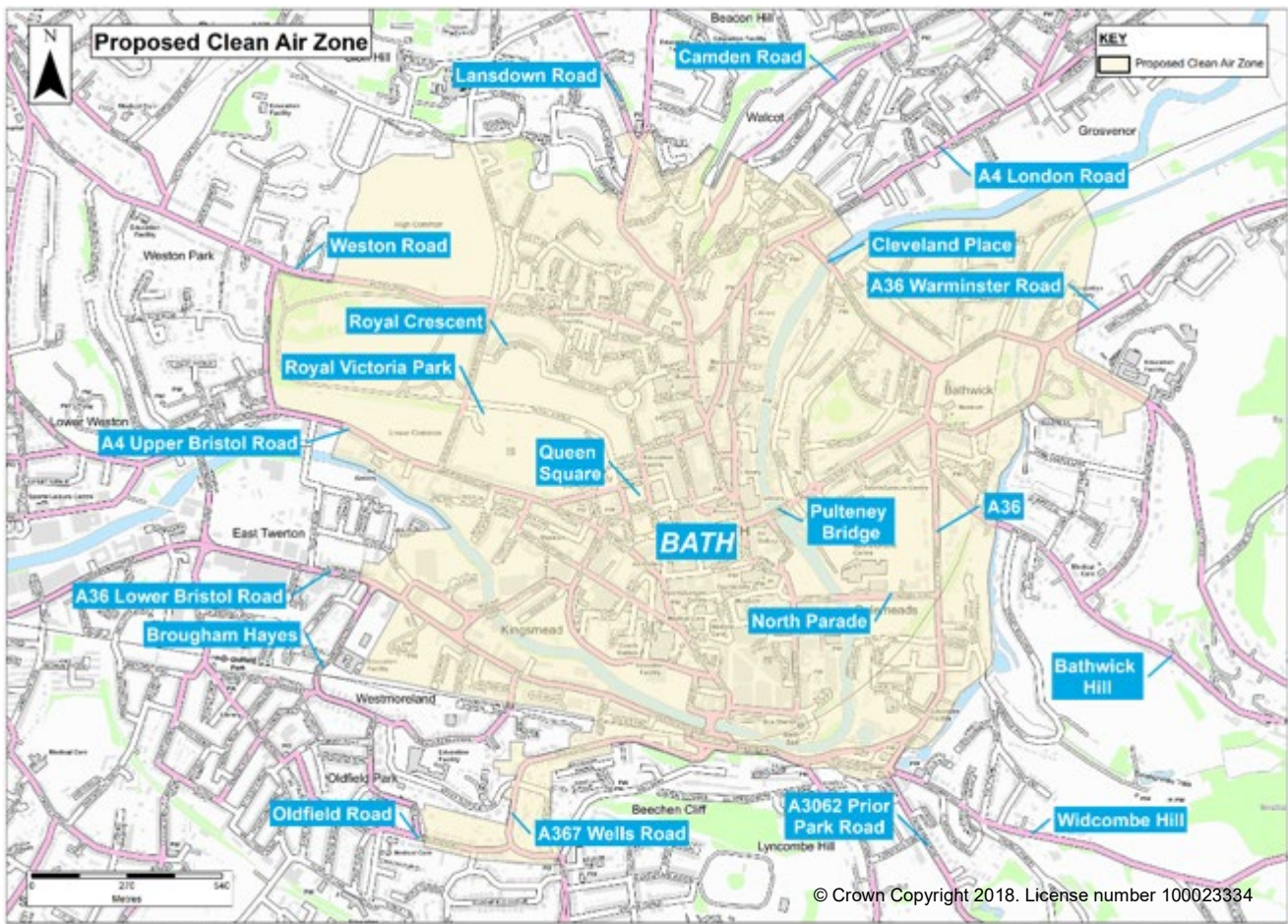


Figure 3-1: Revised Boundary in FBC

3.2.2 Transport Modelling Approach

Section 2.4.1 provided an overview of the transport modelling undertaken to estimate the composition of the vehicle fleet in the base year (2017) and baseline/compliance year (2021). The compliance year was initially calculated using the model runs of each of the options undertaken within the SOC, and an understanding of the time taken to deliver each proposed scheme. This assessment had suggested that the year of compliance could be as early as 2020. However, more detailed modelling undertaken for the OBC indicated the first year of compliance would not be until 2021. Hence the modelled compliance year is 2021. Traffic forecasts were also derived for the future year (2031), to assess the impact of the CAZ ten years after the baseline/compliance year.

The modelled compliance year remains as 2021 for this FBC.

3.2.2.1 Behavioural Responses

The future year traffic forecasts were primarily driven by the behavioural responses anticipated due to CAZ implementation, as inferred from the Stated Preference Survey, described in FBC-30 'Stated Preference Survey Report' in Appendix L of this FBC. The primary responses, listed below, were modelled using the G-BATH highway model using the following methodology, as described in Section 6 of FBC-13 'T3 Methodology Report' in Appendix E of this FBC:

- Pay charge;
- Avoid zone;
- Cancel journey / change mode; and

- Replace vehicle.

The behavioural responses remain the same for the purposes of this FBC.

3.2.2.2 Proposed Charge Rates

A key driver of the behavioural responses was the proposed charge rate for non-compliant vehicles adopted in the analysis. The methodology for determining the proposed charge rates for all vehicle types is discussed fully in FBC-13 'T3 Methodology Report' and Table 3-1 shows the final proposed charges. These are selected as the minimum charges required to address the air quality exceedances within Bath and are expected to bring about compliance with the annual mean Limit Value for NO₂ in the shortest time possible, or 2021, based on the traffic and air quality modelling.

Table 3-1: Bath CAZ proposed charges

Charge Class	Charge
Taxis	£9.00
Light Goods Vehicles (LGV)s	£9.00
HGVs	£100.00
Buses	£100.00
Coaches	£100.00

Taking into account these charging rates and the subsequent impact on individuals' behavioural choices, the response rates outlined in Table 3-2 were adopted within the traffic forecast and modelling.

Table 3-2: Final primary behavioural response rates

Response	Taxis	LGVs	HGVs	Buses	Coaches
Pay Charge	4.1%	18.4%	13.8%	0.0%	20.1%
Avoid Zone	0.0%	11.7%	4.4%	0.0%	0.0%
Cancel Journey / Change Mode	0.0%	3.6%	1.4%	6.4%	11.5%
Replace Vehicle	95.9%	66.3%	80.4%	93.6%	68.4%

It is highlighted that, in accordance with Table 3-2, all modelled options assumed a fully compliant bus fleet operating scheduled services.

The charges and response rates remain the same for the purposes of this FBC.

3.2.2.3 Links to the Air Quality Model

The link from the transport model to the air quality model is outlined FBC-13 'T3 Methodology Report', Chapter 9. Link-based traffic flows, by compliance from the highway model are fed through to the air quality model in a format compatible with the EFT, after undergoing post-processing of the model outputs. FBC-11 'AQ3 Modelling Report' in Appendix D of this FBC provides details of the air quality modelling.

The approach to air quality modelling remains as presented in the OBC.

3.2.3 Preferred Option in the OBC

The OBC identified that a Class D CAZ, or a Class C CAZ with traffic management at Queen Square, could achieve compliance in 2021. Where both options achieve the primary critical success factor of air quality

compliance in the shortest possible time, they were taken forward for economic assessment and social distributional assessment.

The economic assessment in the OBC determined that the scheme could generate an NPV of between -£83.2 million (CAZ C) and -£84.3 million (CAZ D). Under both intervention routes, the economic costs for the proposed schemes were found to outweigh the economic benefits by a considerable margin. This is primarily driven by the loss in consumer welfare associated with changing travel patterns and behaviours and the onerous capital and operational costs. The CAZ C achieved a marginally smaller negative NPV compared to CAZ D and was therefore the preferred option from a monetised cost-benefit perspective.

Further, the distributional and equalities impact assessment within the OBC demonstrated that both schemes would generate significant adverse distributional impacts for businesses within Bath. However, a Class C CAZ has a largely reduced impact on other socio-economic groups compared to a Class D CAZ.

When considering the other secondary critical success factors presented in Section 2.5, the Class C CAZ was found to be marginally more successful overall, particularly in relation to public and political acceptability as cars are excluded from the charging scheme. Refer to Section 2.7.3.3.

In light of these findings, the Class C CAZ (charging higher emissions buses, coaches, taxis, HGVs and LGVs) with additional traffic management was recommended as the preferred option.

3.2.4 Full Business Case

For the core scheme, the Class C CAZ with traffic management option will be assessed for the boundary changes by the following process:

- Revised traffic and air quality modelling to verify that the scheme achieves the primary CSF of air quality compliance in the shortest possible time;
- Undertake revised cost assessment of the scheme;
- Undertake revised economic analysis;
- Undertake revised social distributional impact assessment; and
- Confirm that the Class C CAZ with traffic management remains the preferred option in consideration of the secondary critical success factors.

There are no further changes proposed to the core scheme.

Following ongoing discussion with and feedback from JAQU, the shortlist of proposed supporting measures has also been revised to exclude options that are not sufficiently targeted towards those affected by the proposed Class C CAZ. This includes the scalable abatement options for car drivers originally included in recognition of the wider improvements to air quality (refer to Section 3.3).

The OBC considered a further option of a Class D CAZ with the proposed boundary changes. Since the change to the boundary would have applied to both the Class D and Class C CAZ options, the Class D CAZ has not been assessed again following the process summarised above. This is for the following reasons:

- Any differences to the Class C CAZ with traffic management option could be expected to apply proportionately to the Class D CAZ option. Section 3.5 demonstrates that the main reason economic impacts differ between the OBC and FBC versions of the Class C CAZ option is because the rate of HGV upgrades is slower in the baseline scenario relative to previous analysis. This means that the difference in non-compliant vehicles between the baseline and intervention scenario is greater. The updated baseline figures increase weighted upgrade costs because people upgrade earlier than they would have. This means that on average HGVs are upgraded sooner and depreciation has a smaller impact on narrowing the gap between new vehicles and replaced vehicles. Although no formal traffic modelling has been undertaken to establish the impact of the revised boundary on the Class D CAZ option, it is likely that there would be a proportionate impact as the slower rate of HGV upgrades in the baseline scenario would be constant for this option too. Further, because

the Class D CAZ option affects cars, a slower rate of vehicle upgrades could affect a larger number of vehicles overall, leading to even greater differences in economic impacts. For further detail on the variance in economic impacts between the OBC and FBC analysis and likely causes see Section 3.5.

- The boundary extension consists almost entirely of residential areas, thus a Class D CAZ option with the extended boundary could place further adverse impacts on socio-economic groups that are not currently affected by a Class C CAZ. The socio-economic groups and vehicles types already affected by a Class C CAZ with the boundary extension would be equally affected by a Class D CAZ with the same boundary.
- Due to the reduced or removed impact on some socio-economic groups, the Class C CAZ option remains the most politically and publicly acceptable option. Following political decision, the Class C CAZ with traffic management was taken forward as the preferred scheme at final OBC stage.

3.3 Assessment of Mitigation Measures

In the OBC, the CAZ C and D options were both complemented by the same package of supporting measures, described in Section 2.7.3.4. Under this approach, measures to support cars were considered primarily as mitigation for a Class D CAZ and as abatement for a Class C CAZ, in recognition of the contribution the measures would have to the improvement of air quality and increasing the likelihood of achieving compliance.

The compliant Class C CAZ scheme taken forward as the preferred option was achieved by combining the core charging scheme with traffic management measures at Queen Square, and a compliant bus fleet. It was subsequently recognised for the purposes of the FBC and the final CAF bid that it would be challenging to accurately and reliably model the additional abatement measures for cars in order that the air quality improvement in relation to value for money could be fully demonstrated.

Further research, development and detailed consideration of the options has resulted in a more targeted package of mitigation measures based on the impacted socio-economic groups, comprising predominantly of businesses. A series of measures have been identified from a long list of options. The full assessment and bid for funding is presented in FBC-46 Clean Air Fund Report in Appendix Y of this FBC.

The shortlisted items are:

- Expanding the existing CBTF programme by providing additional funding for retrofitting registered, local Euro 3/4/5 buses
- Financial support for replacing pre-Euro 6 diesel and pre-Euro 4 petrol non-compliant vehicles with compliant ones. This combines:
 - Financial support (grants) for replacing pre-Euro 6 diesel and pre-Euro 4 petrol vehicles and taxis/PHVs with compliant ones.
 - Financial support (interest free loans) for replacing pre-Euro 6 diesel and pre-Euro 4 petrol vehicles and taxis/PHVs with compliant ones.
 - Complementary financial support for installing electric charging points on private land in order to encourage the uptake of electric vehicles.
 - Complementary financial support for retrofitting in order to allow cheaper, non-compliant vehicles to be made compliant.
- Provide support and facilities for alternative delivery and servicing options for businesses. This combines:
 - Delivery and servicing plans for businesses.
 - Increased utilisation of the car/van club in Bath, with an emphasis on increasing the number of LGVs/vans available to businesses.
 - Expanding the proposal (included in Go Ultra Low package) to introduce 'last mile' electric cargo bike hire to the city.
- Provide a sustainable travel and transport team to facilitate the use of the mitigation schemes by the impacted groups and ensure uptake.

3.4 Economic Modelling Approach

Section 3.2.3 and 3.2.4 establish that the preferred option for the charging component of Bath's CAP is a Class C CAZ with traffic management. Further, in light of the revised boundary proposed for the Class C CAZ, additional traffic, air quality, economic and distributional modelling has been undertaken to determine the revised socio-economic impacts of the preferred option. The analysis presented in Section 3.5 to 3.7 provides a summary of the economic and distributional assessments for the preferred option, i.e. Class C CAZ with traffic management and a revised boundary.

Note that in Section 3.5, the economic impacts under the revised boundary are provided alongside the economic impacts stated within the OBC based on the previous boundary configuration. Justification is provided for any differential in economic impacts under the two boundary configurations.

The analysis focuses on the economic impacts associated with the CAZ and CAF components of the Bath CAP. The scheme costs associated with both CAZ charging and CAF mitigation measures have been determined through discussion with preferred contractors. Potential impacts have also been fully assessed and feature in Section 3.5 (mainly CAZ charging-related impacts) and Section 3.7 (mainly CAF mitigation-related impacts). As such, only the CAZ charging measure impacts are fully monetised; the CAF mitigation measure impacts are mainly considered qualitatively.

3.5 Economic Impacts

3.5.1 Health and Environmental Impacts

3.5.1.1 Greenhouse Gas Emissions

By changing travel behaviours (including number of trips, trip mode and vehicle type), the CAP may influence the quantum of Greenhouse Gas (GHG) emissions generated by road transport. A change in GHG emissions, and CO₂ emissions in particular, could generate variable effects on climate change processes.

Based on air quality modelling outputs, the Bath CAP is forecast to initially reduce and then slow the growth of GHG emissions across the appraisal period. Relative to the baseline scenario, the intervention scenario will therefore reduce the quantum of CO₂ emissions released into the atmosphere. This impact is monetised through the application of Department for Business, Energy and Industrial Strategy (BEIS) carbon prices.

The monetised impact of a change in GHG emissions is presented in Table 3-3, which demonstrates that the revised boundary Class C CAZ scheme will generate a smaller benefit (£127,000 versus £165,000 over the ten-year appraisal period). This is likely to be because the revised scheme shows more traffic on the network in the baseline scenario relative to the previous Class C CAZ scheme. Further, there are a higher number of residual non-compliant and older vehicles by 2030 in the intervention case relative to the previous Class C CAZ scheme.

Table 3-3: GHG impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Cumulative Difference in CO ₂ Emissions, 2021-30 (tonnes)	2,834	2,165
BEIS Carbon Prices, 2021-2030 (£/tonne)	69.3 - 79.4	
Present Value (PV) of Impact (£'s 2018 Prices)	£164,936	£127,047

3.5.1.2 Air Quality (PM/NO₂) Emissions

Based on air quality modelling outputs, the Bath CAP is forecast to reduce the level of PM and NO₂ emissions across the appraisal period, contributing to an improvement in air quality. Improvements in air quality can lead to a range of public health, natural and built environment benefits. These benefits can be monetised through the application of JAQU's Damage Cost estimates.

The monetised impact of a change in air quality is presented in Table 3-4, which demonstrates that the scheme will generate a lower aggregate benefit under the revised scheme (£0.80 million over the ten-year appraisal period) compared to the previous Class C CAZ (£0.82 million). This is likely to be because the revised scheme shows more traffic on the network in the baseline scenario relative to the previous Class C CAZ scheme. Further, there are a higher number of residual non-compliant and older vehicles by 2030 in the intervention case relative to the previous Class C CAZ scheme.

Table 3-4: Air quality impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Cumulative Difference in NO ₂ Emissions 2021-2030 (tonnes)	197.2	193.9
NO ₂ Damage Costs 2021-2030 (£/tonne)	4,927 - 5,888	
PV of NO₂ Change (£'s 2018 Prices)	£832,466	£818,668
Cumulative Difference in PM Emissions 2021-2030 (tonnes)	-0.23	-0.30
PM Damage Costs 2021-2030 (£/tonne)	87,729 - 104,845	
PV of PM Change (£'s 2018 Prices)	(£17,208)	(£22,323)
Aggregate PV (£'s 2018 Prices)	£815,257	£796,345

3.5.2 Impacts on Transport Users

3.5.2.1 Fuel Switch Impacts

The transport analysis assumes that some car drivers will switch fuel type from diesel to petrol when upgrading their vehicle in response to the CAZ charge. The change in fuel switch costs is reflected in the change in vehicle operating costs to the user, captured as part of the DfT's Transport User Benefits Assessment (TUBA) presented in Section 3.5.2.5. No additional or separate analysis is provided here.

3.5.2.2 Transaction Costs

Based on the traffic forecasting analysis, the Bath CAP will accelerate the rate at which vehicle owners' purchase or upgrade to compliant vehicles. Each upgrading transaction incurs time costs for vehicle owners relating to identifying and buying a compliant vehicle. By applying JAQU's recommended transaction cost data (provided as part of the National Data Inputs for Local Economic Models) to the number of vehicles anticipated to upgrade, Table 3-5 suggests that the revised scheme will impose a marginally lower transaction cost (just over £40,000 over the ten-year appraisal period) relative to previous Class C CAZ scheme (nearly £40,500). This is attributable to a marginally lower number of vehicles upgrading overall under the revised boundary Class C CAZ.

Table 3-5: Transaction cost impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Number of Vehicles Upgrading	5,950	5,920
PV of Transaction Cost (£'s 2018 Prices)	(£40,454)	(£40,241)

3.5.2.3 Consumer Welfare Impacts

The proposed scheme will affect consumer's²⁶ behaviour by inducing a change in travel behaviour for non-compliant vehicle trips (for example through upgrading vehicles, using alternative modes, cancelling journeys etc, as suggested by the stated preference survey and reflected in traffic model forecasts). However, because consumers would have preferred their original action in the baseline, this change in behaviour leads to a consumer welfare impact. Two elements of analysis were identified to estimate aggregate consumer welfare loss as a result of intervention:

- Welfare loss associated with vehicles upgrading earlier.

²⁶ NB: by consumers, the analysis captures impacts on all highway users affected by the intervention, including businesses, commuters, leisure users etc

- Welfare loss associated with changing travel patterns or behaviours (i.e. mode shift, cancelled journeys, diverted journeys).

The cost of upgrading was estimated by establishing the average cost differential for upgrading a vehicle in the intervention scenario, compared to the baseline scenario. The cost differential was driven by the change in depreciation rates over time and therefore, the change in residual vehicle value between replacement and replaced vehicles, at the time of upgrading in the intervention scenario, relative to the baseline scenario. As vehicles were expected to upgrade earlier in the intervention scenario, the cost of upgrading is expected to be higher as the difference in value between replacement and replaced vehicles is also expected to be higher.

By applying the average cost differential for upgrading to the number of vehicles upgrading (split by vehicle type (i.e. LGVs, buses etc) and upgrade type (i.e. to new or used vehicles)) the consumer welfare loss associated with upgrading earlier is estimated to cost more under the Class C CAZ with revised boundary (nearly £14.8 million) compared to the previous Class C CAZ (£11.1 million), as shown in Table 3-6. This is because assumptions around the number and timing of HGVs upgrading have changed in the interim period between OBC and FBC. This change in assumptions is associated with the extension to the CAZ boundary as part of the FBC. Hence, an accelerated level of upgrading is discernible in the intervention case relative to the baseline case for the revised scheme compared to the previous scheme. This significantly increases the weighted upgrade cost for upgrading HGVs in the revised scheme, as accelerated upgrading means more vehicles are replaced earlier than they otherwise would be the case, resulting in greater loss of consumer welfare for vehicle owners induced to upgrade. This is linked to higher rates of depreciation for newer vehicles, as explained in FBC-18 'Economic Assessment Methodology Report' in Appendix F of this FBC. Note that this figure reflects use of the 'rule of half' to estimate the average loss to each upgrader.

Table 3-6: Consumer welfare: cost of upgrading impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Number of Vehicles Upgrading	5,950	5,920
PV of Consumer Welfare Loss (£'s 2018 Prices)	(£11,100,303)	(£14,819,604)

The cost of changing travel behaviour was estimated by establishing the number of vehicle trips in the baseline that would be fundamentally changed in the intervention scenario. The cost of each individual trip cancelled, changed or switched to a new mode was assumed to be equal to half the cost of the charge. This approach, in line with JAQU's Options Appraisal Guidance, was adopted to reflect that only those trips that were valued at less than the cost of the charge were cancelled; any trips valued more than the charge were assumed to pay the charge. However, as it is not possible to value every trip that induced a behavioural response, each cancelled, changed or mode shifted trip was assumed to be valued at half the price of the charge.

That said, the traffic modelling analysis of the revised boundary Class C CAZ demonstrated that only 28% of non-compliant vehicle trips into the CAZ each day were made by unique vehicles. The charge would only be incurred once per day, irrespective of the number of trips through the zone. Therefore, consumer welfare loss would only be associated with the first trip into the CAZ each day (i.e. the trip that incurs the charge), not all trips. Combining the number of vehicle trips changed with the adjusted charge to enter the zone and further adjustments to reflect the proportion of unique vehicle trips through the zone, Table 3-7 indicates that the consumer welfare loss associated with changing travel patterns or behaviours could cost more than £8.8 million over the ten-year appraisal period under the revised Class C CAZ scheme. This is reduced to £7.6m million under the previous Class C CAZ. This is attributed to a greater number of baseline vehicles trips that are induced to change travel pattern or behaviour under the revised scheme, attributed to a larger boundary that affects more vehicles more frequently.

Table 3-7: Consumer welfare: cost of changing travel pattern or behaviour impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Number of Vehicles Trips Changed	2,355,797	2,573,468
Proportion of Unique Vehicle Trips Changed	30%	28%

PV of Consumer Welfare Loss (£'s 2018 Prices)	(£7,639,766)	(£8,848,688)
---	--------------	--------------

3.5.2.4 Vehicle Scrappage Costs

In line with JAQU guidance, it is assumed that the overall size of the vehicle fleet remains fixed within the upgrading process. Therefore, for every new vehicle purchased (25% of all upgrades as per JAQU benchmarks), an older vehicle is scrapped. The differential in lost asset value associated with scrapping a vehicle earlier in the intervention case relative to the baseline case allows monetisation of this impact. By combining the number of vehicles expected to be scrapped in the intervention scenario by the average differential in lost asset value between the intervention and baseline scenarios, Table 3-8 demonstrates that vehicle scrappage costs will amount to more under the revised Class C CAZ scheme (around £363,000 across the ten-year appraisal period) than the previous Class C CAZ (£318,000). This is because assumptions around the rate of HGVs upgrade have changed in the interim period between OBC and FBC. Hence, an accelerated level of upgrading (and therefore scrappage) is discernible in the intervention case relative to the baseline case for the revised scheme compared to the previous scheme. As such, the weighted residual vehicle value for scrapped HGVs is significantly higher in the revised scheme, as accelerated scrappage in the intervention scenario compared to the baseline scenario means a greater loss of residual asset value. This is linked to higher rates of depreciation for newer vehicles, as explained in FBC-18 'Economic Assessment Methodology Report' in Appendix F of this FBC.

Table 3-8: Vehicle scrappage cost impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Number of Vehicles Scrapped	253	252
PV of Vehicle Scrappage Costs (£'s 2018 Prices)	(£318,353)	(£363,403)

3.5.2.5 Journey Time/Vehicle Operating Costs

By influencing travel patterns and behaviours, the scheme could also have an impact on transport economic efficiency (TEE), measured in terms of changes to journey time savings and vehicle operating costs. By reducing vehicle flows, increasing vehicle speeds and reducing congestion, travel time could be reduced alongside reduced running costs. Using DfT's TUBA software, the change in vehicle movements induced by the revised Class C CAZ scheme could result in a negative impact on journey times and vehicle operating costs amounting to approximately £100,000, as shown in Table 3-9. Under the previous CAZ C scheme, the TEE impacts were forecast to be positive at £1.1 million. The adverse impact under the Class C CAZ is attributable to the following factors:

- (i) The change in demand from the baseline scenario is negligible in the long term, and so impacts are limited and generally indistinguishable from modelling noise; and
- (ii) The Queen Square traffic management scheme acts to create some extra delays / longer routes which will negate the benefits from reduced traffic levels due to the CAZ

Table 3-9: Journey time/vehicle operating cost impacts (2018 prices)

TUBA Impact Category	Total
PV of TEE: CAZ C – OBC Boundary	£1,112,661
PV of TEE: CAZ C – Revised Boundary	(£100,469)

3.5.2.6 Accident Impacts

By changing travel patterns and behaviours, thus affecting vehicle trip numbers and speeds, the scheme could influence the frequency and severity of accidents. Utilisation of DfT's CoBALT software suggests that the number of accidents and casualties is expected to reduce slightly, leading to an accident benefit of £0.85 million (PV) under the revised Class C CAZ boundary. This benefit is lower than the £1.18 million (PV) forecast under the

previous Class C CAZ. The reduced benefit is associated with a smaller differential between baseline and intervention scenario traffic flows under the revised Class C CAZ scheme compared to the previous Class C CAZ scheme.

3.5.2.7 Walking/Cycling Impacts

Based on the findings of the stated preference survey (using work/employee/business trips by car as a proxy), the traffic modelling assessment assumes a small proportion of taxi and LGV trips would be induced to change mode in response to the CAZ. By inducing mode shift, the proposed scheme will increase the number of individuals making walking and cycling trips. This has a positive economic impact, primarily by improving the general health of people, by walking and cycling more regularly, and by reducing absenteeism from work. Using the DfT's Active Mode Appraisal Toolkit, the forecast growth in the number of walking and cycling trips is expected to lead to a benefit of around £0.43 million under the revised Class C CAZ boundary scheme. This value reduces marginally to £0.40 million under the previous CAZ C scheme. This is attributable to a higher number of vehicle trips in the baseline scenario under the revised scheme. This means more people are induced to switch mode to walking and cycling relative to the previous scheme.

Table 3-10: Walking/cycling impacts

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Number of Trips Changing Mode	289,679	314,049
Number of New Cycling Trips	14,855	16,105
Number of New Walking Trips	193,119	209,366
PV Monetised Impact (£'s 2018 Prices)	£396,048	£428,928

Note that not all trips changing mode are assumed to switch to active modes. Some will switch to bus journeys (estimated 15%), rail (5%) and others. The impact of switching to non-active modes has not been monetised within this assessment, beyond the consumer welfare loss induced by switching mode in response to the intervention.

3.5.3 Costs to Central and Local Government

3.5.3.1 Set-Up Costs

The optimism bias-adjusted capital costs associated with delivering the Bath CAP are estimated at £22 million (PV) for the revised boundary Class C CAZ scheme. This is lower than the £41 million (PV) of capital expenditure forecast for the previous Class C CAZ scheme. This variance is attributed a number of changes since OBC submission:

- Updated costs provided through discussion and agreement with contractors
- Removal of 'scalable' non-charging measures (with the reduction in cost associated with this removal partially offset by an increase in the number of cameras and related infrastructure resulting from a larger boundary).
- Reduction in Optimism Bias rates in line with project progression (see FBC-18 'Economic Assessment Methodology Report' for explicit detail in changes in Optimism Bias). The reduction reflects the application of HM Treasury's Green Book lower bound rates for capital expenditure in place of upper bound rates previously used at OBC stage. In the absence of specific rates for operational expenditure, the same rates have been applied for both capital and operational items.

More detail on the derivation of these costs can be found within FBC-21 'Project Costs' in Appendix I of this FBC, FBC-18 'Economic Assessment Methodology Report' in Appendix F of this FBC and FBC-33 'Financial Report' in Appendix W of this FBC. This includes explicit detail on the application of optimism bias across the various capital items.

Table 3-11: Set-up cost impacts (2018 prices and values)

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
PV of Capital Costs	(£41,378,626)	(£22,271,303)

3.5.3.2 Running Costs

Including all scheme components (excluding those funded by private match funding), the operational costs associated with delivering the Bath CAP, including the revised boundary Class C CAZ scheme, are estimated at £12 million (PV). This figure is well below the £26 million of operational expenditure forecast for the previous Class C CAZ. The revised scheme cost estimate is related to the same factors highlighted in Section 3.5.3.1, specifically greater certainty on costs linked to discussions with contractors and reduced levels of Optimism Bias. Also, the financial assistance mitigation measure which comprised a sizeable component of the OBC running costs has now been included within the set-up costs reported in Section 3.5.3.1.

More detail on the derivation of these costs can be found within FBC-33 'Financial Report' in Appendix W and FBC-18 Economic Assessment Methodology Report in Appendix F of this FBC. This includes explicit detail on the application of optimism bias across the various cost items. Note that revenue associated with CAZ charges and Penalty Charge Notices (PCNs) are ignored from the analysis on the basis that this economic benefit to local/central Government is neutralised by the economic cost to individuals of paying the charge/fine.

Table 3-12: Operational cost impacts (2018 prices and values)

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
PV of Operational Costs	(£26,361,684)	(£12,247,340)

3.5.4 Summary

By combining the economic impacts discussed in the previous sections, the Bath CAP with revised boundary Class C CAZ scheme could generate an NPV of -£56.5 million. This negative economic impact is less than the -£83.2 million impact forecast for the previous Class C CAZ scheme. This reduced negative economic impact is attributed to significantly reduced capital and operational scheme costs. This is primarily the result of greater cost certainty (influenced through discussion and agreement with contractors) and reduced requirements for Optimism Bias (as a consequence of greater cost certainty).

That said, some individual impact areas have experienced an increased negative impact – for example, consumer welfare linked to replacing vehicles. This increase can be attributed to changes in the baseline scenario traffic in the revised scheme, which forecast a much slower rate of upgrade than previously anticipated. This results in an increased weighted upgrade cost and weighted residual vehicle value under the revised scheme, as relatively speaking, vehicle upgrades (and scrappages) occur earlier under the revised scheme compared to the previous scheme.

It should be noted that the economic costs for the revised Class C CAZ scheme outweighs the economic benefits by a considerable margin. This is primarily driven by the loss in consumer welfare associated with changing travel patterns and behaviours and the onerous capital and operational costs.

Table 3-13: Net economic impacts (2018 prices and values £)

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Present Value of Benefits		
Air Quality: Changes in NOx	£832,466	£818,668
Active Mode Appraisal Toolkit	£396,048	£428,928

Impact	CAZ C – OBC Boundary	CAZ C – Revised Boundary
Accident Analysis	£1,184,040	£852,341
GHGs	£164,936	£127,047
Journey Time/Vehicle Operating Costs	£1,112,661	n/a (see below)
Present Value of Benefits (PVB)	£3,690,151	£2,226,983
Present Value of Costs		
Journey Time/Vehicle Operating Costs	n/a (see above)	-£100,469
Air Quality: Particulate Matter	-£17,208	-£22,323
Consumer Welfare: Behavioural Response – Replace Vehicle	-£11,100,303	-£14,819,604
Consumer Welfare: Behavioural Response – Cancel Trip/Avoid Zone/Re-mode	-£7,639,766	-£8,848,688
Vehicle Scrappage	-£318,353	-£363,403
Transactions	-£40,454	-£40,241
Capital Expenditure: Set Up Costs	-£41,378,626	-£22,271,303
Operational Expenditure: Running Costs	-£26,361,684	-£12,247,340
Present Value of Costs (PVC)	-£86,856,394	-£58,713,372
Net Present Value (NPV)	-£83,166,244	-£56,486,389

Although the NPV has improved from OBC to FBC stage (primarily related to reduction in scheme costs), the scale of economic benefits (PVB) has reduced overall from £3.7 million to £2.2 million. This is primarily attributable to the reduction in journey time savings and vehicle operating costs associated with the FBC option. The reduction is related to the introduction of Queen Square traffic management, which introduces extra delay and longer routes but is necessary for the achievement of compliance.

To provide context for the scale of this NPV it has been compared to the Gross Value Added (GVA), the measure of the value of goods and services produced in an area of an economy, in B&NES. Across the 10-year period assessed, the NPV of the scheme represents less than -0.11% of the NPV of GVA in B&NES. During the same period the GVA is forecast to grow by 22%.

3.5.5 Comparison of Revised Scheme Impacts Against Other Shortlisted Options at OBC

The forecast negative economic impact of £56.5 million as a result of the revised boundary Class C CAZ scheme is less adverse than both the previous CAZ C scheme (as per Table 3-14) and the CAZ D scheme presented at OBC stage. However, the revised boundary Class C CAZ scheme and the earlier CAZ D scheme are not comparable, as any CAZ D scheme proposed as part of the Bath CAP would need to incorporate the same enlarged boundary as the revised Class C CAZ scheme.

It is likely that the same factors generating a less adverse economic impact for the revised Class C CAZ scheme would have a similar effect for a revised Class D CAZ. For example, greater cost certainty and reduction in Optimism Bias would reduce Class D CAZ capital and operational costs at a similar rate as for the preferred option.

Moreover, some of the increasingly negative impacts reported for the revised Class C CAZ scheme and linked to the enlarged boundary (e.g. greater consumer welfare loss), could be even more pronounced under a Class D CAZ scheme. In particular, the slower rate of HGV upgrading in the baseline scenario under the revised boundary

for the Class C CAZ would also occur under a Class D CAZ. The slower rate of HGV upgrading in the baseline scenario acts to increase vehicle upgrade costs under the revised scheme as it widens the differential rate of upgrading between the baseline and intervention scenarios relative to previous scheme. This means that in effect, people are upgrading earlier than they otherwise would have based on the updated baseline figures. Weighted upgrade costs are therefore higher due to the variable impact of depreciation over time, with earlier upgrading allowing less time for depreciation to narrow the differential cost between new and replaced vehicles. The same situation would occur under a revised Class D CAZ. Further, as a Class D CAZ also charges cars, the impact on HGVs could be replicated for cars too, leading to a significant worsening of economic impact relative to the assessment at OBC stage.

Within this context, it is believed that the OBC results which stated the Class C CAZ scheme performed better from an economic impact perspective relative to the Class D CAZ scheme would be maintained with the revised boundary. Therefore, even though updated analysis demonstrates a significantly improvement economic performance for the revised Class C CAZ scheme, the improvement in performance would be less evident for a revised Class D CAZ scheme which also affects private cars.

3.6 Sensitivity Analysis

3.6.1 Traffic Modelling and Air Quality Sensitivity Testing

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

However, these uncertainties are not specific to this project, and are inherent in any traffic and/or air quality modelling project. The development of the base and baseline models has followed Government guidance and best practice throughout in order to minimise the level of remaining uncertainty.

The base year modelling, both traffic and air quality, has been verified against recent and reliable observed/monitored data, providing reasonable confidence in the 2017 model. Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by the DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

To assess the uncertainty further, a series of sensitivity tests have been undertaken on both the baseline and preferred option models as set out in Table 3-14. Full details of this assessment are provided in FBC-31 'Sensitivity Test Report' in Appendix N of this FBC and a summary of the tests undertaken is provided in Table 3-14 below.

Table 3-14: Summary of sensitivity tests

Traffic modelling	Air quality modelling	Impact of a simultaneous CAZ in Bristol
- Uncertainties in the Transport Model at the National Level - Fleet splits by fuel type: ANPR vs. WebTAG - Fleet splits by European emissions standards: EFT option 1 vs option 2 - Fleet splits by Euro Standards: high and low fleet renewal - Behavioural response to charging	- Differential bias - Euro 6 vehicles - LGV Emissions - Lower Uptake of Compliant LGVs - Inappropriate Emissions Groupings - Engine Size and Vehicle Weight - Average speed emissions factors - Emissions at low speeds - Background concentrations - Model verification - Receptor locations - Road widths and geometries - Gradients - Meteorological Data - Meteorological Parameters - Primary NO₂ Fraction - Regional Ozone - Non-Road Sources - Lower Uptake of Bus Retrofitting	- Analysis of Census Data - Analysis of SP Survey Data - Analysis of ANPR Data

The sensitivity tests have been designed to assess the robustness of the modelling as well as the CAZ scheme. The tests show that with the changes to the assumptions in the modelling (i.e. an increase or decrease in flows, different composition of fleets, meteorological data, etc.) that the CAZ model outputs are still largely showing scheme compliance. The report also covers analysis into who may be affected by a simultaneous CAZ in Bristol

and Bath, which is shown to affect a small number of LGV and HGV vehicles. Out of twenty-seven issues considered in the sensitivity test report, only two tests indicate two or more locations not reaching compliance and five tests showed one location not reaching compliance in 2021. Ten tests indicated compliance would still be reached at all locations. For the other issues considered, there was either no reliable way to reflect the issue or no reason to change the core assumption. Hence, overall, the scheme assessment has been demonstrated to show very little variation in results under the range of reasonable alternative assumptions considered.

3.6.2 Economic Modelling Sensitivity Testing

A number of isolated sensitivity tests were assessed within the economic model. This involved changing some of the key input assumptions to the economic model as outlined below.

- Implementation costs
- Damage costs
- Carbon prices
- Vehicle non-compliance
- Upgrading rate
- Charge rate

Further detail on the specification of the economic model sensitivity tests is provided in FBC-18 'Economic Appraisal Methodology Report' in Appendix F of this FBC. The results of the sensitivity tests are outlined in Table 3-15, which demonstrates the NPV of the revised boundary Class C CAZ scheme could range between -£52m and -£62m, around a core assessment of -£56m.

Table 3-15: Sensitivity Analysis Summary NPV (2018 prices and values)

Key Assumption Changed	Low/Pessimistic	Core	High/Optimistic
Implementation Costs	(54,259,270)	(£56,486,389)	(58,713,529)
Damage Costs	(52,865,106)	(£56,486,389)	(56,497,564)
Carbon Prices	(56,549,912)	(£56,486,389)	(56,422,865)
Vehicle Non-Compliance Scenario	(57,371,258)	(£56,486,389)	(55,601,520)
Charge Rate	(52,062,045)	(£56,486,389)	(60,910,733)
Key Assumption Changed	All Entrants Upgrade Equally	Most Frequent Entrants Only	
Upgrading Rate	(61,755,731)	(£56,486,389)	

3.7 Distributional and Equalities Impact Assessment

For the FBC, the distributional and equalities impact assessment undertaken for the OBC was reviewed for the revised boundary of the preferred option. Detail on the methodology and results of the assessment can be found in FBC-19 'Distributional and Equalities Impact Assessment' in Appendix G of this FBC. The key findings of the assessment in relation to the preferred option of a Class C CAZ with the revised boundary are replicated below:

3.7.1 Baseline – Pre-Intervention Condition

The baseline socio-economic conditions affecting key social and business groups can be described as follows:

- B&NES is home to approximately 189,000 residents; the proposed CAZ area contains the most densely populated communities in the local authority area

- B&NES is relatively affluent; however, there are pockets of income deprivation in the west of the city (as well as less pronounced deprivation within the immediate CAZ boundary).
- Most communities in the central area have a low concentration of children but a high proportion of elderly residents.
- The central areas of the city have a low concentration of female residents and very few people from ethnic minority backgrounds reside within the city.
- The B&NES economy consists of approximately 84,000 jobs across 8,200 businesses (mainly SMEs and micro businesses). Around 2,400 of these businesses and 29% of employment are located within the central area, predominantly in retail, tourism and high value sectors (e.g. finance and insurance and ICT).
- Economic output and productivity for employees is higher than average, with £55,000 of gross value generated per filled job.
- There are significant levels of vehicular non-compliance in B&NES, including 90% for LGVs.
- A range of key infrastructure, including the employment core, schools, community centres, care homes and general practices and green space, are all located within the proposed CAZ boundary.

3.7.2 Post-Intervention Impacts

Tables 3-16 and 3-17 present a summary of the key findings of the distributional and equalities impact assessment. The analysis conducted relates to the locations where the benefits/disbenefits accrue and it has been mapped to the populations that live in those areas. The analysis represents the relative distribution of impacts on socio-economic quintiles compared to that quintiles' population share across B&NES.

Table 3-16: Air Quality Impacts on Relevant Socio-Economic/Business Groups

Socio-Economic/Business Group	Quintiles					Are Impacts Distributed Evenly?
	0-20% (most deprived)	20-40%	40-60%	60-80%	80-100% (least deprived)	
Low-Income Households (Income Deprivation)	✓✓	✓✓	✓	✓✓	✓✓	Yes
Children	✓✓✓	✓✓	✓	✓✓	✓	No
Elderly Residents	✓✓	✓✓✓	✓✓✓	✓	✓	No

Table 3-17: Affordability and User Benefit Impacts by Income Deprivation

Measure	Quintiles					Are Impacts Distributed Evenly?
	0-20% (most deprived)	20-40%	40-60%	60-80%	80-100% (least deprived)	
Affordability impacts due to vehicle operating cost changes	xx	✓	✓✓✓	✓	✓✓	No
User Benefits	xx	xxx	✓✓✓	✓	✓✓✓	No

The key conclusions of the assessment are:

- Air quality benefits are felt across the majority of Bath, with a minor decrease in air quality reported in two LSOAs in low income areas. Beneficial impacts accrue across low-income groups, with greater proportions of low-income households (i.e. those in areas that are most income deprived) benefitting relative to this group's share of the overall population in B&NES.

- There are likely to be small scale public transport accessibility benefits due to a reduction in traffic volumes within the CAZ area and impacts of the supporting abatement measures. These benefits are likely to be concentrated on existing bus users who are typically more likely to be from lower income groups, older people and households without a car than the background population.
- Whilst car drivers will not be subject to CAZ charges, there are negative affordability and user benefits for residents in B&NES due to the traffic management scheme, with those in the 0-20% and 20-40% income groups seeing the largest share of the disbenefits.
- It should be noted that the scale of vehicle operating cost and user benefit impacts are relatively small, particularly when distributed across the modelled area, and as such small changes in benefits/disbenefits could impact the overall assessment scores.
- The scheme is also likely to result in a mix of small scale positive and negative noise, accident, and severance impacts because of traffic flow changes. These impacts are concentrated within the CAZ charging zone with impacts on lower income areas, areas with few children and areas with a higher proportion of disabled people. There is an overall benefit for pedestrians, however, impacts for people cycling and motorcycling are more mixed.

3.7.3 Post-Intervention and Mitigation Impacts

In light of the adverse distributional and equalities impacts relating to affordability and accessibility, a range of mitigation measures are included in the economic appraisal as listed in Section 3.3.3. Funding will be sought from the CAF to deliver these mitigation measures, which are designed to provide greater choice, increase capacity for changing travel behaviours and minimise the cost burden of making such changes, especially for businesses. This will aim to alleviate the adverse affordability and accessibility impacts generated by the intervention. A series of concessions/exemptions are also proposed to provide further mitigation to vulnerable groups. Full details are provided in FBC-05 'Proposed System Design Features and Payment Exemptions' within Appendix A of this FBC.

Based on the range of adverse impacts, the following mitigation measures are proposed to support the transition towards the CAP for vulnerable and protected socio-economic groups:

- Expanding the existing CBTF programme by providing additional funding for retrofitting registered, local Euro 3/4/5 buses;
- Financial support for replacing pre-Euro 6 diesel and pre-Euro 4 petrol non-compliant vehicles with compliant ones;
- Provide support and facilities for alternative delivery and servicing options for businesses;
- Provide a sustainable travel and transport team to facilitate the use of the mitigation schemes by the impacted groups and ensure uptake.

More detail on the specification of each of these mitigation measures is provided in FBC-46 'Clean Air Fund Report in Appendix Y of this FBC.

Consideration of how each proposed measure will mitigate the potential distributional impacts of the intervention is outlined below:

- Providing additional funding for bus retrofitting will not only support the achievement of a compliant scheme, but also mitigate the adverse affordability impacts on bus operators of the charging zone.
- Financial support is proposed to support businesses and individuals suffering from adverse affordability impacts associated with the cost of upgrading to compliant vehicles. Support will be provided to businesses and individuals, with a focus on taxi/private hire firms and businesses with a reliance on HGVs and LGVs. Financial support is proposed to mitigate against the cost of replacing vehicles with compliant ones. Support will be also provided to allow for the installation of electric charging points on private land, for example in bus and coach depots. This will reduce the financial cost facing businesses who wish to purchase an electric vehicle, thereby making the option more affordable.

- Increasing the uptake of delivery and servicing plans, providing electric cargo bike hire and facilities and the option of electric van hire for businesses will help local businesses proactively respond to the CAZ charges and manage its impacts on servicing and deliveries.

In effect, the mitigation measures highlighted above are expected to alleviate many of the adverse accessibility and affordability impacts of the scheme. The uneven distribution of impacts is also expected to be reduced as a result of schemes specifically targeted at groups that are most affected by the scheme (e.g. introduction of financial support for replacing non-compliant vehicles; specifically targeted at businesses). Hence, the mitigation measures are considered appropriate for CAF support.

3.8 Economic Impact of the Clean Air Fund Measures

The economic impacts outlined in Section 3.5 predominantly relate to impacts associated with the CAZ component of Bath's CAP. Section 3.7 demonstrates that there is a clear case for implementing mitigation measures to minimise the potential negative effect of the CAZ on local businesses. Within this context, B&NES are requesting capital and operational grant funding from the CAF to support delivery of the mitigation measures identified above.

Alongside this request, an attempt has been made to monetise the impact of each of the mitigation measures specified in Section 3.7. The impact is outlined in Table 3-18 below. More detail on the approach to monetising the impacts is presented in FBC-46 'Clean Air Fund Report in Appendix Y of this FBC.

Table 3-16: Economic Impact of CAF Mitigation Measures (Undiscounted)

CAF Mitigation Measure	Costs	Benefits	Difference
Additional retrofit funding for registered, local Euro 3/4/5 buses (2018 Prices)	2,313,900	4,016,961	1,703,061
Financial support for replacing pre-Euro 6 diesel and pre-Euro 4 petrol non-compliant commercial vehicles with compliant ones (2019 Prices)	10,842,688	10,842,688	0
Provide support and facilities for alternative delivery and servicing options for businesses (2019 Prices)	1,096,000	1,836,432	740,432
Provide a sustainable travel and transport team to facilitate the use of the mitigation schemes by the impacted groups (2019 Prices)	1,183,059		-1,183,059
General Staff Costs (2019 Prices)	354,918		-354,918
Total	15,790,565	16,696,081	905,516

Note that the costs in the table above do not include optimism bias. Further, the analysis does not present all monetary values in discounted terms using a consistent price base. Nevertheless, the approach adopted above does suggest that the CAF mitigation measures could generate a marginally positive NPV. That said, traditional cost-benefit analysis perspectives do not reflect the full scale of impacts that will result from the mitigation measures. For example, non-quantifiable benefits are not captured as part of the monetised analysis. As such, a range of additional non-quantified benefits linked to delivery of the mitigation measures are outlined below.

- Reduced severance for some rural communities that may lose access to Bath City Centre. As bus companies would be expected to cancel some services in response to the CAZ (in the absence of bus retrofitting); and therefore the mitigation measure will ensure that services are retained.
- Given the rural nature of Bath and North East Somerset, the bus network is characterised by multiple operators including a number of small, locally focussed operators. The mitigation measure will ensure that the cost of upgrading to compliant vehicles does not fall on small operators, thus removing the challenge to their long-term viability.

- By ensuring bus services are retained, the mitigation measure will avoid any negative publicity associated with reducing key public services.
- By ensuring bus services are retained, the mitigation measure will support wider efforts to achieve mode shift from private vehicle use to public transport. Attempts to promote use of public transport could appear illogical if the bus network contracted in response to the CAZ.
- Prevent job losses amongst trades people in Bath, as the availability of financial support allows vehicular upgrade.
- Maintains Bath as a location that is attractive to local trades people, ensuring that consumers continue to have choice.
- Supports dependent businesses such as retail. The financial support measure safeguards the delivery of stock on a reliable basis. This will help prevent job losses and help maintain the vitality and viability of Bath City Centre.
- Supports the leisure and tourism industry in the city by providing opportunities for eligible coach companies to access financial support.
- Most businesses across all sectors are reliant to some extent on freight or delivery services. If non-compliant vehicles continued to enter the CAZ, any associated charge would likely be passed on to end consumers. Provision of financial support for eligible freight vehicles reduces the amount of non-compliant freight vehicles entering the CAZ and therefore helps to minimise pass-through of CAZ costs.
- Protects local freight businesses and traders by reducing the capital cost burden of upgrading to compliant vehicles. This is particularly important for SMEs and sole traders, who may be more vulnerable to a significant financial shock such as upgrading to a compliant vehicle.
- Provides a monetary stimulus for the local economy as new vehicles may be purchased from local dealerships.
- Prevents negative publicity. In the event that SMEs or trades people went out of business as a consequence of the CAZ, both B&NES and central government may be perceived as providing a lack support for vulnerable business groups.
- Promotes more active and healthier lifestyles through support for active mode alternatives via the electric cargo bike infrastructure.
- The option of electric van hire could have a positive impact on the emerging electric vehicle market. The measure could convince more people to switch to electric vehicles. Further, by encouraging the use of electric vehicles, the mitigation measure will increase awareness of a nascent market. Electric vehicles will also contribute to lower operating costs and noise pollution.
- Protects local businesses and traders by providing alternatives to non-compliant LGV use. This is particularly important for SMEs and sole traders, who may struggle to identify these opportunities alone.
- Will ensure the leisure and tourism industry is aware of opportunities to access support in dealing with the transition to the CAP.

Further, B&NES is committed to minimising the impact of the CAP on individuals and businesses whilst ensuring compliance with air quality standards (i.e. by avoiding further exemptions or concessions). Hence, B&NES consider the proposed set of measures to be the best approach to achieving this commitment.

3.9 Summary

The economic appraisal, pivoting from the transport and air quality modelling assessments, considers the economic costs and benefits of the preferred option that has been demonstrated to achieve air quality standards compliance in the shortest possible timeframe (i.e. 2021), a Class C charging option with associated non-charging measures and traffic management. For the FBC this has been undertaken with respect to the changes in the proposed boundary of the scheme following completion of the OBC.

The economic appraisal demonstrates that the scheme generates a significant negative NPV of -£56.5million. This is substantially lower than the value referred to in the OBC (c. -£83 million). This decrease is attributable to a greater cost certainty and less onerous Optimism Rates for capital and operational expenditure. That said, some economic impacts have worsened since OBC submission (e.g. consumer welfare, linked to the scale and timing of vehicle upgrades). This trend is attributed to a slower rate of upgrading for HGV vehicles in the baseline scenario for the revised boundary Class C CAZ, relative to the OBC analysis assessing the smaller CAZ boundary. In the absence of formal modelling of a revised boundary Class D CAZ, it is believed that the Class C CAZ scheme's status as preferential to the Class D CAZ scheme from the OBC would be maintained with the revised boundary. This is because the greater cost certainty and application of reduced Optimism Bias rates would affect both Class C and Class D CAZ schemes in a similar manner, resulting in no overall change in comparative performance. Further, the slower rate of upgrading for HGVs in the baseline scenario would apply equally to the assessment of both a Class C CAZ and a Class D CAZ. In fact, as a Class D CAZ affects cars as well as larger vehicles, the impact of slower upgrading in the baseline scenario could have an even greater effect for a Class D CAZ. Further, the distributional and equalities impact assessment demonstrates that the scheme will generate significant adverse distributional impacts for businesses and residents within Bath.

It should also be noted that the economic appraisal outputs above include the capital and operational costs associated with implementing the CAF mitigation measures but do not capture the potential economic impacts or benefits of these scheme components. Section 3.8 demonstrates that the CAF mitigation measures could generate £34.5 million in economic benefits associated with avoided costs for businesses. Due to the high-level estimation process undertaken to derive these potential benefits, they are not captured within the NPV calculation presented in Section 3.5. That said, the CAF-related capital and operational expenditures are included. As such, inclusion of these potential benefits could further improve the overall economic performance of the preferred CAP scheme.

4. Commercial Case

4.1 Introduction

The Commercial Case for the project takes into account the works and services required to deliver the CAP, the risks associated with the delivery and the procurement routes available to achieve the project in the most efficient way possible. This section describes the commercial strategy for delivering the Bath CAP.

FBC-20 'Procurement Strategy' in Appendix H of this FBC, includes the detailed Procurement Strategy and outlines in more detail the proposed procurement methodology in the following sections, which is required to ensure the timely delivery of an effective CAP in Bath.

For the purposes of the FBC, the commercial case has been updated to include developments since the OBC and the current status of the procurement of works and services to deliver the CAP.

4.2 Output Based Specification

A range of works and services need to be procured to deliver the preferred option.

When considering implementation and operation of the charging CAZ preferred option, the following activities require procurement:

- Roadside technology (ANPR cameras) and enforcement vehicle;
- Queen Square traffic signals and associated civil engineering works;
- On-road infrastructure (signs, cabinets, posts/lamp columns, ducting, cabling, power);
- Variable message signs (VMS);
- Traffic signal timings and operational system (SCOOT) survey;
- Communications networks (roadside to back office and back office system-to-system);
- Queen Square traffic signals and public realm enhancement scheme;
- Queen Square associated ITS works (CCTV/AQ MESH/UTMC interfaces/controller configuration changes);
- Back office payment and penalty system, including integration with the central payment service (software);
- Back office server and data processing facilities (hardware);
- Operations (staffing, provision of control room facilities);
- Pre-scheme surveys and permanent traffic count sites for ongoing surveys;
- ANPR cameras for Wiltshire CC;
- Health and wellbeing study;
- Residents parking zone (RPZ) review and potential extension;
- Communications and engagement;
- Design and specification;
- Traffic management; and
- Maintenance and support.

In addition, the mitigation measures associated with the preferred option will require procurement of the following works and services:

- Financial loan and grant schemes;

- Telematics devices (to inform the financial loan and grant scheme);
- Delivery and Servicing Plans for businesses;
- Car/van club expansion;
- Electric cargo bikes and storage facilities;
- Freight pilot study; and
- Travel advisors and staff to manage and operate the CAF measures.

4.3 Procurement Options

The OBC recommended that the CAZ for Bath is delivered through a range of existing procurement arrangements established by B&NES. They already have existing fit for purpose arrangements in place and identified the following advantages of making use of these existing contracts:

- It is the most likely compliant procurement route to meet the tight timescale requirements for implementation.
- It enables CAZ operations to be aligned with existing operations with minimal overheads and impact on existing functions.
- Quality standards are understood and tested through previous/existing use of these contracts.
- The market has been previously tested and value for money has already been established – further soft market testing has been undertaken to confirm that this is still the case.
- Allows for innovations and savings to be made through existing supply chain relationships.

This approach is now being used in order to procure the works.

Whilst it was anticipated that the works will mostly be delivered by existing contractual arrangements, it was recognised by the OBC that in some instances existing agreements may not be wholly suitable. For example, to provide the required ANPR cameras, a Voluntary Ex Ante Transparency (VEAT) notice was used where technical system continuity is absolutely essential, and competition would not be in B&NES's interest.

This assumption regarding 'technical continuity' was challenged internally within B&NES as to whether a new supplier could fulfil B&NES's requirements more effectively. Discussions were held and alternatives investigated and it was eventually agreed that the VEAT notice was the best course of action to deploy the most suitable system whilst additionally bringing the benefit of allowing integration with B&NES's existing enforcement infrastructure.

An existing contract does exist with the preferred contractor with many of the items required for the CAZ available on it. However, the existing contractual maximum spend limit (£410,000) would be breached with the larger volume of cameras required. This large CAZ requirement was not anticipated when this contract was originally awarded in November 2017. A VEAT notice was therefore advertised and did not undergo any form of challenge, and thus this aspect of the work is now progressing with the preferred supplier. Table 4-1 summarises the required procurement tasks and proposed procurement routes, for all items required by the preferred scheme option, along with the current progress status of these.

Table 4-1: Summary of required procurement tasks

Procurement item		Procurement Route	Status
CAZ System and Operation	Automatic Number Plate Recognition (ANPR) Cameras & Mobile Enforcement Vehicle (MEV)	Existing OJEU contract – ‘Provision of ANPR Cameras’ – new direct award following VEAT notice	Works awarded to contractor which has undertaken several site visits and established a ‘trial site’
	Queen Square Traffic Signals only	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	BoQ prepared & programming discussions taken place. Anticipated timescales moved forward to align with other B&NES essential works
	Installation of scheme cabinets, posts (where lighting columns cannot be used), ducting, network switches and fibre cabling	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	Quotation provided by supplier to deliver scheme – mini order issued to install ‘trial site’. Full scheme works anticipated to commence shortly
	Variable Message Signs (VMS)	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	Quotation provided by nominated sub-contractor
	SCOOT Review (Bath)	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	Awaiting confirmation of cost from nominated sub-contractor
	Communications – Wireless	Existing ‘Wi-fi Solution for Bath’ contract – new award via RM3808 Network Services 2 framework Lot 1	Quotation provided by supplier to supply wireless infrastructure – order issued for trial site only
	Communications – Network Switches	Existing ‘Wi-fi Solution for Bath’ contract – new award via RM3808 network Services framework Lot 1	Quotation provided by supplier to supply network switches – order to be placed soon
	BT lines – communications (backhaul)	New direct award. CCS Network Services 2 Framework RM3808 Lot 1 or 2	Awaiting completion of site surveys to determine exact cost – BT have provided unconfirmed estimate at this time
	Camera mounting – replacement Council street lighting columns & essential power supply works	Existing Street Lighting maintenance & installation contract (NEC3)	Works awarded to contractor
	Scheme signage (including posts)	Existing Highways term maintenance contract (NEC4)	BoQ prepared and discussions underway regarding programming
	Queen Square (civils works)	Existing Highways term maintenance contract (NEC4) in conjunction with larger civil engineering works	Discussions underway regarding programming. Anticipated timescales moved forward to align with other B&NES essential works
	Queen Square Public Realm Scheme	Existing Highways term maintenance contract (NEC4) in conjunction with larger civil engineering works	Feasibility design agreed but final scheme not yet agreed

Procurement item	Procurement Route	Status
Queen Square – CCTV monitoring	3 quotations from approved suppliers list	Quote provided from 'common' supplier for nearby location (lasts 30 days only so not yet issued)
Queen Square – SCOOT validation/controller set up and commissioning	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	Quote provided by nominated sub-contractor. Ready to be progressed
Queen Square – UTM interfaces for active control of signals using Air Quality data	Existing WoEITS Contract for Supply, Installation & Maintenance of Traffic Control & ITS Equipment	Quote provided by nominated sub-contractor. Ready to be progressed
Back office processing and payments system	Existing contract 'The Provision of a Parking Management Information System' (ESPO 509 Framework)	Quotation provided by supplier to supply system software – work anticipated to commence soon
Back office additional server for system operation/storage	Existing contract 'The Provision of a Parking Management Information System' (ESPO 509 Framework)	Quotation provided by supplier to supply servers (hardware) – work anticipated to commence soon
Control room	In house provision using B&NES existing Property Services contractual arrangements as required	Detailed design to be once location agreed
SRN Signage	B&NES pay Highways England directly to commission Ringway (current Area 2 works contractor) to implement required works	Sign locations accurately determined and shared with HE. Awaiting detailed costs.
Permanent Automatic Traffic Counters	New direct award. CCS TMT2 Framework RM1089 Lot 15	Received accurate final costs from supplier following initial survey
Queen Square – Permanent Air Quality Monitor on Gay Street	B&NES Air Quality team - 3 quotations received from approved suppliers list	Quotation received by B&NES AQ team - item ready to be ordered
ANPR cameras – requested by Wiltshire Council	Anticipated use of contracts discussed herein	Detailed design not yet progressed – awaiting instruction
Pre-scheme baseline surveys	Existing South West Collaborative call-off Framework for Traffic Data Collection	Quotation received and order to be placed shortly
Residents Parking Zone (RPZ) review and updates	Existing Highways term maintenance contract (NEC4)	Review underway but detailed civil engineering requirements yet to be determined. Contract SoR will be used.
Community Liaison Events, Publicity & Advertising	B&NES Marketing and Communications Team - New & Existing arrangements (low cost)	Quotations received and ready to be progressed
Detailed Design of Core Scheme	B&NES Design and Projects, street lighting, highways, traffic signals, air quality, legal, procurement in house staff working with external consultants	Works ongoing

Procurement item		Procurement Route	Status
Design Works	Professional Services	Existing Bristol City Council Professional Services Framework & Crown Commercial Services Framework RM3741	New works order issued to progress design work and project management
	Staff to Manage CAZ operations & CAF measures	Direct external appointment and / or redeployment from relevant service areas with vacancies backfilled	Some job descriptions approved by B&NES HR - others pending before being allowed into works structure
	Health and Wellbeing Study	Direct award and/or in-house provision using existing contract	Quotation received and ready to be progressed
Mitigation Measures	Bus Upgrades	No procurement required. Funds issued to bus companies once evidence provided (including match funding)	Detailed costs returned by all suppliers to inform funding application
	Financial Support Scheme	New direct award to specialist finance companies (to administer scheme) creating a new framework arrangement	Procurement documents drafted. ITT ready for issue once legal agreements finalized
	Telematics Devices	Yorkshire Purchasing Organisation (YPO) Dynamic Purchasing System (DPS-750) Vehicle Telematics Framework	Soft market testing undertaken with prospective suppliers. ITT to be produced shortly
	Delivery and Servicing plans (DSP) for business	New direct award. CCS TMT2 Framework RM1089 Lot 12	Pilot scheme in progress with 5 businesses (with costs assumed for subsequent businesses)
	Expansion of Car Club network	Direct award and/or in-house provision using existing contract arrangements	Estimated cost produced using B&NES Schedule of Rates
	Last Mile Delivery	New Open Tender	Existing contract to be amended and advertised. Anticipated cost based upon existing contract
	City Freight pilot	Direct award and/or in-house provision using existing contract arrangements	Detailed design not yet progressed
	Scheme Decommissioning	Existing contracts (various)	Design work not yet undertaken or contractors engaged on this

The proposed procurement route for each item listed in Table 4-1, in relation to the available existing agreements, is described in more detail in FBC-20 'Procurement Strategy' in Appendix H of this FBC.

4.3.1 Payment Mechanisms, Pricing Framework and Charging Mechanisms

The financial arrangements with new suppliers providing works to implement the Bath CAZ are largely confirmed following a period of supplier engagement. There remain a small number of works packages which are not yet fully scoped ready for contract award but those works are awaiting confirmation of acceptance from central government and provision of the appropriate funding. Once agreement is confirmed these respective works

packages will be issued. Where existing procurement arrangements and contracts are to be utilised, pricing and payment for the works and services will be on the basis of those existing arrangements.

Unless otherwise agreed, payment terms will be in accordance with B&NES standard payments terms, nett 30 days from date of invoice and in arrears, following completion of the work.

4.3.2 Risk Allocation and Transfer

As with any agreement, there is always the risk of contract failure, or failure of the contractor to supply on time or to supply faulty goods and defective work. It is however possible to mitigate some risk by procuring via current B&NES framework agreements or contracts. B&NES has established working practices with existing contractors, and they have a working knowledge of B&NES specific requirements and existing assets. In addition, the reduction in timescales and resources required to procure services and materials, coupled with the certainty of having a supplier in place when required, are vital to achieving the delivery timescales of the project.

Whilst this procurement approach offers benefits in terms of risk mitigation, there remain some key risks which are required to be managed and accounted for. These are summarised in Table 4-2 below.

Table 4-2: Procurement Risks and Mitigation

Risk	Likelihood	Impact	Mitigation
Design	Low	High	• Ensure compliant processes are followed • Ensure designers are suitably skilled/qualified
Legislative risks	Low	High	• Ensure compliant processes are followed • Adhere to regulations and standards • Check all contract documents thoroughly
Construction risks	Medium	Medium	• Notify HSE of project works via F10 form • Undertake surveys • Hold pre-commencement meetings with all engaged suppliers
Procurement is challenged	Medium	High	• Ensure compliant processes • Allow sufficient time to complete another procurement exercise
Failure to deliver on time	Low	High	• Early engagement with suppliers • Good contract management • Appropriate contractual clauses – for example time is of the essence
Supplier poor workmanship	Low	Medium	• Ensure design is robust and 'buildable' • Site supervisor to be employed • B&NES staff to be involved as taking on assets post delivery
Supplier staff shortages	Medium	High	• Early engagement with suppliers • Ensure program is realistic and has some 'float' • Delay other schemes to prioritise CAZ with framework suppliers • Client delivery staff to attend sites and build rapport with suppliers
Supply chain breaks down	Medium	High	• Early engagement with suppliers • BREXIT/currency risks identified – request fixed prices for longer • Many CAZs in UK at same time – issue advanced orders to contractors
Supplier goes out of business	Low	High	• Ensure appropriate financial checks are undertaken • Consider alternative supply chains – for example Constructionline
Technology inadequate	Low	High	• Consulted with industry experts during design process • Establish 'trial site' to test wireless technology (in advance of launch) • Liaise with suppliers for alternative options

No suppliers bid for mitigation measures contracts	Low	High	• Early supplier engagement • 'Benchmark' contracts ensuring meet market requirements • Expand use of framework suppliers where appropriate
---	-----	------	---

Risks are generally low with respect to dealing with incumbent contractors on framework contracts as non-delivery or failure to perform would be detrimental to other work and trigger non-performance or service level failure conditions which are well established.

There are also a small number of suppliers who have existing contracts being fulfilled with the council presently on similar projects to the CAZ. These suppliers are required to provide works or materials for the CAZ. These include: Chipside Ltd who provide back office server, system integration and PCN charging (ticket issuing and database) software for bus lane and parking enforcement, Videalert Ltd. who provide ANPR enforcement cameras and image processing and storage for bus lane enforcement and Pinacl Ltd. who provide a wireless communications network to the Council, which is currently undergoing expansion.

The new contract for Chipside Ltd and direct awards to Videalert Ltd and Pinacl Ltd also offer confidence to the Council as these companies offer proven technology and have been very effective providers. Chipside Ltd. and Videalert Ltd. have recently delivered systems which are connected to one another with similar if not identical technology to that required by the CAZ project, albeit on a smaller scale. This provides further reassurance that a quality, secure and effective system will be delivered to B&NES in a timely manner.

A full list of identified project risks can be found within FBC-23 'Quantified Risk Assessment' in Appendix M of this FBC. These risks are regularly reviewed whilst progress is monitored. The risks whilst reduced, remain applicable to either the Authority, the Contractor or alternatively would be shared between parties as highlighted in table 4-3 below.

Table 4-3: – Risk Allocation

Risk	Authority	Contractor	Shared
Design	Achieving NO ₂ reduction	Achieving Output	✓
Legislative risks			✓
Construction risks			✓
Procurement is challenged	✓		
Failure to deliver on time			✓
Supplier poor workmanship		✓	
Contractor staff shortages		✓	
Supply chain breaks down		✓	
Supplier goes out of business		✓	
Technology inadequate	✓		
No supplier bids received	✓		

4.3.3 Contract Length

An indicative programme has been developed, as detailed in FBC-22 'Project Plan' in Appendix K of this FBC.

The implementation works begun in November 2019, with a 'trial site' being established to understand the delivery process and interaction between contractors. This helped the groundworks contractors to ascertain the likelihood of ground condition risks and allowed them to provide more detailed pricing for future works removing potential risk (and contingency cost). The establishment of the trial site went well, however the primary reason for embarking upon this exercise was to test the technology. Early indications suggest that the first site is working well and can be effectively scaled up for the remainder of the project. Preparatory works are now ongoing at a number of other sites, including Queen Square, and the scheme remains on schedule to become operational in late 2020.

4.3.4 Human Resource issues

The issue of TUPE has been considered during the development of scheme options but is not considered a significant risk due to the nature of contracts being awarded. Therefore, no relevant personnel/people management/trade union implications, including Transfer of Undertakings (Protection of Employment) Regulations 1981 (TUPE) have been identified for this project.

4.3.5 Social Value

The Social Value Act requires those who commission public services to consider how they can also secure wider social, economic and environmental benefits. Such Social Value benefits have been factored into the pre-procurement phase of project development, allowing the issues to be embedded into project design. Within the context of the current project, factors such as the potential social, environmental and economic impacts of the CAZ scheme have been appraised from the outset of business case development. Considerable consultation and engagement have also been undertaken throughout the process to ensure that opportunities for Social Value benefits from the project are maximised.

Due to the nature of the CAZ scheme, all three Social Value elements will benefit due to:

- Improving access for all across the main 'protected characteristic' equality groups;
- Health and environmental improvements from promoting active travel;
- Air pollution improvements from charging non-compliant LGVs and encouraging a reduction in engine idling via enforcement, amongst other measures. Low carbon alternatives are also promoted, such as public transport and electric vehicles.

4.3.6 Contract Management

Essential to the successful running of the contract are high-quality project management skills, complemented by specialist cost control expertise and sufficient support resources. These are required from the outset of tender development and evaluation, through project development and up to post-completion.

This team will be supplemented by a project governance structure more fully described in the Management Case, Section 6.

It is proposed that overall responsibility for managing CAP contracts in Bath would fall within B&NES Parking Services. The Head of Parking & Transport (working with the Project Manager) would take overall management responsibility for the CAP and establish appropriate contract management arrangements. Council officers responsible for B&NES's existing contracts used by the CAP, would assist in the delivery of relevant CAP measures.

The Councils Strategic Procurement team will also provide support to ensure the procurement processes are appropriate (i.e. provide value for money and are legally compliant).

As many of the contracts are already in place and the proposed suppliers are already working for B&NES, it puts B&NES in a strong position to successfully manage the implementation and ongoing operation of the CAP through existing contractual management arrangements.

5. Financial Case

5.1 Introduction

This section sets out the overall financial case for the Bath CAP's preferred option of a Class C CAZ with traffic management and has been updated for the FBC based on the revised boundary. It outlines the funding and expenditure requirements for the CAP, as well as outlining wider financial impacts and consequences of the proposed arrangement for B&NES and the Government. It outlines the revenue and capital needs (and associated profile) to deliver the project and is underpinned by a financial model which profiles the scale and sources of proposed funding alongside the timing of expenditure.

In summary, this section thus focuses on outlining:

- Capital and operational expenditure for the project;
- Funding sources for this expenditure and the funding that has been bid for to allow delivery and operations of the intervention and affordability of the scheme;
- Revenue generation estimates from the operation of a charging CAZ; and
- The net operational position of the project.

Further details of the project costs can be found in FBC-21 'Project Costs' in Appendix I of this FBC. Further details of the financial modelling can be found in FBC-33 'Financial Report' in Appendix W of this FBC

Note that all values listed below are in nominal terms.

5.2 Project Costs

5.2.1 Capital Expenditure (CAPEX) Summary

CAPEX costs are predominantly based on supplier quotations and actual prices, however the costs for some items remain estimates, as indicated in Table 4-1 in Section 4.3.

CAPEX will be incurred by B&NES across a range of activities as listed below:

- **Core Scheme – enforcement system and street works:**
 - Camera and communications network infrastructure (all required cabinets, mounting posts, new street lighting columns, ducting and cabling for camera installation as well as ducting, power supply, cabling and connection of the data communications network);
 - Road signing and minor realignment (kerbing alignments, traffic management required for installation, residents parking zones);
 - Queen Square traffic management scheme;
 - Supply, installation, configuration and testing of fixed ANPR cameras; a fully-equipped Mobile Enforcement Vehicle (MEV) and a back-office system;
 - Provision of a control room facility including fitting out of the premises, fixtures, fittings, furnishing and ancillary items;
 - Notice Processing System including server storage, including replacement after five years;
 - Complete system test and Site Acceptance Testing (SAT) integrating with existing systems;
 - Baseline and ongoing scheme monitoring, including traffic and air quality monitoring, active mode and economic indicator surveys and setting up of the local health study;
 - Installation of permanent Automatic Traffic Counters (ATCs) and a continuous air quality monitor at Queen Square; and
 - Provision of ANPR camera coverage in neighbouring authorities.

The CAPEX cost of the street works and enforcement system is a total of £6.38 million (nominal values).

- **Core scheme design and management:**

- Detailed design work of core scheme; and
- Delivery phase project management, infrastructure lead, community liaison lead and site coordinator role all at B&NES Grade 10.

The CAPEX cost for the core scheme design and management is a total of £0.897 million (nominal values).

- **Mitigation measures:**

- Bus upgrades (retrofits and repowering);
- Financial support schemes (including telematics devices);
- Delivery and Servicing Plans for Businesses;
- Car club expansion;
- Last mile delivery (cargo bike scheme); and
- City Freight pilot scheme.

The CAPEX cost for the mitigation measures is a total of £14.198 million (nominal values).

- **Quantified Risk Assessment (QRA)**

Risk has been calculated using Monte Carlo software with risks established for the implementation and delivery phases of the project. The QRA figure in line with WebTag guidance (P(Mean) is £2.798 million (nominal values) across both stages. Full details of the QRA are provided in FBC-23 'Quantified Risk Assessment' in Appendix M of this FBC.

A summary of the total capital costs incurred by the proposed scheme is provided in Table 5-1 below. The table demonstrates that capital costs amount to £24.3 million of capital funding, requested from JAQU via the Implementation Fund (£10.1 million) and the Clean Air Fund (£14.2 million). JAQU have already awarded £5.95 million of funding via the Implementation Fund to deliver components of the scheme related to implementing the Clean Air Zone and complementary traffic management measures at Queen Square. Additional Implementation Fund support is required to deliver additional camera (and supporting) infrastructure associated with a larger CAZ boundary and enhanced monitoring requirements. The residual Implementation Fund request is therefore £4.1 million and the total residual request to JAQU is £18.3 million for capital expenditure (including £14.4 million of CAF request).

A detailed breakdown of CAPEX costs is provided in FBC-21 'Project Costs' in Appendix I of this FBC. Table 5-1 provides a breakdown of the CAPEX by broad theme and sources of funding.

Table 5-1: CAPEX by broad theme and funding source (nominal values)

CAPEX Item	Implementation Fund	Clean Air Fund	Total
Core Scheme: Enforcement System and Street Works for CAZ	6,377,783	0	6,377,783
Core scheme design and management	896,871	0	896,871
Risk	2,797,605	0	2,797,605
Mitigation Measures	0	14,198,428	14,198,428
Total	10,072,259	14,198,428	24,270,687
Funding Already Secured from Implementation Fund	5,950,000	0	5,950,000
Residual Funding Required	4,122,259	14,198,428	18,320,687

5.2.2 Operational Expenditure (OPEX) Summary

OPEX will be incurred by B&NES across a range of activities, throughout the operation life of the CAZ, these include:

- Operations and enforcement of the CAZ
- Maintenance of the CAZ and complementary infrastructure
- Data Communications
- Power
- CAZ project delivery and ongoing operational management
- Operation and maintenance of the Clean Air Fund mitigation measures
- Council overheads on staff costs
- Other costs (including additional PCN administration processes, ongoing monitoring and evaluation etc.)

The majority of these operational costs are accrued on a fixed, annual basis for the lifecycle of the project. However, cost items relating to PCN/Traffic Penalty Tribunal (TPT) activities are contingent on variations in vehicle non-compliance and contravention.

The core scheme OPEX costs, including all cost items, is £14.600 million across the appraisal period (nominal values) and the mitigation measures OPEX costs are an additional £2.461 million. A detailed breakdown of OPEX costs is provided in BoQ format in FBC-21 'Project Costs' in Appendix I of this FBC.

5.2.3 Funding Sources

There are five main funding sources for the set-up and operation of CAZ. These are:

- **An Early Measures Fund** - this is to support small, ambitious and good value early measures to improve air quality and start to reduce concentrations in the CAZ. A maximum of £3 million per local authority has been allocated for this funding which is part of the CAF;
- **A £255 million Implementation Fund** - this is designed to support local authorities in the planning and delivery of targeted action to improve air quality;
- **A £220 million CAF** - an opportunity for local authorities to implement additional measures tailored to their area which minimise the potential impact of local air quality plans - either by enabling the local authority to implement local plans that collectively impact on fewer people, or by providing direct support to those impacted; and
- **Revenue from CAZ charges** - funding will become available from the charges that are applied to each CAZ.

5.2.4 Funding Applications

B&NES is reliant on funding from all sources listed above to deliver this Clean Air Plan. These are described below:

- **Early Measures Fund (EMF)** – The grant funding requested from central Government through the EMF has been granted for £286,000. This has been used to provide a parking permit discount for residents and businesses who change their current vehicle for an Ultra-low Emission Vehicle (ULEV) vehicle.
- **Implementation Fund** – Based on current best estimates, the grant funding requested from central government through the Implementation Fund is £10.1 million for capital expenditure and £1.7 million for operational expenditure. This will cover operating costs associated with pre-implementation and the potential deficit associated with the running of CAZ related infrastructure in the first year of operation prior to revenue realisation. This is to safeguard against budgetary risk for B&NES in the event that the anticipated revenue stream from CAZ income does not materialise. This operational deficit is explicitly modelled within the financial analysis and therefore identified as a deficit that JAQU must underwrite through revenue cost grant funding.

Although the current financial modelling does not reveal any other operational deficits prior to 2027, B&NES assume that should any other operational deficits occur (e.g. for unforeseen reasons that could not be captured as part of the QRA), these will be fully underwritten by JAQU. By definition, the unforeseen impacts on CAZ operation cannot be quantified. As a result, no attempt has been made to formally incorporate or quantify this underwriting requirement as part of the financial analysis.

The sum of £5.95 million from the Implementation Fund has already been awarded to B&NES towards design and implementation of the charging zone.

- **Clean Air Fund** - The grant funding requested from central government through the Clean Air Fund is £14.4 million for capital expenditure and £2.0 million to cover operational costs. This provision will fund scheme components, which mitigate against any potential negative impacts of the Clean Air Plan on local residents and businesses.

5.3 Financial Model

5.3.1 Overview

Modelling of the finances for the Bath CAP has been undertaken to analyse the potential financial performance of the project. Full details of the financial model development and results are included in FBC-33 'Financial Report' in Appendix W of this FBC.

The Clean Air Zone Framework states that local authorities should not set the level of charge as a revenue raising measure and the Transport Act 2000 requires any excess revenue that may arise from charges above the costs of operation are to be re-invested to facilitate the achievement of local transport policies and these should aim to improve air quality and support the delivery ambitions of the zone.

The financial model is underpinned by key assumptions, as listed below:

- The preferred intervention option is a Class C CAZ with traffic management. This imposes CAZ charging on high emission buses, coaches, taxis, private hire vehicles, HGVs and LGVs. Private cars are unaffected;
- The operational phase begins in 2021 and is operational until the primary objectives of the Clean Air Plan are achieved (i.e. compliance with the air quality limit values and objectives). The model assumes that the Clean Air Plan remains in operation until 2030 to ensure steady-state rather than temporary compliance;
- The forecast number of non-compliant vehicles in 2021 is adopted from transport modelling outputs, with non-compliant vehicle forecasts for subsequent years based on interpolation also undertaken as part of transport modelling; and
- Administration costs associated with reviewing and processing foreign vehicles are included within the model. However, any revenue generation is excluded on the basis that it is difficult to charge, fine and/or pursue payment for foreign vehicles. It is assumed that all operational activities associated with foreign vehicle enforcement would be outsourced to third parties, who typically operate on a 'no-win no-fee' basis. Based on ANPR data, 1.55% of all vehicles in the CAZ area are foreign vehicles; any revenue relating to these vehicles is ignored within the model, even though processing charges are captured.

The overarching framework for revenue generation as a result of the CAZ is outlined in Figure 5-1.

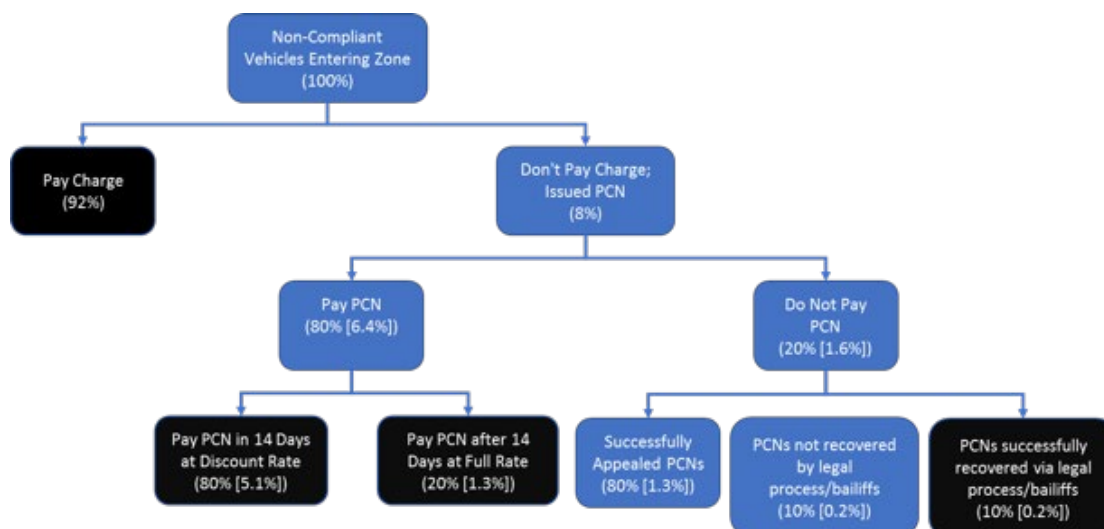


Figure 5-1: CAZ revenue generation framework

5.3.2 Revenue Generation

Table 5-2 summarises the anticipated income from the CAZ including direct CAZ income (from the charge) plus the indirect CAZ income (from the PCN process). Calculations suggest the CAZ could gross £5.2 million in Year 1, declining to £83,000 in 2030, an average of £2.4 million per annum.

It should be noted that the revenue generation is reliant on a number of key assumptions which are not certain. B&NES has made reasonable attempts to estimate these assumptions based on similar schemes delivered in the UK or experience of enforcement within the authority, but since a CAZ has not yet been implemented outside London the available evidence is limited and hence the forecasts are uncertain. In addition to the analysis above, a range of more detailed sensitivity tests have been undertaken to understand the impact of amending these assumptions on the forecast revenue generation and are presented later in this report in Section 5.3.4.

Table 5-2: CAZ revenue generation summary table

Variable	Year of CAZ Operation										Total	Annual Ave
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
No. Non-Compliant Trips (000s)	213.2	193.6	173.9	139.9	109.6	75.1	49.0	26.9	13.2	4.9	999.2	99.9
No. Paying CAZ Charge (000s)	200.4	181.9	163.4	131.5	103.0	70.6	46.0	25.2	12.4	4.6	939.2	93.9
No. Contravening CAZ Charge (000s)	12.8	11.6	10.4	8.4	6.6	4.5	2.9	1.6	0.8	0.3	60.0	6.0
A) CAZ Charge Income (£'000s)	£4,342	£3,916	£3,490	£2,763	£2,120	£1,407	£880	£453	£202	£63	£19,635	£1,964
No. Paying PCN (000s)	10.2	9.3	8.4	6.7	5.3	3.6	2.4	1.3	0.6	0.2	48.0	4.8
No. Paying After TPT (000's)	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	1.2	0.1
B) CAZ PCN Fine Income (£'000s)	£813	£899	£939	£636	£496	£338	£219	£118	£57	£20	£4,535	£454
A + B) Total CAZ Income (£'000s)	£5,155	£4,815	£4,429	£3,399	£2,616	£1,744	£1,099	£571	£259	£83	£24,170	£2,417

5.3.3 Net Operational Position

Under the core scenario, the analysis indicates that cumulatively, revenue generation will be more than operational costs, resulting in a net operational surplus of £7.1 million across the appraisal period. Given that B&NES assume that £2.0 million of operating costs associated with the CAF mitigation measures will be funded by JAQU and paid upfront, the net operational surplus is effectively £9.1 million. However, the scheme will generate a net operational deficit in the pre-implementation phase (as no revenue is forecast to materialise prior to 2021), and in the later years of the appraisal period (as the number of non-compliant vehicles falls but scheme operations are maintained).

The analysis demonstrates that the CAZ revenue is sufficient to cover operational costs of the scheme. However, B&NES request that the following additional funding is provided to support the ongoing operation of the Clean Air Plan interventions:

- Revenue grant funding from the Implementation Fund to cover all operational costs preceding revenue generation that are essential to achieving compliance. There is an expectation that some operational costs will be incurred prior to revenue generation. As such, B&NES is requesting upfront financial support in the form of a grant from JAQU's Implementation Fund to cover all operating expenses prior to operation of the CAP (i.e. 2019 and 2020). Such support is required to fund recruitment, training and other overheads associated with CAZ enforcement, which will need to be in place prior to scheme opening (and therefore any revenue generation).

There is also a risk that the revenue generation does not materialise when the scheme is scheduled to commence due to legal challenge or other factors. This could lead to a scenario where an operational deficit could persist into 2021, as although the Clean Air Zone is up and running, no revenue is accruing. In line with the pessimistic set of revenue-generating conditions outlined above, current best estimates suggest that revenue generation could be delayed until July 2021. Under these circumstances, the CAP could incur significant operational costs with no form of revenue generated to offset this burden. As such, B&NES is requesting upfront financial support in the form of a grant from JAQU's Implementation Fund to cover the identified potential for operational deficit, which persists for the first six months of the operational period (i.e. up to July 2021). Based on current modelling, as soon as the CAZ returns an operational surplus (i.e. forecast for July 2021), no further Implementation Funding to cover operational funding will be requested²⁷.

This approach will soothe short-term cash flow issues prior to and immediately after scheme opening. It will also minimise the Council's financial burden and any risk associated with delays to receipt of revenue following implementation of the scheme.

- Further, and as noted above, a grant from the Clean Air Fund is anticipated to cover operating costs associated with measures proposed to mitigate the impact of the Clean Air Plan:
 - Last mile delivery cargo bike operation and maintenance
 - Various staff roles required to administer the CAF mitigation measures in 2020 and 2021, including:
 - Supporting measures team manager
 - Sustainable travel and transport team comprising:
 - Sustainable travel and transport team lead
 - Technical administration officers
 - Business engagement officers
 - Travel advisors
 - Bus retrofit lead

²⁷ That said, and in line with the position of B&NES' S151 Officer, other impacts that were not possible to incorporate into the financial analysis could occur which threaten the operational position of the CAP. In the event that these impacts are unforeseen and/or national scale risks that could not be accounted for within the QRA, but result in an operational deficit being incurred beyond June 2021, it is expected that any such deficit will be underwritten by JAQU and funded in the year that the impact is realised. Essentially, In the event that the Council incurs unidentified operating costs for the CAZ in excess of the income generated by the scheme, the Council is assuming that any resulting unidentified revenue deficit position will be underwritten by JAQU and funded in the year that the shortfall is realised

- Financial assistance scheme lead (whilst this post is retained until 2028, CAF grant support is only required to fund the first two years of the role)

In the absence of revenue grant funding to support the operational costs associated with these interventions, it will not be possible to ensure these interventions are retained over the entire period they are required. B&NES is unable to cover any shortfall due to the lack of certainty that the anticipated revenue will be realised. As such, these interventions will be removed from the Clean Air Plan in the absence of revenue grant funding (alongside initial capital grant funding to implement the interventions).

The resulting revenue grant funding request is estimated as follows:

- Implementation Fund: £1.7 million – to cover all operational expenditure pre-implementation (2019 and 2020) and the potential operational deficit recorded in the first six months of operation in 2021.
- Clean Air Fund: £2.0 million – to cover selected mitigation measures required to offset any potential adverse impacts of the scheme on local residents and businesses.

The above requests are based on current best estimates for the operational phase of the scheme. In the event that the Council incurs unidentified operating costs for the CAZ in excess of the income generated by the scheme in any given year, the Council is assuming that any resulting unidentified revenue deficit position will be underwritten by JAQU and funded in the year that the shortfall is realised. This does not affect the identified operational deficit forecast for 2027-30, which will be covered through the Sinking Fund (see below).

That said, based on current financial forecasts, where revenue grant funding is provided to cover the operational costs stated above, Table 5-3 demonstrates that the Clean Air Plan will be able to achieve a net operational surplus. This includes with the worst case scenario that assumes delay in revenue generation and other negative impacts on income (as per Section 5.3.4):

Table 5-3: Net Cash Flow Position (£'000s)

	Net Cash Flow Position (£'000s)												
Operational Item	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Operational Income	17	1,800	3,881	4,029	3,470	2,751	2,114	1,407	883	457	206	65	21,081
Operating Revenue	0	0	2,113	3,898	3,470	2,751	2,114	1,407	883	457	206	65	17,365
CAF Revenue Grant	0	930	928	131	0	0	0	0	0	0	0	0	1,989
IF Revenue Grant	17	870	840	0	0	0	0	0	0	0	0	0	1,727
OPEX	17	1,800	2,711	2,002	1,683	1,651	1,418	1,036	1,034	1,036	974	1,370	16,733
Net Operating Position	0	0	1,170	2,027	1,787	1,100	696	370	-151	-579	-769	-1,305	4,348

With revenue grant funding in place, in line with the requirements outlined by the worst case scenario, the operational summary demonstrates that the Clean Air Plan is forecast to generate a positive cash flow over the appraisal period. Any cashflow surplus associated with the scheme will be ring-fenced for the following purposes, in order of priority:

- Creation of a Sinking Fund to safeguard ongoing and long-term operational expenditure, particularly in years 2027-2030 when the scheme is anticipated to face an operational deficit, as well as decommissioning cost. The Sinking Fund is designed to cover the operational deficit identified through the current financial modelling. In the event that additional operational deficits materialise or the forecast deficit between 2027-30 worsens

(e.g. due to unforeseen/unknown/national scale risks), the Council assumes that any resulting operational deficit position will be underwritten by JAQU. This would require funding in the year that the shortfall is realised. Effectively, the Sinking Fund is only intended to cover for identified and modelled operational deficit, not additional operational deficit that may occur;

- Creation of a Clean Air Revenue Re-Investment Reserve, in line with the Bath Clean Air Zone Charging Order 2019, where any residual revenue surplus will be used by B&NES to:
 - Support and extend the non-charging measures identified to supplement the Clean Air Plan;
 - Support programmes and policies both in Bath and the wider Council area that are aligned with the aspirations of the Clean Air Plan (i.e. wider air quality and transport priorities); and
 - Mitigate any negative impacts on the Councils budget that arises from the implementation of the CAZ.

Within this context, the residual cash position for the CAP in Bath is expected to be neutral throughout the appraisal period, as demonstrated in Table 5-4 below.

Table 5-4: Residual Cash Flow Position (£'000s)

	Net Cash Flow Position (£'000s)										
Operational Item	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Net Cashflow	1,170	2,027	1,787	1,100	696	370	-151	-579	-769	-1,305	4,348
Contribution to Sinking Fund to Cover Long-term Shortfall	1,170	1,633	0	0	0	0	-151	-579	-769	-1,305	0
Reinvestment Reserve (residual monies)	0	394	1,787	1,100	696	370	0	0	0	0	4,348
Residual Cash Position	0	0	0	0	0	0	0	0	0	0	0

5.3.4 Sensitivity Analysis

In line with JAQU guidance, a range of sensitivity analysis tests have been undertaken to determine the implications of variations to key assumptions, which underpin the CAPEX and OPEX summaries. The sensitivity tests that have been undertaken are outlined below.

The following key assumptions have been adjusted within the sensitivity analysis:

- Increase/decrease in CAPEX costs; and
- Changes to OPEX costs:
 - Alternative contravention rates
 - Delay in revenue generation, as a result of the operational phase of the project being delayed, either due to a legal challenge or other delaying issues
 - Outsourcing the administration and enforcement of the scheme
 - Alternative rates of successful PCN payments received
 - Alternative numbers of non-compliant vehicles travelling within the CAZ
 - A combination of impacts comprising alternative numbers of non-compliant vehicles travelling within the CAZ, alternative rates of successful PCN payments received and a delay in revenue generation. This represents the worst-case scenario for Bath CAP.

A switching values test was also undertaken to demonstrate the scale of cost or revenue change needed to reach a cost neutral position in the core scenario.

The sensitivity analysis demonstrated that the surplus revenue could fall within the range of £4 million and £12 million after creation of a Sinking Fund. Full details of the sensitivity test analysis are provided in FBC-33 'Financial Report' in Appendix W of this FBC.

5.4 Summary

The financial analysis for the preferred Clean Air Plan option, i.e. a Class C CAZ with traffic management, demonstrates that the capital cost of implementation will amount to more than £24.3 million. B&NES is requesting around £10.1 million from the Implementation Fund to support capital expenditure for the preferred option. They have already secured £5.95 million from this source, leaving a residual funding request of £4.1 million. B&NES is also requesting £14.2 million from the Clean Air Fund to support capital expenditure on mitigation measures. Hence, the total residual capital funding request to JAQU is £18.3 million.

From an operational perspective, the financial analysis demonstrates that CAZ revenue is sufficient to cover operational costs for the preferred Clean Air Plan option, under the core scenario. However, there will be a significant operational deficit in the years immediately before implementation and in the latter stages of the appraisal period. Further, there is an outstanding risk that the CAZ income revenue stream identified in the operational analysis may not materialise.

As a result, and because the CAZ revenue estimation is so uncertain (due to a lack of precedence and direct benchmarking for a similar scheme), B&NES is requesting that revenue grant funding is provided to cover operational costs for the pre-implementation phase. It would also be required to cover the potential operational deficit that could be incurred within the first six months post-implementation, based on the financial modelling. This is in addition to capital funding. The total revenue grant funding request is in the region of £1.7 million from the Implementation Fund to support the initial operational costs associated with scheme components that are essential to achieving compliance and to cover forecast operational deficit in 2021. Similarly, it is assumed that £2.0 million of funding will be forthcoming from the Clean Air Fund to support the ongoing operational costs. The funding would be used for essential scheme components, which mitigate against any potentially adverse impacts from the Clean Air Plan on local residents and businesses. The base operational funding request to JAQU is therefore £3.7 million.

Further, B&NES assume that any additional operational deficit that occurs (beyond that identified and mitigated against in the modelling [e.g. via the Sinking Fund covering 2027-30]) will be fully underwritten by JAQU. Effectively, in the event that operational deficit occurs over and above that identified, B&NES expect revenue funding support from JAQU. This position reflects the potential for unforeseen and national scale risk that could not be accurately included within the core financial modelling or risk analysis.

In summary, the total request to central government for the delivery and operation of B&NES' Clean Air Plan is around £22.0 million (exclusive of the £5.95 million has already been secured), split as follows:

- £18.3million in capital grant funding, of which:
 - £4.1 million from the Implementation Fund (exclusive of the £5.95 million funding already secured);
 - £14.2 million from the Clean Air Fund.
- £3.7 million in revenue grant funding, of which:
 - £1.7 million from the Implementation Fund, required to cover:
 - The initial operational costs (pre-implementation) for those scheme components required to achieve compliance; and,
 - The potential operational deficit that could materialise in the first six months of 2021 in the event that worst case scenario assumptions apply.
 - £2.0 million from the Clean Air Fund required to cover selected operational costs of scheme components required to mitigate against potential adverse impacts of the Clean Air Plan on local residents and businesses.

With revenue grant funding provided in line with the above conditions, the preferred option can achieve a net operational surplus of between circa £4m and circa £12m. It is assumed that any surplus can be used to support a Sinking Fund to mitigate against identified operational deficits, support complementary air quality and transport projects in B&NES, as well as mitigate against any unforeseen negative impacts on the Council's budget that may arise from implementation of the preferred option. That said, the surplus cannot be used to cover any unidentified revenue deficit associated with operation of the CAZ. B&NES assume that any such deficit will be fully underwritten by JAQU.

6. Management Case

6.1 Introduction

The purpose of the management case is to provide JAQU with confidence that appropriate arrangements are in place to ensure successful delivery of the Bath CAP. In line with JAQU guidance, the management case builds on the OBC by making recommendations about the optimal solution to the following issues:

- The governance structure during the implementation and operational phases, including key management roles and responsibilities and a project organogram;
- Evaluation and monitoring processes and associated benefits realisation;
- Risk management and mitigation; and
- The provision of a realistic and achievable project plan.

6.2 Previous Experience and Lessons Learned

B&NES has a proven track record of delivering recent transport and environmental projects of a similar type and scale to the proposed CAP. This practical experience of delivering schemes of a similar size and nature means B&NES has a thorough understanding of the challenges, and associated solutions, that could materialise during the implementation and operation of the CAP. Examples include the Bath Transportation Package and Bus Lane and Parking Enforcement. A summary of some of the most pertinent projects follows, as well as some of the key lessons learned that could be applied to support delivery of the CAP.

6.2.1 Bath Transportation Package

The Bath Transportation Package²⁸ is a DfT-supported investment of £30 million, comprising a range of measures designed to meet the current and future transport infrastructure needs of Bath. The works include the implementation of a range of IT and intelligent transport systems, including VMS and a Real Time Information (RTI) system, along with associated street works and bus shelter improvements.

This ongoing work is being successfully implemented by B&NES officers who will be key members of the project team for the CAP.

6.2.2 Bus Lane Enforcement

In 2016, the Authority identified the strategic requirement to replace the existing and aging ANPR camera network, with modern and up to date technology, to maintain high-quality enforcement within the core historic centre of Bath and on priority arterial routes. Bath was one of the early adopters of the technology in 2009 and the installation has been successful in reducing the number of vehicles travelling in contravention of the restrictions, increasing public transport journeys and reducing cross city car journeys. The use of the technology results in approximately 30,000 PCNs being issued per annum.

The project replaced all of the existing cameras and relocated them, in accordance with the updated best practice guidelines issued by the TPT. The cross departmental working between third party suppliers and internal IT teams allowed improved data security and information governance in line with GDPR requirements.

Replacement of the cameras has improved the enforcement of the restrictions by upgrading the technology to high definition (HD) footage, with improved infra-red vehicle number plate capture and recording. The coverage of the capture areas on the highway by the new cameras is significantly improved compared to the previous equipment, increasing reliability and the ability to confirm and evidence the circumstances of the contravention, if raised as part of the statutory appeals processes laid out in legislation.

²⁸ http://www.bathnes.gov.uk/sites/default/files/btp_aims_and_objectives.pdf

Key lessons within the delivery of the project that apply to the implementation of the CAZ scheme include:

- The soft market testing and assessment of ANPR solutions;
- Assessment of appropriate ANPR locations to ensure best evidence capture;
- Implementation of IT solutions to ensure evidence flow from remote ANPR stations to enforcement software; and
- Management of a white list to exempt authorised vehicles.

6.2.3 Parking Enforcement and Management System Improvement Project

The introduction of new parking management software, including permits and pay by mobile solutions, provided an integrated enforcement, payment and permit management system that improved customer service and streamlined internal operations, allowing staff to efficiently use the additional functionality and capacity to increase performance.

This internally funded project involved working with internal departments and linking into the Council Tax database, LLPG dataset and related information. It also reduced the number of IT software applications and volume of storage space required by Parking Services, by combining the separate functions under one supplier to allow easier cross referencing of authorisations, permits, payments and enforcement actions.

This solution increased the level of direct customer self-service and provided additional benefits such as virtual parking permits, online evidence viewing and direct entry of appeals for PCN representations.

These applications, as well as delivering a financial saving in the region of £250,000 per annum when compared to the previous systems, have provided an accurate management information system that enables better decision making, with regard to staff deployment and process change.

In particular, the introduction of virtual parking permits has led to a new way for residents and businesses to purchase and process their permits and parking stays. This includes trade persons permits and a staff management scheme that records individual stays by department but does not charge the individual users.

Pay & Stay customers are also able to activate parking via their mobile phone. This has been recently enhanced in a UK first where residents are able to access a separate and reduced tariff set to visitors through the pay by mobile system, reducing the costs of parking for residents to enhance the Council's commitment to putting residents first.

6.3 Project Management

The project will continue to be managed in accordance with the PRINCE2 principles set out in the B&NES Corporate Project Management System, which have been tailored in the Project Handbook to suit the particular needs of this project environment.

A number of key roles have been identified for delivery of the project within the organogram in Appendix A and are set out below along with the responsibilities of each role.

Project Board – The Project Board meets monthly and is responsible for guiding and steering the direction of the project. The board consists of the relevant cabinet members and senior B&NES officers. The lead cabinet member chairs these meetings. The Project Board:

- Reviews and approves the Project Handbook;
- Reviews and approves the final issue Plans and associated resource allocation;
- Receives Highlight Reports from the Project Manager;

- Reviews and approves any issues, risks and additional requirements escalated by the Project Manager that have resulted, or may result, in major deviations from the agreed Plans;
- Communicates information about the project to other senior officers and members and liaise with the Project Manager regarding any feedback;
- Ensures that the objectives of the project are met;
- Ensures that the project is undertaken within the agreed scope; and
- On completion, reviews and approves the Project Close Out Report.

Senior Responsible Officer (SRO) – The SRO for the implementation and operational phases of the project is the Group Manager for Transport and Parking. The SRO has overall responsibility for ensuring the CAP meets its objective and delivers the projected benefits within the time and cost parameters set out in this FBC.

Internal Transport Steering Group – The Internal Transport Steering Group will meet quarterly and will oversee the utilisation of any net revenue held in the Revenue Reinvestment Reserve, as per the recommendations set out in the Financial Case, Section 5 and in accordance with the plans set out in the Charging Order, Annex 5. The board will consist of councillors, senior B&NES officers and members of business and other key interest groups and it will be responsible for reviewing and prioritising the proposed improvements and making recommendations to the Project or Transportation Programme Board (depending on the phase of the project) for approval.

Project Manager – The Project Manager is responsible for the day-to-day management of the project on behalf of the Project Board. The Project Manager:

- Maintains the Project Handbook;
- Obtains approval from the Project Board for the Project Handbook;
- Liaises with the Project Team regarding the draft issue Plans;
- Obtains approval for the final issue Plans from the Project Board;
- Chairs the Project Team meetings and attend sub-group meetings as and when required;
- Provides Highlight Reports to the Project Board summarising:
 - The work done and work planned against the agreed Plans; and
 - Any issues, risks or additional requirements that have resulted, or may result, in major deviations from the agreed Plans;
- Coordinates any feedback about the project received via the Project Team and Project Board from other senior officers, members and stakeholders;
- Ensures that the objectives of the project are met;
- Ensures that the project is undertaken within the agreed scope; and
- On completion, liaises with the Project Team and prepare the Project Close Out Report.

Project Team – The Project Team consists of B&NES officers from a range of services, including transport, public protection, highways, parking, economic development, planning and public health with support from technical consultants and officers in the Council's communications, procurement, accounts and legal teams as appropriate. The Project Team meets fortnightly and is responsible for liaising with contractors and delivering the work set out in this FBC. The Project Manager chairs these meetings. The Project Team:

- Reviews the draft issue Plans and assesses the impact on the Council's resources;
- Provides Progress Reports to the Project Manager summarising:
 - The work done and work planned against the agreed Project Plan;
 - Any issues, risks or additional requirements that have resulted, or may result, in deviations from the agreed Plans;

- Communicates information about the project to stakeholders as appropriate and liaise with the Project Manager regarding any feedback;
- Ensures that the objectives of the project are met;
- Ensures that the project is undertaken within the agreed scope; and
- On completion, inputs into the Project Close Out Report.

Specialist Advisors – Due to the large and complex nature of the project, specialist advisors have been and are being engaged where necessary to supplement the Project Team's capacity and skills. The scope of this is set out in the Task Orders and comprises:

- Marketing and communications specialists;
- Legal counsel
- Vehicle asset finance specialists; and
- Delivery and servicing planning specialists.

The Project Team is further organised into work package teams which meet on a weekly or daily basis as required. Sub-groups will also be formed as and when required to focus on particular areas, undertake specific tasks and/or address specific issues.

Oversight of the project is via regular reports to the Council's Transportation Programme Board, Corporate Director, Cabinet and Climate Emergency and Sustainability Policy Development and Scrutiny Panel.

Figure 6-1 presents an organogram of the project team and governance structure.

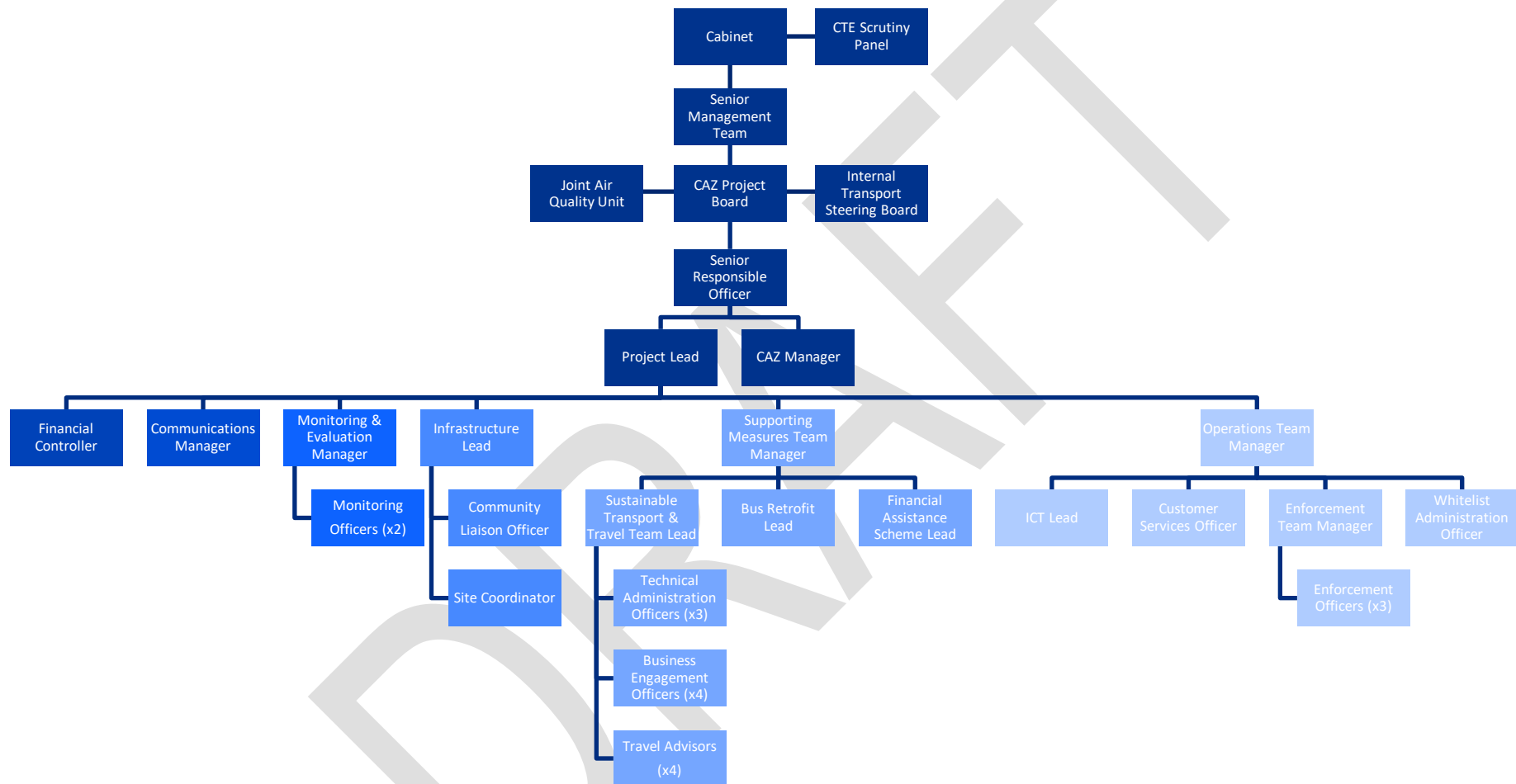


Figure 6-1: Project team and governance structure

As noted above, the project will be managed in accordance with the PRINCE2 principles set out in the B&NES Corporate Project Management System, which have been tailored in the Project Initiation Document to suit the particular needs of this project environment.

The Project Board will meet monthly. The Project Team will meet fortnightly and is responsible for delivering the work set out in the business case. The project reporting cycles will follow suit in order to inform these meetings.

In its meetings the Project Team will report on progress with the work identified in the Project Plan (both work done in the previous fortnight and work planned for the coming fortnight) and discuss any issues, risks or additional requirements that have resulted, or may result, in deviations from the agreed Plan. The Project Manager will chair this meeting.

As an output from the Project Team meetings the Project Manager will then produce a Highlight Report for the monthly Project Board meetings. The SRO will chair these meetings.

6.4 Financial Management

6.4.1 Financial Reporting

Regular financial reporting will be critical to ensure that the SRO, Project Board and Project Team are able to track progress against the timescales and budgets set out in the Project Plan and Financial Case. The Project Manager, in liaison with the Financial Controller, will be responsible for undertaking regular financial reporting to inform the Project Board of the project's progress and performance via monthly Highlight Reports.

Scrutiny and oversight of the project's financial management will continue to be provided by the Council's Accounts Team.

6.4.2 Change Control

6.4.2.1 Procedure to move funds or alter delivery timescales within a Work Package

Change is likely to occur during the implementation of the scheme and there may be a need to move funds between tasks in a Work Package or to amend the start or finish date of a particular task.

All requests to move funds and/or alter delivery timescales will be submitted to the Project Manager via a Change Request and reported to the Project Board via the Change Request Log.

A scheme of delegation will apply to requests for additional time or funds. The authorisation levels are set out below. Change requests exceeding the Project Manager's threshold will be accompanied by an Exception Report.

Table 6-2: Authority Levels to move funds or alter delivery timescales within a Work Package

Authority Level	Threshold
Work Package Manager	Authorised to move a maximum of 10% between individual tasks within a work package up to an absolute value of £50,000 Authorised to change the start or finish date of any one individual task by up to two weeks
Project Manager	Authorised to move a maximum of 20% between individual tasks within a work package up to an absolute value of £75,000 Authorised to change the start or finish date of any one individual task by up to one month
Senior Responsible Officer	Authorised to move a maximum of 30% between individual tasks within a work package up to an absolute value of £100,000 Authorised to change the start or finish date of any one individual task by up to two months
Project Board	Authorised to move a maximum of 40% between individual tasks within a work package up to an absolute value of £250,000 Authorised to change the start or finish date of any one individual task by up to three months

Authority Level	Threshold
Corporate Director and Cabinet member	Authorised to move a maximum of 50% between individual tasks within a work package up to an absolute value of £500,000 Authorised to change the start or finish date of any one individual task by up to six months

Section 6.4.2.5 describes the process to be followed when the highest change control level is breached.

6.4.2.2 Procedure to move funds within the Change Budget

The Change Budget will comprise funds to underwrite:

- Implementation phase QRA risks
- Operational phase QRA risks

There will be no call on the operational phase risk allocation during the implementation phase. Any surplus risk allocation from the implementation phase will be carried forward to the operational phase. Any surplus risk allocation from the operational phase will be carried forward to the revenue reinvestment reserve.

All requests to move funds will be accompanied by a Change Request and Exception Report, recorded on the Change Request Log and submitted to the Project Board and then the Corporate Director and Cabinet member for authorisation.

The QRA only accounts for risks that can be reasonably foreseen and quantified at this stage in the project. The Council is assuming that any unforeseen and/or national scale risks arising that are not accounted for within the QRA and impact on the capital or operating cost of the scheme will be underwritten by JAQU and funded in the year that the impact is realised.

6.4.2.3 Procedure to move funds from the Change Budget to a Work Package

From time to time there may be a need to move funds from the Change Budget to a Work Package.

All requests to move funds will be submitted to the Project Manager via a Change Request and reported to the Project Board via the Change Request Log.

A scheme of delegation will apply. The authorisation levels are set out below. Change requests exceeding the Project Manager threshold will be accompanied by an Exception Report.

Table 6-2: Authority Levels to move funds from the Change Budget to a Work Package

Authority Level	Threshold
Project Manager	Authorised to approve up to £75,000 in aggregate in each 12-month period
Senior Responsible Officer	Authorised to approve up to £100,000 in aggregate in each 12-month period
Project Board	Authorised to approve up to £250,000 in aggregate in each 12-month period
Corporate Director and Cabinet member	Authorised to approve up to £500,000 in aggregate in each 12-month period

Section 6.4.2.5 describes the process to be followed when the highest change control level is breached.

6.4.2.4 Procedure to move funds between Work Packages

During the implementation of the scheme there may be a need to transfer funds between work packages. Any surplus funds held within a Work Package will first be transferred to the Change Budget prior to reallocation elsewhere. There will be no direct movement of funds between Work Packages.

All requests to move surplus funds will be accompanied by a Change Request, recorded on the Change Request Log and submitted to the Project Board for authorisation.

6.4.2.5 Procedure to change the scope of a Task Order

It is recognised that during the implementation of the project the scope of some Task Orders may change. This is particularly relevant to task orders which are still undergoing design development.

The overarching principle of the project is that the scope will not deviate significantly from that set out in the Task Orders. Any significant changes from those set out in the Task Orders are likely to have impacts on the business case and predicted outcomes.

Task Order scope changes will be classified as 'minor' and 'major'. The definition of a 'major' changes is set out below. Any other scope changes will be classed as minor.

Requests to make a minor scope change will be accompanied by a Change Request and Exception Report, recorded on the Change Request Log and submitted to the Project Board for authorisation.

The Project Board, Corporate Director and Cabinet member recognise the requirement to consult JAQU on any significant change to the scope of the project.

Requests to make a major scope change will be accompanied by a Change Request and Exception Report and recorded on the Change Request Log. If the change is likely to result in a significant change to the scope of the project the SRO will consult with JAQU with a view to obtaining their authorisation prior to submitting the change request to the Project Board, the Corporate Director and Cabinet member for authorisation.

For the purpose of this project the definition of a major change is:

- A request to move funds or alter the delivery timescales within a Work Package that exceeds the Corporate Director and Cabinet member authorisation threshold;
- A request to move funds from the Change Budget to a Work Package that exceeds the Corporate Director and Cabinet member authorisation threshold; or
- A request to stop or remove a Task Order or add a new Task Order.

6.5 Project Plan

A Project Plan, included in FBC-22 'Project Plan' in Appendix K of this FBC, has been developed for delivery of the CAP, setting out the main project stages and their anticipated timescales.

A summary of the anticipated completion dates for each key activity is shown in Table 6-3.

Table 6-3: Key activity completion dates

Activity	Completion Date
Full business case completion	13/12/2019
Design and procurement	
ANPR camera design and procurement	10/10/2019
Communications network design and procurement	09/10/2019
Signage design and procurement	06/01/2020
Back-office system design and procurement	14/11/2019
Queen Square Traffic Management scheme design and procurement	21/01/2020

Scheme Implementation	
ANPR camera implementation	30/07/2020
Communications network implementation	15/06/2020
Signage installation	19/06/2020
Back office system implementation	23/07/2020
Queen Square Traffic Management implementation	24/04/2020
System integration testing, monitoring and handover	30/09/2020
CAZ operation ready to commence	02/11/2020
Clean Air Fund mitigation measures	
Clean Air Fund application	04/12/2019
Bus retrofits completion	01/10/2020
Financial assistance schemes – ready to operate	20/02/2020
Travel advisors and supporting measures team – ready to operate	16/01/2020
Alternative delivery and servicing options for businesses – ready to operate	22/05/2020

The implementation phase is expected to commence in November 2019 and continue until November 2020, when the Project Plan becomes fully operational.

The constraints around achieving the timescales set out have been considered, with appropriate action taken to ensure that they do not impinge upon the operational date. This is summarised as follows:

- The Project Plan considers confirmed network constraints, including Christmas embargos.
- Early and ongoing liaison with internal B&NES Council teams is in place to ensure that works are coordinated with other schemes planned around the city.
- Contractors are already engaged in the works planning process to ensure that they can meet the required timescales and the various workstreams are coordinated.
- Communications and liaison strategies are in place to ensure stakeholder and public liaison in relation to the works is comprehensive and timely.
- Involvement of other third parties, for example Highways England, is also currently being managed but not considered to be on a critical path.

6.6 Assurance Framework

In line with PRINCE2, quality assurance of both process and outcome will be undertaken throughout the programme.

Up to and including the FBC, the quality assurance process has been supported by the following JAQU review panels from JAQU:

- the Technical Independent Review Panel (T-IRP) responsible for technical assurance; and
- The Delivery Independent Review Panel (D-IRP) responsible for project delivery assurance.

JAQU have also now formed a Central Evaluation Team responsible for monitoring and evaluating the progress made towards meeting the air quality objectives set out in the CAP.

At the implementation and operational stage, it is envisaged that the Project and Transportation Programme Board (depending on the phase of the project) will delegate Quality Assurance to a nominated representative from the Board. A Peer Review Group will also be established to support Quality Assurance. All Project Board members will be given the opportunity to provide staff for this group.

The Peer Review Group will be convened at the discretion of the Project Board member with quality assurance responsibilities. The purpose of the group is to provide an internal 'challenge' role to support the Project Board. The group will not undertake any audits or reviews at this level but rather raise formal issues to the nominated Project Board member if concerns are identified. It is envisaged that the Peer Review Group will initially be convened immediately following procurement and then at appropriate points through the implementation and operational stage.

6.7 Communication and Stakeholder Management

6.7.1 Communication with Media

The Communications Office will be the primary point of contact for any contact with the media and will in the first instance consult with the Project Manager or SRO about how best to handle the enquiry.

6.7.2 Engagement

A robust engagement plan has been developed to achieve efficient and effective internal and external communications. The Stakeholder Management and Engagement Plan is provided in FBC-07 'Stakeholder Management and Engagement Plan' in Appendix B of this FBC.

6.7.3 Communications/Engagement Strategy Summary

B&NES recognises the value of engaging stakeholders and the public on the CAP. The Engagement Strategy to date has therefore been underpinned by two main objectives:

- To seek feedback at key stages to help shape the CAP; and
- To raise the profile of air quality issues and the CAP.

The communications and engagement strategy has been updated during every phase of engagement, SOC, OBC and FBC phase. The engagement phases remaining are:

- **Implementation** – at this stage, engagement with stakeholders and the public will split into two workstreams:
 - Engagement associated with installing the charging and traffic management infrastructure, led by the community liaison team.
 - Engagement on the supporting measures, led by the travel advice team.
- **Operation** – this phase will involve continued conversations with interested parties, led by the travel advice team.

The opportunity for the public and stakeholders to influence the process will be more limited through the next phase of the project. Implementation and Operation Phases will focus on:

- The timescale for implementation; and
- The practical measures people need to take to prepare for the introduction of the CAZ.

There will also be a need to raise awareness of CAZ infrastructure placement and construction start dates for those directly impacted, such as those people living or working adjacent to cameras and signs. A key theme that will continue to run through all remaining engagement will be health messages.

FBC-07 'Stakeholder Management and Engagement Plan' details some key groups, identified as particularly affected. These groups are key audiences for future communication and engagement due to their potential to be

impacted most by the CAP. However, the importance of communicating widely to ensure that everyone has awareness of the proposals is noted.

FBC-07 'Stakeholder Management and Engagement Plan' details the communication and engagement tools that have been employed throughout the SOC, OBC and FBC stages and those that will continue through to implementation and operation. The communication tools centre around a bespoke website, www.bathnes.gov.uk/bath-breathes-2021, with associated social media, newsletter and advertisement campaigns to draw in as wide a selection of the population as possible. These tools will be supplemented by face to face events as appropriate. FBC-07 'Stakeholder Management and Engagement Plan' further details the engagement and communications plan for the Implementation and operation phases.

6.8 Risk Management Strategy

A risk management strategy for the CAP is underpinned by the QRA, considered in detail in FBC-23 'Risk Management Strategy – Quantified Risk Assessment' in Appendix M of this FBC. The main purpose of the QRA is to support the costings as presented within the financial case, by predicting the level of risk contribution, with a defined level of confidence, to cover the implementation/operation of the scheme. QRA allows for uncertainty in unplanned additional cost items, including cost due to delay, that cannot be otherwise included in the project costs. The assessed risk value has been used in the financial case and incorporated in the economic appraisal.

The QRA process involves four steps:

- **Step 1** - identification of all of the risks affecting the project through risk workshops and risk reviews. This step results in a risk register.
- **Step 2** - analysis of the identified risks by defining their distributions in terms of probabilities, impacts and knock-on effects. This information is also gathered through risk workshops and other interactions including with stakeholders.
- **Step 3** - undertaking the risk modelling using Monte Carlo simulation (for this project @Risk® software was used).
- **Step 4** - analysing the results against required contingency needs for the project.

The QRA figure included in this FBC, in line with WebTAG guidance is the P(Mean), the mean percentile value. In addition, the 50th Percentile (P(50)) and 80th Percentile (P(80)) also provide further levels of confidence. The QRA results are shown below.

Table 6-4: QRA Results (November 2019)

	P(50)	P(80)	P(Mean)
Grand Total Risk (Financial + Delay)	£2,529 k	£3,471 k	£2,703 k

The top 10 risks by Grand Total Risk (i.e. Financial + Delay) identified by the sensitivity testing are listed below.

Table 6-5: Top Ten Risks

Rank	Risk Ref	Description
1	Risk 016	Successful challenges to the process for making the Order
2	Risk 025	Scheme is not sufficient to achieve air quality compliance by 2021 as anticipated
3	Risk 008	HE or other LA approvals for the signage on the SRN take longer than anticipated
4	Risk 020	The signage installation takes longer than anticipated due to competing priorities for contractors
5	Risk 001	Reliance on the industry's understanding/ability to deliver retrofit solutions for buses/coaches
6	Risk 019	The ANPR camera installation takes longer, or costs more, than anticipated due to competing priorities for contractors

7	Risk 022	Installation delayed due to clashes with other highway works, or requirement to integrate with other large works and major schemes
8	Risk 010	Queen Square Traffic Management design takes longer, or costs more, than anticipated due to changing scheme requirements
9	Risk 018	Delays in obtaining JAQU funding from the Clean Air Fund
10	Risk 004	Delays in obtaining JAQU approvals for the FBC (for example due to a General Election)

The QRA only accounts for risks that can be reasonably foreseen and quantified at this stage in the project. Section 6.4.2.2 describes how unforeseen and/or national scale risks will be dealt with.

6.9 Monitoring and Evaluation Plan and Benefits Realisation Strategy

It is recognised that Evaluation and Monitoring both during delivery of the CAP and post-completion will be vital to assess the benefits realisation of the programme. As such, and in line with PRINCE2 principles, the implementation and operational phases of the project will be subject to a Monitoring and Evaluation Plan and Benefits Realisation Strategy. FBC-26 'Evaluation, Monitoring and Benefits Realisation Plan' in Appendix R of this FBC sets out the detailed approach to these issues, covering the monitoring of impacts and the approach to determining the projected benefits, impacts and objectives.

In order to undertake the required monitoring, existing traffic and air quality monitoring infrastructure will be supplemented to provide a comprehensive network across the CAZ and beyond to monitor the impacts of the scheme. Further health, economic, walking and cycling and mitigation scheme impact monitoring is also proposed. Baseline surveys will be undertaken prior to scheme commencement. Corrective action planning has been considered along with the overall approach to scheme completion.

The evaluation element of the Plan covers quantitative and qualitative measures, thereby covering a range of outcomes and impacts. Furthermore, the evaluation strategy will help influence similar schemes. It will comprise both 'process evaluation' and 'impact evaluation', with the former focusing on the processes by which the scheme was undertaken and the latter focusing on whether the desired impacts of the scheme were realised.

Table 6-6 shows the mapping of the Desired Impact and Outcome Analysis of the plan.

Table 6-6: Monitoring outputs for assessing desired impacts (showing primary links only)

Desired Impacts (D) by Monitoring Outputs (M)	M1: Air quality data	M2: Vehicular fleet information	M3: Traffic Flows	M4: Retail/ business /office space vacancy figures	M5: Retail footfall surveys	M6: Park and Ride passengers data	M7: Walking and cycling counts	M8: Bus usage data	M9: Stakeholder Feedback from Council User Group Forums	M10: Taxi fares and unmet demand	M11: Early Measures Fund – ULEV Parking Permits	M12: Bus retrofit /compliance data	M13: Financial support scheme uptake	M14: Travel Advisor session uptake	M15: Anti-idling enforcement	M16: Weight restriction enforcement	M17: Delivery and servicing plans uptake
Implementation Fund Scheme:																	
D1: Deliver compliance with NO ₂ air quality Limit Values																	
D2: Deliver compliance with NO ₂ air quality Air Quality Objectives																	
D3: To minimise the impact to residents, particularly low income groups																	
Clean Air Fund Scheme:																	
D4: To minimise the impact to businesses																	
D5: To minimise adverse traffic impacts																	
D6: Contribute to the delivery of the 'Getting Around Bath' Transport Strategy.																	

- Appendix A. Scheme Documents and Related Documentation to Systems Set Up**
- Appendix B. Stakeholder Management and Engagement Plan**
- Appendix C. Options Assessment Report**
- Appendix D. Air Quality Reports**
- Appendix E. Transport Modelling Reports**
- Appendix F. E1: Economics Appraisal Methodology Report**
- Appendix G. Distributional and Equalities Impact Analysis**
- Appendix H. Clean Air Plan Procurement Strategy**
- Appendix I. Explanatory Note on CAZ System Cost Estimates**
- Appendix J. Draft Charging Order**
- Appendix K. Bath CAP Infrastructure Work Programme**
- Appendix L. Stated Preference Survey Report**
- Appendix M. Quantified Risk Assessment**
- Appendix N. Sensitivity Testing Technical Note**
- Appendix O. Engagement Summary Report**
- Appendix P. Environmental Assessment**
- Appendix Q. Consultation Report**
- Appendix R. Evaluation, Monitoring and Benefits Realisation Plan**
- Appendix U. Letter from S151 Officer**
- Appendix V. Memorandum of Understanding for Emergency Service Vehicles**
- Appendix W. Financial Report**

Appendix Y. Clean Air Fund Report