Cardiff Council Clean Air Feasibility Study Interim Plan - Outline Business Case







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Acronyms, Definitions and Notes

AADT	Annual Average Daily Traffic
ANPR	Automatic Number Plate Recognition
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CASAP	Clean Air Strategy and Action Plan
CAZ	Clean Air Zone
CCBTF	Cardiff Clean Bus Technology Fund
CCR	Cardiff Capital Region
CCW	City Centre West
CCN	City Centre North
СО	Carbon Monoxide
CSF	Critical Success Factor
Defra	Department for Environment, Food and Rural Affairs
DfT	Department of Transport
DIA	Distributional Impact Assessment
DPFs	Diesel Particulate Filters
EV	Electric Vehicle
FBC	Full Business Case
fNO ₂	NO ₂ Fraction
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management
LES	Low Emission Strategy
LEV	Low Emission Vehicle
LGV	Light Goods Vehicle
LowCVP	Low Carbon Vehicle Partnership
LTP	Local Transport Plan
NO ₂	Nitrogen Dioxide
NPV	Net Present Value
O ₃	Ozone
ODB	Organisational Development Board

OBC	Outline Business Case
OLEV	Office for Low Emission Vehicles
PM2.5	Particulate matter with a size (diameter) generally less than 2.5 micrometres (2.5 thousandths of a millimetre)
PM10	Particulate matter with a size (diameter) generally less than 10 micrometres (10 thousandths of a millimetre)
PCM	Pollution Climate Mapping
PPW	Planning Policy Wales
PSB	Public Service Board
PQA	Project Quality Assurance
РМО	Project Management Office
SCR	Selective Catalytic Reduction
SEWTM	South East Wales Transport Model
SO ₂	Sulphur Dioxide
TRC	Traffic Regulation Condition
ULEV	Ultra-Low Emission Vehicle
WFG	Well-being of Future Generations (Wales) Act 2015
µgm⁻³	Micrograms per cubic metre

Definitions

"CASAP measures" is also referred to as "CASAP Package" & "CASAP 3". All refer to a final package of non-charging mitigation measures which are an accumulation of identified mitigation measures developed from the long list of measures outlined in the Clean Air Strategy and Action Plan, as well as from followed up detailed air quality modelling.

CAZ 1 & 2 are both variants of a Charging Clean Air Zone.

Cardiff Council is normally referred to in this OBC as "Cardiff Council", but sometimes as "the Council".

Welsh Government- Environment Act 1995 (feasibility study for Nitrogen Dioxide Compliance) Air Quality Direction 2018- referred to as "the direction" throughout this OBC.

Notes regarding appendices

Please note that appendices will comprise separate documents for the OBC, due to their size. They will be available as separate documents via the Council's website, following publication of this OBC. Consideration will be given to providing a summary of them in the FBC, within the respective appendices.

Background

In response to a legal direction Cardiff Council received from Welsh Government- Environment Act 1995 (feasibility study for Nitrogen Dioxide Compliance) Air Quality Direction 2018- the Council must:

- Submit "initial scoping proposals"- by March 2018- to set out how Cardiff Council would undertake a feasibility study.
- Submit an "initial plan", by September 2018, to set out the case for change and develop options for measures that the local authority will implement to deliver compliance with Clean Air targets in the shortest possible time.
- Submit the "final plan", no later than the 30th June 2019, to set out in detail the preferred option for delivering compliance in the shortest possible time, including a full business case

The Council has been following a legal process to comply with the direction. As part of this process the Council submitted its "initial scoping proposals" in March 2018 and its Initial Plan, to Welsh Government in September 2018, as approved by Cabinet 15th November 2018 which presented the results of the initial baseline assessment of the Clean Air Feasibility Study.

Whilst the Direction itself does not specifically require the Council to submit an Outline Business Case (OBC) the development of a Full Business Case (FBC) cannot be achieved without first assessing the OBC. The OBC sets out a preferred option for the Council to implement to achieve compliance in the shortest possible time.

Results of Initial Plan

The results of the local modelling presented in the Initial Plan, differed to that undertaken by Defra using the Pollution Climate Mapping model. DEFRA's modelling identified two road links under baseline conditions which were projected to show non-compliance beyond 2021, namely the A48 and the A4232.

The localised modelling identified only one road link under baseline conditions projected to show noncompliance beyond 2021, this being the A4161 Castle Street, in the City Centre. In assessing the model data the main reason for this exceedance relates to very high traffic flows, some 32,000 vehicles a day and accompanying slow speeds of around 11mph on this specific road link.

Within the Initial Plan Report a long list of measures developed from the Draft Clean Air Strategy and Action Plan (CASAP) were qualitatively assessed against a primary objective of achieving compliance with set air quality objectives in the shortest possible time. The measures were considered against secondary objectives and were subjected to further qualitative assessments against the WeITAG Wellbeing Aspects.

The shortlist presented in the Initial Plan was as follows:

- Implement further speed restrictions and enhance already established 20mph Zones.
- Development of Cycling Superhighways infrastructure and Expansion of Next bike Scheme
- Implement Zero Emission Buses on Cardiff Network
- Revision to Taxi Licensing Policy to include emissions standards
- Bus Network Programme- Strategic Bus Network to improve bus networks and efficiency of the services via increased and improved bus lanes

- Accelerate Park and Ride (P & R) programme in NW & NE of Cardiff. NW; Implement new Park and Ride facilities at Junction 33 (750 Spaces) and Llantrisant Road (250 Spaces). NE; expansion of P & R on the A48.
- City Centre West and Central Interchange and Eastside City Centre Schemes
- Improve and promote the uptake of low emission vehicles by enhancing Cardiff's EV infrastructure
- Review and implement car parking and car permit charges.

Prior to commencing the assessment of the above measures, further additional measures were also identified owing to the results of the local modelling. These additional measures have been assessed to include a wider Bus Retrofitting Programme, further network improvements on the A470 and a bus based P&R at Nantgarw.

In addition to assessing the package of measures, as required by the Government Guidance the Council has assessed the effectiveness of a charging Clean Air Zone (CAZ) in terms of whether compliance could be achieved quicker than the proposed measures.

Government Guidance is clear that a charging CAZ should only be considered as a preferred option/ implemented if non-charging alternatives have been found to be insufficient to bring about compliance with air quality limits in the shortest possible time.

As a result the OBC has assessed two CAZ options for benchmarking purposes. Both options focussed on a small city centre zone, as detailed on page 36 of this report. In summary the two CAZ options were assessed as follows:

- CAZ 1 Private cars which did not meet Euro 4 (petrol) or Euro 6(diesel) emission standards would be charged a £10 daily fee for entering the CAZ. No other vehicles were included in the CAZ.
- CAZ 2 Commercial vehicles HGVs, LGVs, did not meet Euro 4 (petrol) or Euro 6 (diesel) emission standards, would be charged daily rates for entering the CAZ. For HGVs the daily charge was set at £50 and for LGVs £10

Results of Assessments

Localised air quality modelling and transport modelling was undertaken to establish the impact of the CASAP measures and CAZ as to whether compliance could be achieved by 2021.

The CASAP measures have been assessed accumulatively in terms of combining the measures identified in CASAP 1 with CASAP 2 and finally all measures have been assessed together as a final package, CASAP 3.

Unsurprisingly the full CASAP package achieves the greatest level of compliance on Castle Street, with a concentration of $35 \ \mu\text{g/m}^3$ forecasted as a result of the implementation of the measures. In addition to achieving compliance on Castle Street, the impact of the package of measures has also been modelled at local air quality monitoring locations, including those locations within existing Air Quality Management Areas (AQMAs). The results of the modelling indicate that all monitoring locations are expected to have concentrations below 40 $\mu\text{g/m}3$ which demonstrates that the package of measures will improve local air quality including within existing AQMAs.

The ruling of the Client Earth 2 set out three tests that Clean Air Plans (the Feasibility Study) must meet in order that they are seen to comply with Article 23 of the EU Directive. The third test states that the plans must demonstrate that compliance with the limit values is not just possible, **but likely.** As summarised above through the implementation of the full CASAP measures the level of compliance that is modelled to be obtained on Castle Street, is the greatest with NO₂ concentrations reduced from 41.1 μ g/m³ to 35 μ g/m³.

Owing to the level of uncertainty in the air quality modelling achieving a level of **35** μ g/m³ or better is an important target for the Council to obtain. Probability analysis undertaken, indicates that modelled levels of 35 μ g/m³ or less gives a greater than **80%** probability that compliance with the limit value will **actually be achieved**, when the measures are implemented.

As a comparison the results of the modelling undertaken on the CAZ scenarios are summarised as follows:

- CAZ 1 Private cars achieves compliance on Castle Street 32.5 μg/m³;
- CAZ 2 Commercial vehicles achieves compliance on Castle Street NO₂ 35.3 μg/m³

The results for CAZ 1 and 2 show that NO_2 concentrations are estimated to be lower than the baseline 2021 scenario at most links, but with CAZ 1 showing small increases on 6 links and Caz 2 showing increases on 4 links. The largest decrease observed in both CAZ 1 and CAZ 2 is on Castle Street, as might be expected for a measure that is specifically targeting the city centre.

Compared to the CASAP measures, most links show higher concentrations of NO_2 in the CAZ 1 and 2 scenarios. But this is to be expected, as the CAZ scenarios do not include any of the CASAP measures and targets a smaller geographical area. Overall the CASAP measures provide wider overall improvements to air quality across Cardiff.

Funding and Implementation Costs

The Welsh Government has stated that it has allocated over £20 million for an Air Quality Fund through to 2021 to help accelerate compliance with NO_2 limits and improve air quality in Wales. Welsh Government have stated that this fund will primarily be used to provide on-going support, guidance and finance to enable Cardiff Council (and Caerphilly County Borough Council) to take action to achieve compliance in the shortest possible time.

Within the Minister's letter that accompanied the formal direction it was confirmed that finance would be made available for the production of the feasibility study and for the <u>implementation of the chosen scheme</u>.

In addition to the above funding mechanisms, the Council will continue to work collaboratively with Welsh Government officers to identify all available and an appropriate funding mechanisms including transportation funds, to maximise the financial contribution from Welsh Government towards the implementation of any measures.

The proposed implementation cost	s of the preferred	l package is sur	nmarised as follows:
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Measure	Est. Funding Requirements £M
Electric Buses	£1.8M
Bus Retrofit	£1.4M
Taxi Mitigation Schemes	£5.5M*
City Centre Schemes	£18.9M
Active Travel and CS1 completion	£4.2M
	Total: £31.8M

Next Steps

Government guidance is quite clear that a charging CAZ should only be considered as a preferred option if other non-charging measures are not sufficient to bring about compliance in the shortest possible time. Given that the modelling undertaken has demonstrated that a package of measures achieves compliance in the same period if not sooner than a charging CAZ, then ultimately the Council is justified in implementing a package of measures as a preferred option rather than a CAZ. Further as detailed above in the implementation of the non-charging measures provides wider air quality improvements across Cardiff as a whole, including within the existing AQMAs.

This OBC therefore proposes that a refined package of measures is taken forward as the Councils preferred option. This refined package of measures includes the following:

- Implementation of Electric Buses 36 Electric Buses to be implemented on a number of routes within the City Centre;
- **Bus Retro Fitting Programme** Target up to 94 buses that currently do not meet latest Euro 6 emission standard;
- Taxi Licensing Policy and Mitigation Scheme;
- City Centre Loop Schemes, inclusive of Castle Street ; and
- Active Travel Measures

The revised package of measures will be further assessed both in terms of transport and air quality modelling, as a final package of measures to enable the Council to develop the Full Business Case. This will include the full detailed socio-economic distribution of the measures and a distributional analysis to understand the extent to which these measures may impact on the residents of Cardiff and those that travel in to the city. For the full business case these additional considerations will be assessed in more detail in terms of a health impact assessment and a distributional impact assessment.

The results of this assessment will then demonstrate the level of compliance that will be achieved by implementing the preferred option on Castle Street, and elsewhere across the City including within the existing AQMAs. The preferred option will be subject to a full economic assessment following appropriate guidance to demonstrate the full impact of implementing the preferred option. This report will be reviewed and assessed by the Welsh Government's Expert Review Panel, prior to final approval of the preferred option being provided from Welsh Government.

Section 1 Introduction

1.1 Cardiff

As the capital city of Wales, Cardiff has a population of 346,100 people, and is a base for many of the country's political, cultural, sporting and commercial institutions. Principal destinations include the Principality Stadium in the City Centre, the St David's shopping centres, and the historic Cardiff Castle. To the south of the city, Cardiff Bay (in the Butetown and Grangetown Wards) houses the Senedd, Wales Millennium Centre, BBC studios. Cardiff City Football Club and rugby union side Cardiff Blues are also both based in the capital.

Cardiff is located within a well-defined landscape setting with prominent ridges to the west and north and Severn Estuary to the south. The Western, Northern and Eastern areas of the City are mainly residential, with the main commercial areas being in the City Centre and to the south. Cardiff is currently the most populated Welsh local authority, with approximately 361,468 inhabitants and this is predicted to grow to between 395,000 and 413,000 by 2026. Therefore, the Local Development Plan¹ calls for 41,100 new dwellings and 40,000 new jobs to be created. Such population growth is likely to place additional strain on the transport network, exacerbating existing problems of congestion and harmful emissions across the urban area.

In 2013 around 217,600 commuters travelled to work in Cardiff daily, with 83,100 commuting from outside of the city and 134,500 Cardiff residents travelling within the city to their place of work². The city's travel to work area extends to the whole of South East Wales with an increasingly significant number of people arriving from Rhondda Cynon Taf, the Vale of Glamorgan and beyond.

Moreover, although there has been an increase in the use of active and sustainable modes of travel in recent years, the most used mode of travel in Cardiff both within and into the city is by the private car. The dominance of the private car leads to congestion and the associated adverse impacts on the environment, including air quality, greenhouse gas (GHG) emissions and noise pollution.

The countryside and urban area contains a wealth of natural and historic interests. For example, there are almost 1,000 Listed Buildings, 27 Conservation Areas, 2 sites noted for their international biodiversity (Cardiff Beechwoods SAC and Severn Estuary SAC/SPA/RAMSAR) The city has a particularly rich Victorian and Edwardian legacy.

Cardiff has over 400 hectares of recreational open space and 2000 hectares of amenity space. The four river valleys of the Ely, Taff, Rhymney and Nant Fawr provide extensive and continuous blue corridors running from the countryside and through the urban area.

1.2 Overview of Study

The UK has in place legislation passed down from the European Union, 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 is breached in the UK and there are on-going breaches of the nitrogen dioxide limit value in Cardiff. The UK and Welsh Government is taking steps to remedy this breach in as short a time as possible. Within this objective, the UK and devolved governments published a plan for tackling roadside nitrogen dioxide in July 2017. ³

¹Cardiff Council Adopted Local Development Plan 2006-2026

² Annual Population Survey 2014

³ <u>https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017</u>

Due to modelled air quality exceedances Cardiff Council has been directed ⁴ by the Minister to produce a feasibility study, to identify the option which will deliver compliance with legal limits for nitrogen dioxide in the area for which the authority is responsible, in the shortest possible time.

The Direction specified that Cardiff Council was required to produce an Initial Scoping Proposal, which required the Council to set out its proposed approach to the feasibility study and included a scope of work, governance, resourcing, procurement approach, indicative costs and timings. This report was required to be submitted, to Welsh Government no later than the 31st March 2018. Cardiff Council submitted this proposal to Welsh Government in March 2018⁵.

The Direction subsequently requires two further aspects of the feasibility study. Firstly an **Initial Plan**, setting out the case for change and identifying, exploring, analysing and developing options for measures which the local authority will implement to deliver compliance in the shortest possible time, with indicative costs for those options. The Direction required this report be submitted to Welsh Government no later than the **30**th **September 2018**. This report was submitted to Welsh Government in line with the timelines of the direction.

This report acts an Interim Plan, setting out an Outline Business Case (OBC) for a preferred option. This will enable the Council to develop a **Final Plan**, which as part of the Direction requires the Council to identify in detail the preferred option for delivering compliance in the shortest possible time, including a Full Business Case (FBC) setting out value for money considerations and implementation arrangements and timings. The Direction requires this report be submitted to Welsh Government no later than the **30**th **June 2019**.

The focus of the Feasibility Study is on achieving results in the shortest time possible, and in accordance with the High Court Order in November 2016⁶ will only consider cost when comparing between two equally quick schemes.

1.3 Purpose of This Report

As detailed above this report is an Interim Initial Plan setting out an OBC which follows the requirements of an Outline Case for a preferred option which will bring about compliance with the Limit Value for annual mean NO₂ in the shortest time possible in Cardiff.

It has been produced where feasible in line with the Inception, Evidence and Options Appraisal packages of Guidance issued by the Joint Air Quality Unit (JAQU) in 2017, and the HM Treasury Green Book⁷. It also reflects the requirements of the Welsh Transport Appraisal Guidance (WelTAG).⁸

1.4 Summary of Initial Plan

The results of the local baseline modelling results are presented in detail in the Initial Plan Report⁹ submitted to Welsh Government on the 30th September 2018. The results of the local modelling differed to that undertaken by Defra using the Pollution Climate Mapping model.

⁴ Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) Air Quality Direction 2018 14th Feb 2018

⁵ Cardiff Council Initial Scoping Report for Feasibility Study

⁶ November 2016 in R (Client Earth) (NO₂) V Secretary of State for Environment Food and Rural Affairs [2016] EWHC 2740 (Admin).

⁷ HM Treasury Green Book

⁸ <u>https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag</u>

⁹ Cardiff Council, Clean Air Feasibility Study – Initial Plan, September 2018.

DEFRA's modelling identified two road links under baseline conditions which were projected to show non-compliance beyond 2021 as detailed in Figure 1. The roads that were modelled as exceeding the NO_2 annual limit value for by 2021 using the DEFRA Model were the A48 and the A4232.



Figure 1 - PCM Road Links Results 2021

The localised modelling as reported in the Initial Plan identified only one road link under baseline conditions projected to show non-compliance beyond 2021, this being the A4161 Castle Street as detailed in Figure 2.



Figure 2 - Local Modelling Baseline Results 2021

In assessing the model data the main reason for this exceedance relates to very high traffic flows, some 32,000 vehicles a day and accompanying slow speeds of around 11mph on this specific road link.

The main reasons for the differences between the local model results and the PCM results is primarily down to the fact that the local model has a far greater level of detail which is based on local data, and not national assumptions, and thus can be seen to be a better representation of local circumstances. The key aspects of the local model that influence the results are as follows:

- Traffic flows are based on a local traffic model;
- Traffic speeds are based on a local model and local traffic master;
- Local fleet data from the ANPR, not just national averages; and
- Local topology is accounted for in terms of gradient, canyons,

In 2021 the main contribution to pollution on Castle Street, is anticipated to be road traffic (73 - 78 %), with diesel cars still contributing the largest proportion of emissions (36%) to the total road NOx emissions. The proportion of emissions from HGVs and buses is expected to reduce to 10% and 11% respectively. Figure 3 shows the source apportionment analysis on Castle Street for the baseline assessment for the forecasted year of 2021.



Figure 3 - Source Apportionment Analysis 2021

Within the Initial Plan Report a long list of measures were qualitatively assessed against a primary objective of **achieving compliance with set air quality objectives in the shortest possible time**. The measures were considered against secondary objectives and were subjected to further qualitative assessments against the WeITAG WeII-being Aspects. As a result of this analysis the following shortlist of measures was decided upon and summarised in Table 1.

Measure reference:	Scheme Description
M8	Implement further speed restrictions and enhance already established 20mph Zones.
M13	Development of Cycling Superhighways infrastructure and Expansion of Next bike Scheme
M14	Implement Zero Emission Buses on Cardiff Network
M21	Revision to Taxi Licensing Policy to include emissions standards
M11	Bus Network Programme- Strategic Bus Network to improve bus networks and efficiency of the services via increased and improved bus lanes
M12	Accelerate Park and Ride (P & R) programme in NW & NE of Cardiff. NW; Implement new Park and Ride facilities at Junction 33 (750 Spaces) and Llantrisant Road (250 Spaces). NE; expansion of P & R on the A48.
M10	City Centre West and Central Interchange and Eastside City Centre Schemes
M18	Improve and promote the uptake of low emission vehicles by enhancing Cardiff's EV infrastructure
M23	Review and implement car parking and car permit charges.

Table	1	-	Initial	Shortlist	of	Measures
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It must be noted that the above shortlist of measures were initially identified as measures that would likely have the greatest impact on the road links identified by the PCM modelling as being non-compliant, namely the A48 and A4232 near Cardiff Bay. However, the measures were also assessed in terms of their likely impact on improving air quality within the Councils existing Air Quality Management Areas (AQMAs). As detailed in the Initial Plan Report, the results of the local modelling demonstrated that compliance issues are not forecasted to occur on the A48 or the A4232. Non-compliance issues are now predicted to only occur on Castle Street which is immediately adjacent to the boundary of the City Centre AQMA, and measures put forward to address air quality in this AQMA will likely have an impact on this road link.

The above measures have been grouped together as a package of measures to assess their effectiveness in achieving compliance. In addition to the above measures, the Council is required as part of a benchmarking exercise to assess the effectiveness of a Charging Clean Air Zone (CAZ) as a separate measure.

As detailed in the Initial Plan, the modelling of charging CAZ undertaken by Defra focussed on delivering compliance on the road links identified by the PCM model as being non-compliant. The local baseline modelling has demonstrated that non-compliance issues were not projected on the A48 or A4232 but where restricted to the City Centre with only Castle Street, A4161 projected to be non-compliant.

This report presents the findings of local air quality and transport modelling of the shortlist of measures identified in the Initial Plan and these measures have been benchmarked against a Charging Clean Air Zone. The result of these assessments will enable the Council to identify our preferred option, which will be refined into a Full Business Case to be presented in the Final Plan, which must be submitted to Welsh Government no later than **the 30**th **June 2019**.

Section 2 Strategic Case

2.1 Background and Strategic Context

The <u>Initial Plan</u> report presented a detailed baseline assessment of the existing situation, including an overview of legislation and policies and a description of the current EU Limit Value compliance status for Cardiff as well as a summary of the current local air quality management issues within Cardiff, and a summarised version is presented below.

2.1.1 UK Air Quality Strategy

The UK Air Quality Strategy¹⁰ identifies nine ambient air pollutants that have the potential to cause harm to human health. These pollutants are associated with local air quality problems, with the exception of ozone, which is instead considered to be a regional problem.

The Air Quality (Wales) Regulations and subsequent amendments (National Assembly for Wales, 2000 and 2002) set objectives for the seven pollutants that are associated with local air quality. The objectives aim to reduce the health impacts of those pollutants to negligible levels as part of the Local Air Quality Management in Wales

Welsh Ministers have a responsibility to ensure air quality levels in Wales comply with air quality limit values in accordance with the Air Quality Standards (Wales) Regulations, 2010. Cardiff Council has a statutory duty under Part IV of the Environment Act 1995 & Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 to manage local air quality. The Local Air Quality Management (LAQM) process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not air quality objectives are likely to be achieved.

2.1.2 European Air Quality Directives

Air Quality Framework Directive (96/62/EC) on ambient air quality assessment and management defines the policy framework for 12 air pollutants known to have a harmful effect on human health and the environment. The limit values for the specific pollutants are set through a series of Daughter Directives. European Directive 2008/50/EC consolidates existing air quality legislation (apart from the 4th Daughter Directive) and provides a new regulatory framework for PM2.5.

The UK and Welsh Governments have an obligation to achieve European Air Quality Limit Values (Directive 2008/50/EC, Annex III). The most relevant are limits for nitrogen dioxide (NO₂) and Particulate Matter smaller than 10 μ m (PM10) which must not exceed 40 μ g/m3 as an annual mean (i.e. measured over a calendar year). There are a number of requirements of the Directive, including that the Limit Value applies at locations which are accessible, including footpaths but excluding areas within 25m from major road junctions.

In 2015, 37 of the 43 monitored areas across the country were in exceedance of the annual mean Limit Value for NO_2 . One of these 43 areas includes the Cardiff Urban Agglomeration where the Government has forecast that exceedances will remain beyond 2021.

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 Pollution Climate Mapping (PCM) model to forecast exceedances, which is adjusted based on

¹⁰ https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-andnorthern-ireland-volume-1

the monitored data. This is the approved means of reporting air quality information to assess legal compliance with the European legislation.

2.1.3 Air Quality Objectives and Limit Values

The air quality objectives and limit values currently applicable to the UK can be split into two groups. UK air quality objectives set down in regulations for the purposes of local air quality management which are targets; and EU Limit Values transcribed into UK legislation which are mandatory.

A summary of the UK Air Quality Objective and EU Limit Values for NO_2 and particulate matter (PM10 and PM2.5) is given in Table 2.

Furthermore, the UK has a target to reduce average concentrations of PM2.5 at urban background concentrations by 2 μ g/m3 by 2020.

Table 2 - UK and EU Air Quality Objectives for NO₂, PM10 and PM2.5

	Pollutant	Standard/ Concentration	Measured As	Date to be achieved and maintained thereafter
UK Air Quality Objectives	Nitrogen Dioxide	200 µg/m3 not to be exceeded more than 18 times per annum	1 Hour Mean	31.12.2005
		40 μg/m3	Annual Average	31.12.2005
	Particulate Matter (PM 10)	so μg/m3 not to be exceeded more than 35 times per annum	24 Hour Mean	31.12.2004
		40 μg/m3	Annual Average	31.12.2004
	Particulate Matter (PM 2.5)	25 μg/m3	Annual Average	2020
EU Limit Values	Nitrogen Dioxide	200 μg/m3 not to be exceeded more than 18 times per annum	1 Hour Mean	
		40 μg/m3	Annual Average	
	Particulate Matter (PM 10)	50 μg/m3 not to be exceeded more than 35 times per annum	24 Hour Mean	01.01.2010
		40 μg/m3	Annual Average	01.01.2010
	Particulate Matter (PM 2.5)	25 μg/m3	Annual Average	2015

2.2 Public Health Impacts

There is clear scientific evidence which shows that air pollution exposure reduces life expectancy by increasing mortality and morbidity risk from heart disease, and strokes,

respiratory diseases, lung cancer and other conditions¹¹. Public Health Wales have stated that poor air quality is probably the second greatest health concern after smoking and is the most significant environmental determinant of health.

In the UK it has been estimated that an equivalent of **29,000** deaths are attributed to long term exposure to fine particulate air pollution exposure each year and an equivalent of **23,500** deaths are attributed to long term exposure to nitrogen dioxide (NO₂) exposure each year¹². There is an overlap between the effects of both pollutants; as such, it has been estimated that the equivalent of **40,000 deaths** occur each year in the UK as a result of exposure to outdoor pollution¹³. On average, exposure reduces the life expectancy of every person in the UK by 7 to 8 months¹⁴. It has been estimated that reducing particulate air pollution by 10 µg/m3 in the UK would extend lifespan by five times more that eliminating casualties on the roads or three times more that eliminating passive smoking¹⁵.

In Wales, based on data for the period 2011-2012, it has been estimated that an equivalent of **1,604** deaths can be attributed to fine particulate exposure each year, and **1,108** deaths can be attributed to nitrogen dioxide exposure each year¹⁶. Accounting for the pollutant effect overlap, it is estimated that an equivalent of around **2,000** deaths occur each year in Wales as a result of exposure to fine particulate and NO₂ exposure each year.

A study undertaken in 2014 published by Public Health England estimated that in **Cardiff 143** deaths were attributable to exposure to fine particulate air pollution.¹⁷ More recent work by Public Health Wales estimates that the equivalent of over 220 deaths each year among people aged 30 and over in the Cardiff and Vale area that can be attributed to NO₂¹⁸ with many more citizens suffering ill health as a consequence of poor air quality.

In 2012, the International Agency for Research on Cancer listed diesel exhaust pollution as a Class 1 carcinogen and extended this to all ambient air pollution in 2013.

For particulate air pollution and nitrogen dioxide there is no safe level of exposure and any initiatives to reduce air pollution will have positive health benefits. Welsh Government have indicated that the national air quality objectives used to identify Air Quality Management Areas (AQMAs) should not be seen as 'safe' levels and impacts are observed below levels permitted by current legal limits. Air pollution can cause adverse effects on health and quality of life at lower exposures, depending on the circumstances of the exposed individual. As a consequence, the majority of the avoidable health burden associated with air pollution in Wales is the result of population exposures outside AQMAs.

Although air pollution is a public health priority in Wales, its management needs to be a collaborative approach between public bodies, private companies, third sector partners and the public, all whom have important roles to play in addressing this pressing issue.

¹⁴ Defra. The air quality strategy for England, Scotland, Wales and Northern Ireland (vol. 1). 2007.

¹¹ WHO. Review of evidence on health aspects of air pollution-REVIHAAP. 2013. Copenhagen: WHO.

¹² Defra. Draft plans to improve air quality in the UK: tackling nitrogen dioxide in our towns and cities. UK overview document. 2015. London: Defra.

¹³ Royal College of Physicians and Royal College of Paediatrics and Child Health (2016). Every breath we take: the lifelong impact of air pollution. From: <u>https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution</u>

 ¹⁵ Defra (2017) Air Quality: Public Health Directors briefing. From https://laqm.defra.gov.uk/assets/63091defraairqualityguide9web.pdf
 ¹⁶ Brunt. H and McCarthy J., (2017). Estimating the mortality burden of air pollution in Wales

¹⁷ Gowers. A. M, Miller., BG, Stedman., JR. Estimating local mortality burdens associated with particulate air pollution. 2014. London: Public Health England

¹⁸ Estimating the mortality burden of air pollution in Wales, Public Health Wales

Poor air quality does not only have a significant health impact but it also has a wider societal cost. Accounting for health service costs and reduced productivity through lost work-days in the UK this is significant, standing at around $\pm 20b$ every year.¹⁹

Widespread air pollution is associated with routine car use for journeys within, into and out of, Cardiff. Well-designed measures to reduce air pollution will also increase active travel rates. Reducing reliance on the car as the primary mode of transport will have co-benefits of increased physical activity, mental well-being, and improved productivity and reduced stress, and will play a vital role in reducing carbon emissions which contribute to climate change.

The Director of Public Health's Annual Report 2017 highlights how our built environment has become increasingly shaped around car use over the last 50 years, with journeys made by car across the UK increasing from 27% to 83% over that period, while journeys made by bus have fallen from 42% to 5%, and by cycling from 11% to 1%. Over half of adults in our area are overweight or obese. To help reduce these levels, as well as levels of cardiovascular disease and type 2 diabetes, we need active travel to become the default for short journeys once again.

2.3 Air Quality in Cardiff

2.3.1 Monitoring

Currently there are 75 locations across Cardiff where monitoring for annual nitrogen dioxide (NO_2) concentrations is undertaken with the use of passive diffusion tubes. In addition, automated AURN monitoring stations are located on Frederick Street in the City Centre and Newport Road, which provide continuous monitoring for Nitrogen Dioxide (NO_2) , Particulate Matter $(PM_{10} \& PM_{2.5})$, Sulphur Dioxide (SO_2) , Carbon Monoxide $(CO) \& Ozone (O_3)$.

2.3.2 Air Quality Management Areas

Based on monitoring results and further detailed assessments there are currently 4 Air Quality Management Areas (AQMAs) declared across the authority which were all declared due to exceedances of the annual mean NO₂ Air Quality Standard (40 μ g/m³), known to be derived from road transport.

Two AQMAs are primarily focused in Cardiff City Centre (Cardiff City Centre AQMA established: 01/04/2013 & Stephenson Court AQMA established: 01/12/2010). North of the City Centre, lies the Llandaff AQMA established: 01/04/2013 and to the west of Cardiff is the Ely Bridge AQMA established: 01.02.2007.

Figure 4 details the location of the AQMAs and the results of the latest 2017 monitoring for NO_2 monitoring across Cardiff as reported in the Councils 2018 Annual Progress Report²⁰. As yet the 2018 data has not been finalised and reported in the 2019 Annual Progress Report so these values have not been reported in this report.

¹⁹ Royal College of Physicians and Royal College of Paediatrics and Child Health (2016). Every breath we take: the lifelong impact of air pollution.

²⁰ Cardiff Council 2018 Local Air Quality Management Annual Progress Report





2.3.3 Improvements to Air Quality -Progress to Date

The Council has a statutory requirement to produce an Air Quality Action Plan (AQAP) for each identified AQMA within the local authority area. However previous experience in implementing singular actions plans in Cardiff has not proven to be sufficiently successful. The main issue with this particular approach is that the AQAP focuses on introducing local measures to individual road links/ areas, which only targets at improving air quality within the identified AQMA itself.

Whilst such measures have been successful in improving air quality within the individual AQMA (High Street/ St Mary's Street Action Plan) such localised measures can ,and have led, to an adverse impacts on air quality in surrounding areas and result in more widespread air quality issues. These plans have not been sufficient enough in looking at the primary cause of the problem, this being road traffic derived emissions, resulting in air quality levels being detrimentally increased in neighbouring areas.

The Council recognise that there is no defined "safe level" when describing levels of NO_2^{21} . The Council is committed to achieving NO_2 levels as low as reasonably practicable.

Datasets for annual average NO₂ levels recorded at relevant public exposure locations within the AQMAs do display signs of improvement. However, levels are consistently elevated and are seen to be either exceeding or encroaching on the annual average NO₂ objective. Table 3 draws upon ratified NO₂ datasets monitored via passive diffusion tubes at most relevant sensitive receptor locations, i.e., residential facades within each AQMA.

AQMA	Site ID	Bias Adjusted Annual Average NO ₂ Concentration (µg/m ³)					
		2012	2013	2014	2015	2016	2017
City Centre	143	41.5	42.1	42.1	38.2	38.7	38.2
Stephenson Court	131	47.9	43.9	41.2	39.5	39.6	36.7
Ely Bridge	117	42.6	44.9	42.3	39.5	41.3	38
Llandaff	161	43.0	39.1	37.2	32.3	35.0	32.5

Table 3- Five Year Dataset For Monitored Annual Average NO₂ Levels At Residential Facades.

Bold -= exceedance of the Air Quality Standard for NO₂ as an annual average (40 μ g/.m³)

As displayed by Table 3, although it can be suggested that compliance is being met in the existing AQMAs, the Council do not consider these levels as low as reasonably practicable. With Cardiff's expected future growth and approved development works already in progress, further work is needed to ensure compliance with the air quality objectives and EU Limit Values is of a greater magnitude.

In order to monitor the Council's identified strategic measures and their effectiveness, the Council will continue to monitor levels of NO₂ at various relevant exposure locations citywide. The Council will look at improving the network of monitoring across the city by examining ways of increasing monitoring capabilities, for example looking at personal air quality monitoring for the public and purchasing automatic monitoring equipment to provide a further understanding of air quality trends. The Council will also design a transport monitoring programme which will look to examine different modes of transport trends, undertaken on a yearly basis. The scope for such a transport study would include examining figures for cycle trips, school journey mode determination, bus patronage, trends in peak traffic flow times

²¹ Local air quality management in Wales Policy guidance June 2017

and fleet composition analysis using routes through AQMAs and surrounding tributary road networks.

2.4 Early Interventions

Since producing the Initial Plan the Council has made progress on a number of initiatives in Cardiff to promote and encourage modal shift to active travel and additional measures to increase the uptake of low emission vehicles (LEVs) which will ultimately lead to further improvements in air quality and these are summarised below.

2.4.1 On Street Residential Charging Points

The Council has been successful in obtaining a bid from the Office of Low Emission Vehicles (OLEV) 36 charge points in 21 locations across the city and accessible to the public by 31st March 2019. The Council will aim to submit a further bid in 2019/20 to further increase the network of residential charging points.

In addition to the above the Council will also be launching a rapid charge pilot with a commercial provider to assess the viability of undertaking a wider implementation project.

2.4.2 Electric Charging Points at Council Facilities

The Council has made progress in terms of increasing electric charging infrastructure at four main employment hubs. It has been agreed that in 2019/20 for 8 electric vehicle chargers each at County Hall, Lamby Way, Wilcox House and Coleridge Road (i.e., total of 32 chargers).

In conjunction with this the proposals are in place for the Council to fund the hire lease costs of 56 new EVs in 2019/20 (replacing existing petrol/diesel vehicles) and 37 vehicles in 2020/21.

2.4.3 Planning Guidance for the Provision of Electric Vehicle Charging Points

In November 2018, the Council published a guidance documents for developers on the provision of charging points in new developments. This document sets out the Councils expectations on the minimum number of electric charging points that should be provided depending on the nature of the development. The expectations are summarised in Table 4 as follows:

Development Type	Provision
Houses	One electric vehicle dedicated charging point (up to 7kW (32A) where possible) or installation of passive wiring to allow future charging point connection per house with garage or driveway.
Flats	At least 10% of parking bays should be provide with dedicated electric vehicle weatherproof charging points.
Commercial Car Parks and Community Facilities	At least 10% of parking bays should be provided with dedicated electric vehicle weatherproof charging points.
Public Transport Facilities and Taxi Ranks	Charging infrastructure will be required to facilitate the conversion of bus and taxi fleet, using appropriate technological solutions at suitable locations across the city.
Future Proofing	Subject to agreement with the Local Planning Authority standard provision may also require installation of groundwork/passive wiring at the outset to enable further future installation to match demand.

Table 4 - Council Expectations on the Provision of EV Charging Points

2.4.4 Expansion of Nextbike Scheme

Since the introduction of the Nextbike scheme in March 2018, the Cardiff scheme has become the UKs most successful²², with over 150,000 rentals since March 2018. As a result the scheme is set to double with an increase of a further 500 bikes bring the total number of bikes available to 1,000 bikes by the summer of 2019.

2.4.5 Public Service Board Targets

Working initially through Cardiff Public Services Board, a Healthy Travel Charter for Cardiff has been developed with major public sector employers which will be launched in April 2019. Signatories to the Charter make 14 commitments on improving access to active and sustainable travel for staff and visitors to their main sites, and jointly commit to three targets namely:

- Reduce the proportion of commuting journeys made by car;
- Increase the proportion of staff cycling weekly; and
- Increase the proportion of vehicles used for business purposes which are plug-in hybrid or electric.

The Charter will be signed by 11 public sector organisations at launch in April 2019, employing over 33,000 staff, with additional public and private sector organisations subsequently invited to sign up to the Charter.

2.5 Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 (WFG) is a significant enabler to improve air quality as the Act calls for sustainable cross-sector action based on the principles of long-term, prevention-focused integration, collaboration and involvement. It intends to improve economic, social, environmental and cultural well-being in Wales to ensure the needs of the present are met without compromising the ability of future generations to meet their own needs. The Act places responsibilities on public bodies in Wales to work in new ways (including via Public Services Boards) towards national Well-being goals. Progress is measured against a suite of well-being and Public Health Outcomes Framework indicators; there is one specifically concerned with air pollution.

As Figure 5 illustrates, the Act is the legislative vehicle for "Health in all Policies in Wales" and provides the underpinning principles for all policy and decision making, including economic development, in Wales. Reducing air pollution, health risks and inequalities can help contribute to most, if not all, of the well-being goals. As such, the Act presents excellent opportunities to change policy and practice to enhance air quality management arrangements across Cardiff (and wider).

²² NextBike In Depth Review 2018

Figure 5 - The Well- being of Future Generations (Wales) Act 2015 Matrix



2.5.1 Cardiff Well-Being Plan 2018-2023

Under the Act the Cardiff Public Services Board (PSB) has produced its Well-Being Plan for 2018-2023²³, which sets out the Cardiff PSB's priorities for action over the next 5 years, and beyond. The Plan contains Well-being Objectives, high-level priorities that the Cardiff PSB have identified as being most important. It also contains 'Commitments,' or practical steps that the city's public services, together, will deliver over the next 5 years. The Well-Being Plan has set out Well-Being Objectives as follows:



- **Objective 1** A Capital City that Works for Wales;
- **Objective 2** Cardiff grows in a resilient way;
- Objective 3 -Safe, Confident and Empowered Communities
- **Objective 4** Cardiff is a great place to grow up;
- **Objective 5** Supporting People out of poverty;
- **Objective 6** Cardiff is a great place to grow older; and
- **Objective 7** -Modernising and Integrating Our Public Services

Within the Well-Being Plan Objective 2 details the following; *Cardiff is one of Britain's fastest* growing cities, and is by far the fastest growing local authority area in Wales. Successful cities are those in which people want to live and this growth is welcomed and a sure sign of strength for the city. However, this growth will bring challenges too, putting pressure on both the city's physical infrastructures, community cohesion, its natural environment and public services. Managing the impacts of this population growth and of climate change in a resilient and sustainable fashion will be a major long term challenge for Cardiff.

Improving levels of NO₂ and particulate matter ($PM_{10, 2.5}$) is a City level outcome indicator that the PSB will seek to impact in order to meet this specific Objective. The Plan forecasts a future Cardiff with improved air quality and has committed to taking 'a *city-wide response to air pollution through supporting the development and delivery of a Cardiff Clean Air Strategy.*' Given the primary critical success factory of this feasibility study is achieve compliance with Limit Value for NO₂, it is fairly obviously that this study will fully compliment and assist the PSB in achieving their Objective. The work to develop a Clean Air Strategy has been fundamental in developing this study, and enabled the development of a long list of measures that was assessed in the Initial Plan in terms of the measures meeting the primary success factory. The Clean Air Strategy is included in Appendix C.

2.5.2 National Well-Being Goals and the Five Ways of Working

The feasibility study will ensure that future decision making in terms of air quality will comply with the WFG in terms of ensuring that meets the five ways of working as set out below.

Long term – The feasibility study will balance short-term needs of achieving compliance with the limit value in the shortest possible time, with the need to safeguard the ability to ensure longer term continued improvement in air quality within Cardiff. Whilst the measures assessed later in this report provide potential solutions to the identified compliance issues, the Council has longer term ambitions to improve air quality in Cardiff beyond legal limits, in order to reduce public exposure to as low as reasonable practical. This is demonstrated in the full Clean Air Strategy as detailed in Appendix C which sets out further measures that are not intended to achieve compliance in the shortest possible time, but provide further initiatives to ensure that once compliance is achieved the focus of the Council is to provide wider improvements in air quality thus fulfilling one of the aims for Objective 2 of the Well-Being Plan for Cardiff.



Prevention –By implementing the preferred option identified by this study, the Council will ensure improvements in air quality are achieved, as demonstrated by the modelling work reported in Section 3.3. This will ensure that preventative action is taken by the Council to address the air quality issues in terms of not only achieving compliance in the shortest possible time, but implementing wider measures as detailed in the Clean Air Strategy and Action Plan to prevent air quality getting worse in the future, thus protecting public health and the wider environment.



Integration—The development of a preferred option in the Final Plan will take into consideration other public body's well-being objectives and will assess how the preferred option may impact upon each of the well-being goals, or on the objectives of other public bodies. The Council has worked with the PSB in developing this study and has ensured the PSB has been fully informed on the development of the study.



Collaboration –The development of the shortlist of measures and preferred option detailed within this report has been done so in collaboration with many departments within the Council and other external organisations, e.g., Public Health Wales. This collaborative approach will be taken forward in the development of the preferred option in the Final Plan.



Involvement –Prior to developing the Final Plan the preferred option as set out by this report, will be subject to an appropriate level of public engagement (see Section 2.7) which will ensure that the most relevant stakeholders and interest groups have an opportunity be fully involved and their opinions on the preferred option considered as the Council develops our Full Business Case to be presented in the Final Plan. Overall, improving air quality and developing a preferred option to achieve compliance with the NO_2 limit value, contributes significantly to the majority of the well-being goals, but specifically as follows:



A Globally Responsible Wales – Poor air quality is recognised globally as a major health and environmental issue that needs urgent action. The development of a preferred option and its subsequent implementation will see Cardiff Council work towards improving air quality and leading the way for Wales.



A Healthier Wales – As detailed in Section 2.2 air quality is now considered the greatest environmental risk to health with proven detrimental impacts on human health. The development and implementation of our preferred option will ultimately improve the air quality within Cardiff, which will provide overall public health benefits. The inclusion of measures to increase active travel and behavioural change will lead to a more active and healthier population in Cardiff, and cleaner air will ultimately encourage further uptake of active travel.



A Prosperous Wales – As detailed in Section 2.2 the impact of poor air quality has a secondary impact on productivity due to days lost and thus an impacts on the health service costs. The implementation of the preferred option to address the compliance issues and to improve air quality will have additional benefits in terms of productivity and a reduction in health service costs.

2.6 Consistency and Relevance with Other Policies

2.6.1 Local Policy

2.6.1.1 Local Transport Plan

Cardiff Council's longstanding vision for transport in the city is for:

"An integrated transport system that offers safe, efficient and sustainable travel for all, where public transport, walking and cycling provide real and desirable alternatives to car travel, which contributes to making Cardiff Europe's most liveable capital city."

Our priorities to achieve this are:

- 1. Widening travel choices making it practical for most daily trips to be made by alternatives to the car, such as public transport, walking and cycling;
- 2. Demand management taking steps to reduce the demand for travel overall, and particularly by car; and
- 3. Network management using technology to make best use of the existing highway network, rather than building new roads that would generate more traffic.

As a result, it is necessary to assess how the various options considered to improve the air quality in Cardiff will align with, and support, the realisation of the strategic objectives contained within the emerging policy documents.

The key strategic themes and principles of the existing policies overlap with several of the critical success factors used in the economic assessment, including those related to air quality improvements, benefits to the economy, social inclusion and public health benefits.

Cardiff is growing and changing, and this brings more journeys and more pressures on Cardiff's transport network. Reducing the number of car journeys made in the city, and promoting the use of active and sustainable modes of travel, is central to Cardiff Council's Transport Strategy and in improving air quality in the city. Our Local Development Plan (LDP) provides for 41,000 new homes and up to 40,000 new jobs up to 2026. The LDP sets the target of achieving a 50:50 modal split – this means that 50% of all journeys need to be made by sustainable transport by 2026 in order to accommodate the future development set out in the LDP. Our policies set out in the LDP support the need to secure significant improvements to the public transport and active travel networks in combination with new developments.

Cardiff's Local Transport Plan (LTP) was approved by the Welsh Government in May 2015. The LTP sets out our main transport infrastructure proposals which will support this significant modal shift. The Local Transport Plan recognises the need to improve air quality and in doing so its programme prioritises:

- Development of active travel networks to increase walking and cycling for local journeys;
- The provision of cycling infrastructure;
- The bus network;
- Reduced speed limits;
- Reducing congestion;
- Improving transport efficiency and reliability; and
- Bus based park and ride

The LTP has been used to help develop a number of the measures which have been assessed by this study.

2.6.1.2 Cardiff's Local Development Plan 2006-2026

Cardiff's Local Development Plan (LDP) 2006-2026, forms the basis for decisions on land use planning in Cardiff up to 2026 and assumes that, within the plan's time frame, approximately 40,000 new jobs and 41,100 new dwellings will be developed in Cardiff as a direct response to Cardiff's role as the economic driver of the City-region.

In addition to its independent examination, the LDP was subject to a Strategic Environmental Assessment (SEA) to ensure that the policies reflect sustainability principles and take into account environmental impacts.

Policy KP2 of the LDP allocates 8 Strategic Sites to help meet the need for new dwellings and jobs. These strategic allocations on both Greenfield and brownfield sites will include 500 homes or more and/or include significant employment/mixed uses which will bring significant benefits to the city. The sites are:

- (i) Cardiff Central Enterprise Zone;
- (ii) Former Gas Works, Ferry Road;
- (iii) North West Cardiff;
- (iv) North of Junction 33 on the M4;
- (v) South of Creigiau;
- (vi) North East Cardiff (West of Pontprennau);

- (vii) East of Pontprennau Link Road; and
- (viii) South of St. Mellons Business Park Employment Only.

The LDP identifies that sustainable transportation solutions are required in order to respond to the challenges associated with new development by setting out an approach aimed at minimising car travel, maximising access by sustainable transportation and improving connectivity between Cardiff and the wider region.

The Plan sets out a strategy to achieve this by making the best use of the current network, managing demand and reducing it where possible by widening travel choices. The aim is to secure a modal split of 50% car and 50% non-car modes.

The following LDP policies are of relevance to air quality;

KP8: SUSTAINABLE TRANSPORT

Development in Cardiff will be integrated with transport infrastructure and services in order to:

i. Achieve the target of a 50:50 modal split between journeys by car and journeys by walking, cycling and public transport;

ii. Reduce travel demand and dependence on the car;

- iii. Enable and maximise use of sustainable and active modes of transport;
- iv. Integrate travel modes;
- v. Provide for people with particular access and mobility requirements;
- vi. Improve safety for all travellers;
- vii. Maintain and improve the efficiency and reliability of the transport network;
- viii. Support the movement of freight by rail or water; and
- ix. Manage freight movements by road and minimise their impacts

For Cardiff to accommodate the planned levels of growth, existing and future residents will need to be far less reliant on the private car. Therefore, ensuring that more everyday journeys are undertaken by sustainable modes of transport, walking, cycling and public transport, will be essential.

KP14: HEALTHY LIVING

Cardiff will be made a healthier place to live by seeking to reduce health inequalities through encouraging healthy lifestyles, addressing the social determinants of health and providing accessible health care facilities. This will be achieved by supporting developments which provide for active travel, accessible and useable green spaces, including allotments.

KP18: NATURAL RESOURCES:

In the interests of the long-term sustainable development of Cardiff, development proposals must take full account of the need to minimise impacts on the city's natural resources and minimise pollution, in particular the following elements.....minimising air pollution from industrial, domestic and road transportation sources and managing air quality.

EN13: AIR, NOISE, LIGHT POLLUTION AND LAND CONTAMINATION

Development will not be permitted where it would cause or result in unacceptable harm to health, local amenity, the character and quality of the countryside, or interests of nature conservation, landscape or built heritage importance because of air, noise, light pollution or the presence of unacceptable levels of land contamination.

C6: HEALTH

Priority in new developments will be given to reducing health inequalities and encouraging healthy lifestyles through:

i. Identifying sites for new health facilities, reflecting the spatial distribution of need, ensuring they are accessible and have the potential to be shared by different service providers; and *ii.* Ensuring that they provide a physical and built environment that supports interconnectivity, active travel choices, promotes healthy lifestyles and enhances road safety.

The LDP also outlines the approach the Council will take to increase the proportion of people travelling by sustainable modes and to achieve the 50:50 modal split target. This will involve:

- enabling people to access employment, essential services and community facilities by walking and cycling through, for example, high quality, sustainable design and measures to minimise vehicle speed and give priority to pedestrians and cyclists;
- developing strategic bus and rapid transit corridor enhancements and facilitating their integration with the wider transport network;
- facilitating the transfer between transport modes by, for example, improving existing interchanges and developing new facilities such as strategically located park and ride facilities; and
- maximising provision for sustainable travel within new developments and securing infrastructure investment which can support modal shift within existing settlements.

2.6.1.3 Capital City Regional Deal

The Cardiff Capital Region (CCR) City Deal is a programme agreed in 2016 between the UK Government, the Welsh Government and the ten local authorities in South East Wales to bring about significant economic growth in the region through investment, upskilling, and improved physical and digital connectivity.

One of the Cardiff Capital Region (CCR)'s objectives is to connect communities, business, jobs, facilities and services in the area. The CCR Transport Authority, working closely with the Welsh Government, Transport for Wales and others, has been established as a subcommittee by the CCR Cabinet to facilitate the City Deal by coordinating transport planning and investment across the region. The transport improvements underlying the CASAP measures to be assessed later in this report will be fundamental to delivering this objective of CCR.

2.6.2 National Policy

There are a number of key Welsh Government Policy strands that our feasibility study directly relate to and compliment and thus the outcomes of this study should act as a catalyst to achieving a number of these policies.

2.6.2.1 Prosperity for All

In September 2017, the Welsh Government published a national strategy, Prosperity for All²⁴ to deliver its key priorities during the latest term of the Assembly. One of the key themes of this strategy is to build healthier communities and better environments, and a key aspect of this theme is to reduce emissions in order to deliver improvements to air quality. The Councils Feasibility Study and identification of a preferred option to deliver legal compliance will work towards this building healthier communities and better environments by ensuring compliance with the Ambient Air Quality Directive is achieved in the shortest possible time.

²⁴ Welsh Government, 2017 – Prosperity for All

2.6.2.2 Welsh Transport Policy

A revised Wales Transport Strategy is due to be published by the end of the 2019, and it is understood that Improving air quality by reducing emissions will be key pillar within this strategy. Many of measures within the CASAP package of measures which will be assessed in detail later in this report aim to reduce emissions, through vehicle upgrades/ retro fitting existing bus fleets, and increasing the uptake of active travel. The implementation of a preferred package of measures which priorities such measures will ensure consistency with the

2.6.2.3 Planning Policy Wales

Welsh Government have stated in the most recent Planning Policy Wales (PPW)²⁵ that it is s committed to reducing reliance on the private car and supporting a modal shift to walking, cycling and public transport. Delivering this objective will make an important contribution to decarbonisation, *improving air quality*, increasing physical activity, improving the health of the nation and realising the goals of the Well-being of Future Generations Act.

PPW further states that Air just barely compliant with these objectives is not 'clean' and still carries long-term population health risks, and thus it is desirable to keep levels of pollution as low as possible.

The Councils feasibility study, therefore fully compliments PPW in terms of implementing measures that look to reduce the reliance on the private car and increasing modal to active and public transport. Such measures will be assessed in terms of not only achieving compliance but reducing levels of NO_2 to as low as reasonable practical.

2.6.2.4 Active Travel (Wales) Act 2013

This Act²⁶ came into force in September 2014 and requires local authorities to map and continuously improve routes and facilities for cycling and walking. Reducing road traffic emissions will be a key aspect of the measures being taken forward and thus the increase in modal shift to active travel will be a key component of the Councils preferred option to achieve compliance. The increase in active travel will be assessed as part of the CASAP measures.

2.7 Stakeholder Engagement

In order to ensure that Cardiff Council implements a solution that not only delivers compliance in the shortest possible time, but ensures that such a solution is supported and welcomed by citizens, businesses and visitors to Cardiff it will be vitally important to fully engage and work with the public and businesses to ensure that the preferred option implemented meets the citizens expectations.

2.7.1 Consultation on the Green Paper on Transport and Clean Air

At the end of March 2018 the Council launched a Green Paper on Transport and Clean Air²⁷. The paper set out a number of proposals/ ambitions termed as 'Big Ideas' on measures to improve transport and air quality in Cardiff.

Cardiff's Transport & Clean Air Green Paper

Changing how we move around a growing city



²⁵ <u>Planning Policy Wales – 10th Edition December 2018</u>

²⁶ Active Travel (Wales) Act 2013

²⁷ https://www.cardiff.gov.uk/ENG/resident/Parking-roads-and-travel/tra paper/Documents/Cardiff%27s%20Transport%20and%20Clean%20Air%2(

Fundamentally the paper focused on the need to tackle congestion and offer active travel options to discourage unnecessary private car use, keeping the city moving and ensuring the health of citizens. The paper enabled members of the public, businesses and other organisations a chance to score the proposals in terms of preference of them being implemented in Cardiff.

Consultation on the Cardiff's Transport and Clean Air Green Paper was open from the 26th March to the 1st July 2018.

The consultation centred on an electronic survey, with a communication campaign conducted via social media.

The survey received 3,580 total valid survey responses (including 266 partial responses) The total number of surveys collected from schools was 285. At the time of writing this report the full detailed assessment of the consultation responses is ongoing but some key headline data can be extracted from this survey.

The Top 3 'Big Ideas' were:

- Integrated Ticketing
- Zero Carbon Bus Fleet
- Improving the digital network and user information (for public transport).

The lease favourable 'Big Ideas' were:

- Autonomous Vehicles
- Parking Levies (increase parking charged and or work place parking levies)
- A Total City 20mph Zone

The information above does indicate that there is a desire for an increase use in Public Transport given that the 'top 3' all relate to improvements in public transport measures. Consideration of the outcome of this consultation has informed the refinement of the shortlist of measures that have been fully assessed as detailed in Section 3.3.

2.7.2 Engagement on Preferred Option

The Council will launch an engagement exercise on our preferred option to enable appropriate views of the citizens of Cardiff and specifically key groups on the preferred option to be considered.

In designing this engagement exercise it is important, to understand that the length of engagement is severely restricted by the requirements of the Direction to produce a final plan no later than the 30th June 2019. Owing to the fact that the feedback from the consultation will need to be considered when developing the FBC, the time period of the consultation has been reduced to a maximum 6 weeks. Similar engagement periods have been undertaken by other UK cities under legal Direction to produce a feasibility study.

Further details on the Communication strategy are detailed in Section 6.6 with the full Communication Strategy presented in Appendix E.

2.8 The Case for Change

2.8.1 Primary Objective

The primary objective of the feasibility study is to deliver a scheme that leads to compliance with the EU AAQD annual average NO_2 limit value in the shortest possible time and thus to identify a preferred option to achieve this.

2.8.2 Secondary Objectives

JAQU's Options Appraisal Package ²⁸document states that while the primary CSF allows appraisers to test whether an option meets the minimum requirements, other secondary CSFs are needed to undertake a comparative assessment of the options. The guidance states that these may include factors such as value for money, distributional impacts, wider strategic air quality policy alignment, affordability and achievability.

Following this guidance, a number of secondary CSFs have been defined for the Plan for which options that have been assessed as achieving the Primary CSF have been further assessed against. Further, this study contributes to the strategic priorities for Cardiff Council, including that of the Well-being of Future Generations (Wales) Act 2015. As such, based on the Future Generations Act and the further recommendations within The National Institute for Health and Care Excellence (NICE)²⁹ on air quality guidelines and health, the following are considered as **secondary objectives** in the appraisal process:

- Will the measure deliver an overall reduction in NO₂ emissions to air;
- Will the measure result in additional benefits or other environmental improvements;
- Will the measure contribute to well-being goals:
 - Will the measure have a positive impact on wider public health;
 - Mitigate financial impact on low income households and reduce inequalities;
- Does the option fit or compliment other local policies;
- Value for Money Do the likely benefits of this option exceed the costs; and
- Are there constraints that prevent/ impact on the implementation of the measure.

Section 3 Economic Case

3.1 Introduction

As detailed above in Section 1.4 the Council reported on a shortlist of measures that were assessed against the primary and secondary objectives of the study. For reference the shortlist of measures are detailed in Table 5 as follows;

Table 5 - Shortlist of Measures Detailed in Initial Plan

Measure reference:	Scheme Description	
M8	Implement further speed restrictions and enhance already established 20mph Zones.	

²⁸ Joint Air Quality Unit - OPTIONS APPRAISAL GUIDANCE 2017

²⁹ NICE (2017). Air pollution: outdoor air quality and health. NICE Guideline NG70

M13	Development of Cycling Superhighways infrastructure and Expansion of Next bike Scheme
M14	Implement Zero Emission Buses on Cardiff Network
M21	Revision to Taxi Licensing Policy to include emissions standards
M11	Bus Network Programme- Strategic Bus Network to improve bus networks and efficiency of the services via increased and improved bus lanes
M12	Accelerate Park and Ride (P & R) programme in NW & NE of Cardiff. NW; Implement new Park and Ride facilities at Junction 33 (750 Spaces) and Llantrisant Road (250 Spaces). NE; expansion of P & R on the A48.
M10	City Centre West and Central Interchange and Eastside City Centre Schemes
M18	Improve and promote the uptake of low emission vehicles by enhancing Cardiff's EV infrastructure
M23	Review car parking and car permit charges.

The results of baseline modelling showed there to be NO_2 exceedances in different areas to those shown by the national PCM model. In particular, the baseline results showed that concentrations were higher in the city centre than previously shown in the PCM model, and with levels close to the limit value on the A470. Hence a further modelling scenario was developed – labelled CASAP 3 – to address these road links, focusing specifically on the city centre and the A470. As such and following the submission of the Initial Plan further potential shortlisted measures have been considered in CASAP 3 as follows:

- Impact of a Clean Bus Technology (Retrofit) Scheme on buses operating in Cardiff. The modelling assumed 94 Cardiff Buses based on a previous grant application;
- Additional general traffic lane (Nantgarw to Tongwynlais) on A470 created by narrowing other lanes; and
- New bus-based Park and Ride close to A470/A468/A4054 junction at Nantgarw.

In addition to the above and in line with the Joint Air Quality Units (JAQU) Options Appraisal Guidance, a Charging Clean Air Zone (CAZ), has also been taken forward as a benchmarking option, as the guidance clearly states that '*local authorities are required to shortlist, and take forward for full modelling, the lowest class of charging Clean Air Zone that will deliver compliance in the year after implementation, as the benchmark option.*'

However, with regard to the benchmarking exercise the Council is mindful, of further JAQU guidance, 'Evidence Based Approach to Setting Clean Air Zone Charges' which clearly states on a number of occasions that 'The Joint Air Quality Unit (JAQU) is clear that charging Clean Air Zones (CAZs) should only be implemented if non-charging alternatives have been found to be insufficient to bring about compliance with air quality limits in the shortest possible time.

In light of this it is the Council's opinion that should the measures achieve compliance, in the same time as a charging CAZ then the likely preferred option that the Council will develop further will be a package of measures.

As detailed in the Initial Plan, in order for the study to provide a robust assessment of the impacts of these measures, that they be modelled as a package of measures rather than individual measures. The rest of this section provides the methodology and results of the transportation and air quality modelling results of the package of measures and a Clean Air Zone scenario.

3.2 Modelling of the Shortlist of Measures

The section outlines the transport modelling work undertaken by Mott MacDonald to assess the transportation impacts of the proposed measures to develop the evidence base to progress this study. Transport modelling has been undertaken using the South East Wales Transport Model (SEWTM) using methods that are appropriate for a high-level feasibility study. The full details of the transport modelling are included in Appendix B of this Report.

3.2.1 Clean Air Strategy & Action Plan (CASAP) Package Interventions

The CASAP Package transport interventions have been assessed using the 2021 baseline as a starting point and applying highway network and trip matrix adjustments using methods set out in Table 6. The full details of the full transportation modelling methodologies are detailed in full in Appendix B.

CASAP Measure	Measure Description	Modelling Methodology Employed
1	Active travel packages, covering two areas close to the city centre	For each of the locations a 3.5%-point reduction in the car driver mode share was
2	Cycling programme to end of 2020, covering a corridor north from the city centre	assumed for trips entirely within the given area, and the car vehicle demand matrices adjusted accordingly
3	New 50mph speed limit on A4232 (Culverhouse Cross to Butetown Tunnels)	The representation of the affected section of the A4232 was changed from a national speed limit link type to a 50mph speed limit link type
4	Westgate Street mid-point closure to general traffic	The central section of Westgate Street was closed to all cars and goods vehicles to prevent through-movements whilst maintaining local access
5	East side scheme, reducing through traffic movements on Station Terrace	Links were opened/closed as appropriate and junctions edited to reflect the proposed scheme.
6	A48 St Mellons bus-based park and ride	For trips in nearby corridors with a trip end in the city centre, a proportion to be intercepted at the new P&R site was assumed, based upon evidence from existing sites. One of the trip ends for these trips was then reassigned from the city centre to the location of the P&R site.
7	M4 J33 park and ride	As item 6, except that the number of trips to be intercepted was calculated using an assumed occupation level (broadly equivalent to current occupation of the East P&R site).
8	Parking charges and controls, affecting vehicles with non-compliant engines.	UK government Joint Air Quality Unit (JAQU) guidance on option appraisal was used to provide estimates of the effect on trip making of implementing charging zones for non- compliant vehicles. A proportion of vehicles affected by increased parking charges was calculated using parking "event" data provided by Cardiff Council. Non-compliant vehicle trips were then moved to the compliant matrix, removed from the matrices altogether, or left unaltered accordingly.

Table 6 - CASAP Measures Transportation Modelling Methodologies
CASAP Measure	Measure Description	Modelling Methodology Employed
9	Smart expressway & traffic management measures on the A470 South (Upper Boat to Coryton) and Traffic management and control measures at Coryton Interchange	Narrow lanes to give extra lane, reallocation of southbound lane to 2 lanes off to Coryton, 1 lane ahead into Cardiff (and this could include better provision for bus going A470 into Cardiff); also looking at speed limit reduction and VMS gantry signage to improve traffic management and air quality.

From Table 6, it is evident that not all the CASAP measures previously detailed are included in in the SEWTM. This is owing to the fact that these measures are purely emission based interventions which can only be modelled in the air quality dispersion model. These measures are the Electrification of and retrofitting of Buses, and the revised taxi licensing policy being based on emission standards. The impacts of these measures are therefore only considered once the results of the transportation model are inputted into the air dispersion model.

3.3 Local Air Quality Modelling Results for CASAP Measures

In line with the detailed modelling exercise that was undertaken to report on the baseline position, as detailed in the Initial Plan, the same modelling has been undertaken to assess the CASAP measures. The full methodology for the air quality modelling is presented in Appendix A. In addition to the modelling assumption detailed above for the transportation model, the following assumptions have been made for the measures that can only be modelled in terms of emissions as detailed in Table 7.

Measure	Description
ULEB application for 36 electric buses	The 36 buses were allocated to routes 27, 49/50, 44/45, with the related bus AADT removed as these are now zero emission. The remaining bus fleet is then adjusted to reflect the removal of 36 older Euro3 vehicles.
Taxi licensing requiring a 10 year age limit and all new renewal or grants 2019 to be minimum Euro 6.	Taxi fleet adjusted to remove all vehicles over 10 years old and replace these by new Euro 6 vehicles.
Retro-fit programme to convert remaining buses to Euro 6	Retro-fit programme to convert remaining buses to Euro 6, similar to Clean Bus Technology Fund (CBTF)

Table 7 - Emission Based Modelling Assumptions

3.3.1 Modelled Results on PCM Road Links

In line with the modelled baseline results, detailed in the Initial Plan, the results for the CASAP packages of measures have been generated for each of the PCM road links. This has been done using the exact same modelling principles as per the baseline assessment and three sets of results have been calculated.

The CASAP 1 scenario shows a general reduction in concentrations across the links, with an average of about 1 μ gm-3. The links where the largest reductions are being seen are those directly affected by the measures such as the electric bus measure. The largest reduction is actually on Castle Street where the electric buses will operate. This is also the exceedance link of concern and this scenario brings it down from 41.1 μ gm-3 to 37.3 μ gm-3. Therefore, the CASAP 1 scenario is enough to bring all the PCM links into compliance.

CASAP 2 provides some further benefit in terms of NO_2 concentrations with some links improving although some links do see a small increase in concentrations. This appears to be driven by changes in the traffic flows caused by vehicles rerouting because of the city centre traffic management schemes and the parking controls. This will also have impacts on vehicle speeds which also affected emissions and hence concentrations.

A full list of tabulated results for the PCM road links for the modelled year of 2021 is shown in Table 8. Mapped results for CASAP3 are shown in Figure 6.

Unsurprisingly, the CASAP 3 package provides the greatest improvements in concentrations, with an average of decrease of 1.3 μ gm⁻³. However there are a number of links were larger reductions are seen, and those road links are directly affected by the specific measures such as the electric bus measure.

The largest reduction is actually achieved on Castle Street where non-compliance was forecast for 2021 under base line conditions, with NO₂ concentrations reduced by 6 μ gm⁻³, from 41.1 μ g/m⁻³ to **35.0 \mug/m⁻³**. However, it is apparent from the results that on some road links there is a very marginal increase in NO₂ concentrations, and this would appear to be as a result of the changes in the traffic flows caused by vehicles rerouting because of the city centre traffic management schemes and the parking controls. This will also have impacts on vehicle speeds which also affected emissions and hence concentrations at these locations.

Pood	PCM Ba	seline	Local E	Baseline	CASAP 1	CASAP 2	CASAP 3
KUdu	2015	2021	2015	2021	2021	2021	2021
A4119	22.4	17.9	37.1	30.7	29.7	30.2	29.73
A4054	19.1	15.0	25.3	19.5	19.1	19.2	17.92
A4119	29.9	24.0	34.4	24.4	23.6	27.6	26.77
A4161	40.3	32.7	34.9	26.2	25.5	25.5	25.31
A48	27.9	22.3	32.9	25.4	24.1	24.1	23.99
A4119	27.2	21.8	23.8	18.8	18.2	18.2	17.75
A470	31.1	25.2	45.4	30.6	27.5	26.5	25.09
A4160	32.2	25.7	36.7	26.9	25.5	25.1	24.94
A4161	43.7	33.8	42.2	30.8	28.8	28.3	27.84
A4161	37.5	29.7	43.9	30.4	28.1	27.3	26.92
A469	33.1	27.1	27.2	21.5	20.7	20.7	20.36
A4160	30.4	25.0	30.4	23.7	22.6	22.3	22.25
A4119	31.9	25.9	36.6	29.0	27.5	27.5	26.77
A4232	47.3	37.7	34.3	29.5	28.0	28.3	28.23
A48	48.8	39.1	40.0	30.6	31.3	31.6	31.45
A4160	28.2	22.7	24.2	19.3	18.9	18.6	18.49
A469	28.5	22.4	33.0	25.8	24.8	24.8	24.59
A4161	29.5	23.3	26.5	20.3	19.6	19.6	19.26
A4161	24.9	20.1	26.6	20.2	19.5	19.9	19.78
A48	31.9	25.7	29.4	22.7	21.9	22.0	21.72
A469	31.8	25.5	32.2	24.7	24.5	24.3	24.02
A4119	28.4	22.9	31.6	24.5	23.5	23.9	23.76
A4161	40.9	33.4	43.7	29.6	28.1	28.0	27.59
A470	40.8	32.5	38.1	27.6	26.1	25.6	25.23

Table 8 - PCM and local model NO₂ concentration results for 2015 and 2021 (NO₂ in µgm-3)

Decil	PCM Ba	seline	Local E	Baseline	CASAP 1	CASAP 2	CASAP 3
Road	2015	2021	2015	2021	2021	2021	2021
A48	45.3	37.1	37.1	28.8	28.0	28.2	28.01
A4160	38.3	32.1	40.0	28.8	27.8	30.0	29.75
A4232	43.1	34.3	32.1	27.5	26.8	27.2	27.09
A4055	34.9	28.4	31.4	25.5	24.0	24.1	24.06
A470	35.6	28.5	37.3	29.1	28.3	28.2	27.96
A470	31.3	24.6	41.3	30.0	27.9	27.8	27.32
A48	59.6	45.4	36.4	27.9	27.6	27.6	27.48
A4232	52.5	40.7	30.1	24.8	22.9	23.0	22.99
A4119	27.5	21.6	28.8	22.3	21.6	21.7	21.42
A4161	41.2	31.9	55.7	41.1	37.3	36.0	35
A4055	35.8	29.1	31.6	24.5	23.4	23.4	23.34
A4234	44.6	36.8	38.2	26.3	25.4	26.3	26.16
A4232	33.6	26.4	21.7	17.5	17.3	17.4	17.31
A4232	42.2	29.9	35.3	28.9	29.6	29.8	29.68
A4160	26.9	21.2	21.0	18.1	16.3	16.4	16.3
A470	26.5	22.2	26.9	21.8	21.4	21.9	21.66
A470	35.4	25.3	34.8	25.2	23.3	23.0	22.42
A4050	30.2	23.1	32.5	25.0	24.1	24.3	24.19

Note: local results are colour coded as green for less than 35μ gm⁻³, amber between 35μ gm⁻³ and 40μ gm⁻³ and red for greater the 40μ gm⁻³ (the compliance threshold). Numbers are rounded to the nearest integer, hence any values less than 40.5μ gm⁻³ are not counted as exceedances



Figure 6- PCM Links Local Model Results for CASAP 3 Package- 2021

3.3.2 Results at Local Monitoring Locations

Modelled 2021 NO₂ concentration results for the CASAP packages of measures scenario at each of the monitoring locations used for reporting on Local Air Quality Management purposes have been calculated, and are detailed in Table 9 below. The baseline 2021 data has been provided for reference.

These results provide an indication of whether compliance is predicted at monitoring locations in 2021 following implementation of the CASAP measures. The implementation of the CASAP package indicates that our local monitoring locations, compliance with the 40 μ g/m3 limit value for is achieved at all sites by 2021, including all those sites in the existing AQMAs. The results are presented in Table 9 . This is an important aspect of the assessment as it further demonstrates that the CASAP measures not only deliver compliance but further improve and reduce relevant exposure in terms of LAQM across Cardiff as whole, which provides further public health benefits.

		Cito turo	Ar	nual Avera	ge NO₂ µg/n	1 ³
Monitoring site name	Site ID	Site type	Baseline 2021	CASAP 1 2021	CASAP 2 2021	CASAP 3 2021
Ninian Park Road	16	Ninian Park Road	14.2	14.0	14.4	14.3
Mitre Place	33	Mitre Place	31.5	29.9	29.8	29
City Road	44	City Road	20.4	19.8	19.8	19.7
Mackintosh Place	45	Mackintosh Place	23.4	23.2	23.0	22.8
Penarth Road	49	Penarth Road	17.1	16.6	16.6	16.5
Birchgrove Village	56	Birchgrove Village	17.1	16.6	16.5	16.3
Westgate Street	58	Westgate Street	30.3	24.9	26.3	25
Stephenson Court	81	Stephenson Court	25.3	24.3	24.1	23.8
104 Birchgrove Road	82	104 Birchgrove Road	18.0	17.5	17.5	17.1
497 Cowbridge Road West	85	497 Cowbridge Road West	15.2	14.6	14.6	14.4
19 Fairoak Road	86	19 Fairoak Road	19.0	18.7	18.7	18.7
Manor Way Junction	96	Manor Way Junction	23.2	22.5	22.4	22
Newport Road (premises)	97	Newport Road (premises)	21.4	20.8	20.8	20.6
Western Avenue (premises)	98	Western Avenue (premises)	18.2	17.6	17.7	17.5
Cardiff Road Llandaff	99	Cardiff Road Llandaff	27.8	26.3	26.3	25.6
Cardiff AURN	101	Cardiff AURN	18.4	17.7	17.5	17.3
Cardiff AURN	102	Cardiff AURN	18.4	17.7	17.5	17.3
Cardiff AURN	103	Cardiff AURN	18.4	17.7	17.5	17.3
30 Caerphilly Road	106	30 Caerphilly Road	24.6	23.7	23.6	23.4
Lynx Hotel	107	Lynx Hotel	21.6	21.1	21.0	20.9
98 Leckwith Road	111	98 Leckwith Road	15.3	14.8	14.9	14.8
17 Sloper Road	112	17 Sloper Road	17.2	16.8	17.2	17.1

Table 9 - Predicted NO₂ Annual Mean Concentrations at Monitoring Site Locations in 2015 & 2021

			Ar	nual Avera	ge NO₂ µg/m	3
Monitoring site name	Site ID	Site type	Baseline 2021	CASAP 1 2021	CASAP 2 2021	CASAP 3 2021
21 Llandaff Road	115	21 Llandaff Road	15.2	14.9	14.9	14.8
25 Cowbridge Road West	117	25 Cowbridge Road West	20.0	19.2	19.2	18.8
Havelock Street	119	Havelock Street	22.3	20.6	20.0	19.2
287 Cowbridge Road East	124	287 Cowbridge Road East	14.4	14.3	14.3	14.1
Westgate Street Flats	126	Westgate Street Flats	27.6	23.0	24.1	23.1
117 Tudor Street	128	117 Tudor Street	16.1	15.8	16.9	16.7
Stephenson Court 2	129	Stephenson Court 2	23.9	23.0	22.9	22.6
Burgess Court	130	Burgess Court	24.5	23.5	23.4	23.1
Dragon Court	131	Dragon Court	24.7	23.7	23.6	23.3
St Mark's Avenue	133	St Mark's Avenue	28.1	27.0	27.0	26.8
Sandringham Hotel	134	Sandringham Hotel	18.8	17.8	16.9	16.6
Lower Cathedral Road	139	Lower Cathedral Road	19.8	19.0	20.8	20.6
Clare Street	140	Clare Street	21.2	20.4	22.3	22.1
Fairoak Road 2	141	Fairoak Road 2	18.9	18.4	18.4	18.4
Windsor House	143	Windsor House	27.9	22.9	24.5	23.3
Marlborough House	144	Marlborough House	26.6	22.4	21.7	20.8
Tudor Street Flats	145	Tudor Street Flats	24.3	23.7	27.3	26.3
Neville Street	146	Neville Street	19.8	18.9	19.4	19.1
211 Penarth Road	147	211 Penarth Road	17.5	17.0	16.7	16.6
161 Clare Road	148	161 Clare Road	18.0	17.4	17.6	17.5
10 Corporation Road	149	10 Corporation Road	16.5	16.1	16.1	16
James Street	152	James Street	22.0	21.4	21.7	21.6
Magic Roundabout	153	Magic Roundabout	21.6	21.3	21.4	21.3
2a/4 Colum Road	156	2a/4 Colum Road	18.5	18.0	17.9	17.7
47 Birchgrove Road	157	47 Birchgrove Road	20.8	20.2	20.2	19.9
64/66 Cathays Terrace	158	64/66 Cathays Terrace	18.0	17.5	17.5	17.4
IMO façade replacement	159	IMO façade replacement	22.6	22.0	21.9	21.7
High Street Zizzi	160	High Street Zizzi	20.6	19.1	18.9	18.5
52 Bridge Road	161	52 Bridge Road	18.9	18.2	18.2	17.8
58 Cardiff Road	162	58 Cardiff Road	18.0	17.3	17.3	16.9
118 Cardiff Road	163	118 Cardiff Road	19.4	18.7	18.8	18.7
725 Newport Road	164	725 Newport Road	16.6	16.2	16.2	16.1
6 Heol Tyrrell	165	6 Heol Tyrrell	13.2	12.8	12.8	12.8
163 Lansdowne Road	166	163 Lansdowne Road	16.9	16.5	16.5	16.4
359 Lansdowne Road	167	359 Lansdowne Road	17.0	16.5	16.5	16.2
570 Cowbridge Road East	168	570 Cowbridge Road East	18.7	18.1	18.1	17.8

			Ar	nual Avera	ial Average NO ₂ μg/m ³			
Monitoring site name	Site ID	Site type	Baseline 2021	CASAP 1 2021	CASAP 2 2021	CASAP 3 2021		
11 Pengam Green	170	11 Pengam Green	17.6	17.4	17.4	17.3		
23 Tweedsmuir Road	171	23 Tweedsmuir Road	17.9	17.7	17.8	17.7		
Ocean Way 1	172	Ocean Way 1	18.9	18.7	18.9	18.9		
Ocean Way 2	173	Ocean Way 2	19.6	19.4	19.6	19.5		
76 North Road	174	76 North Road	23.9	22.6	22.2	21.9		
Castle Arcade	176	Castle Arcade	42.7	38.8	37.5	36.4		
Angel Hotel	177	Angel Hotel	33.1	28.0	28.4	27.3		
Park Street/Westgate Street	178	Park Street/Westgate Street	32.0	28.4	27.3	24.5		
Altolusso, Bute Terrace	179	Altolusso, Bute Terrace	26.3	24.6	23.9	23.6		
Station Terrace	183	Station Terrace	32.1	29.6	25.3	24.6		
Hophouse, St Mary Street	184	Hophouse, St Mary Street	29.3	26.5	25.5	24.2		
Northgate House, Duke Street	185	Northgate House, Duke Street	27.2	25.2	25.2	24.5		
Dempsey's Public House, Castle Street	186	Dempsey's Public House, Castle Street	40.5	36.6	35.4	34.4		
Angel Hotel	187	Angel Hotel	32.8	27.6	28.1	26.9		
Westgate Street (45 Apartments)	188	Westgate Street (45 Apartments)	35.1	30.5	28.3	25.4		
3 Pearson Street	190	3 Pearson Street	16.5	16.2	16.2	16.1		
7 Mackintosh Place	191	7 Mackintosh Place	23.7	23.4	23.3	23		
3 Cowbridge Road West	192	3 Cowbridge Road West	18.8	18.0	18.0	17.7		
24 Kings Road	193	24 Kings Road	20.1	20.0	20.4	20.3		
115 Cowbridge Road West	194	115 Cowbridge Road West	16.6	16.0	16.0	15.8		
244 Newport Road	195	244 Newport Road	24.8	24.1	24.0	23.8		
2 Pencisely Road	196	2 Pencisely Road	18.1	17.4	17.5	17.4		
GFF 369 Newport Road	197	GFF 369 Newport Road	20.1	19.7	19.7	19.6		
Next Building to Stephenson Court	198	Next Building to Stephenson Court	20.0	19.5	19.4	19.3		
157 Newport Road	199	157 Newport Road	20.0	19.5	19.4	19.3		
350 Whitchurch Road	200	350 Whitchurch Road	25.7	24.7	24.7	24.5		
23 Lower Cathedral Road	201	23 Lower Cathedral Road	18.4	17.8	19.1	18.9		
22 Clare Street	202	22 Clare Street	19.6	18.9	20.4	20.2		
10 Fairoak Road	203	10 Fairoak Road	16.3	15.8	15.8	15.7		
53 Neville Street	204	53 Neville Street	16.8	16.2	16.6	16.4		
Fitzalan Court, Newport Road	205	Fitzalan Court, Newport Road	22.1	21.3	21.6	21.3		
Windsor House, Windsor Lane	206	Windsor House, Windsor Lane	21.9	21.0	20.6	20.3		

Monitoring site name	Site ID	Site type	Ar	nual Avera	ge NO ₂ μg/m	3
Monitoring site name	Site ib	Site type	Baseline 2021	CASAP 1 2021	CASAP 2 2021	CASAP 3 2021
42 Waungron Road	207	42 Waungron Road	15.6	15.3	15.3	15.1
2 Llantrisant Road	208	2 Llantrisant Road	17.7	17.2	17.2	16.9
178 North Road	209	178 North Road	22.7	21.5	21.2	20.9
485 Caerphilly Road	210	485 Caerphilly Road	19.6	19.0	19.0	18.7
19 Well Wood Close, Penylan	211	19 Well Wood Close, Penylan	17.2	17.4	17.5	17.4
62 Bridge Road	212	62 Bridge Road	22.9	22.0	21.9	21.3

3.3.3 Modelling Uncertainty

The city-wide model used to predict NO_2 concentrations is a large and complex model comprising many thousands of road links, a large amount of input data and a number of modelling assumptions. Both the transport and air quality modelling teams have followed all the appropriate guidance to produce as robust a model as possible. However, it needs to be recognised there is always inherent uncertainly in such models and this needs to be taken in consideration when interpreting the results.

Both the transport and air quality models have been validated. In terms of the air quality model a direct assessment of uncertainty is carried out for the baseline model year (2015) as part of the validation process against monitored air quality data. In this process model performance and uncertainty is assessed using the Root Mean Square Error (RMSE) for the observed vs. predicted NO₂ annual mean concentrations, as detailed in Technical Guidance LAQM.TG (16). In this case the RMSE was calculated at 5.1 µg.m-3. This can then be used as a measure of error on forecast results for future years. This error metric has been used when considering the results by considering locations over $35 \mu g.m^{-3}$ as being at risk of exceedance. More details on this validation exercise can be found in Appendix A.

However, when assessing future years there will also be uncertainty related to the forecast assumptions we have made in modelling future years. The key assumptions relate to:

- The forecast of traffic activity in the traffic model which is related to local development factors and national growth factors;
- Forecasting the local fleet composition from the ANPR data to future years, this has been done using national trends.

One particular area of forecasting that bears further exploration is the use of the split transport model in 2021 with compliant and non-compliant vehicles. This split is not used for the 2015 traffic modelling. As such we are not strictly comparing like with like going from 2015 to 2021. However, going forward an assessment of additional scenarios taking account of expected policy options will be carried out, and for this we will need to use the split matrix transport model. It will therefore be more robust to compare these option results with the baseline 2021 results using the split model as well. Splitting the transport model in this way can influence both the traffic flows and speeds and the fleet composition on individual links when comparing with an un-split model. To assess the impact of this we plan to do a sensitivity test by running the un-split 2021 transport model results through the air quality model and comparing this with the current 2015 and 2021 results.

Another area of uncertainly is the emissions data used in the modelling. We have used the latest COPERT emission factors available in line with guidance, however, we are aware that these do not always reflect 'real world' vehicle performance accurately. For example, remote sensing work carried out by Ricardo has shown that LGV emissions, particularly for Euro 5 vehicles, can be significantly higher than the standard emission factors. There is also significant variation within a Euro class. This uncertainty also relates to the primary NO_2 fraction (fNO₂) which can have implications for the NOx to NO₂ conversion process used in the modelling as it can be quite sensitive to fNO₂. Again, we have followed the current guidance on this and used a link-specific fNO₂ derived from modelled primary NO₂ and NOx concentrations at each location.

Lastly, the PCM results have been extracted using the 4m buffer as described above, as per guidance. However, in defining relevant receptors along the 4m buffer we also have to account for several other key criteria:

- The receptor location should be representative of 100m length of road;
- It should not be closer than 25m to a major road junction;
- There must be public access such as a footpath or building.

The sampling is done automatically in a GIS system and the above exceptions removed manually. However, there is some subjectivity around these exceptions such as what constitutes a major junction and how publicly accessible are certain locations. The final results allocated to any given PCM link can be quite sensitive to the final selection of receptors. However, we have taken all endeavours to ensure the final set of receptors used is a reasonable interpretation of the criteria given in the guidance.

With the above detailed it is apparent then that the measures should ensure the greatest level of certainty in terms of achieving compliance. As detailed below in Figure 7, where modelled concentrations are recorded at $35 \ \mu g/m^3$ or less, the probability of achieving actual compliance is greater than 80%. This is vitally important in terms of complying with the High Court legal ruling which requires demonstrate that compliance is not only obtained in the shortest possible time but that it is likely.

Figure 7 - Probability Distribution Analysis



Model error is an RMSE (root mean square error) of 5 µg/m³ which gives the following probability distribution

3.4 Charging Clean Air Zone – Benchmarking Exercise

As previously detailed, the assessment of the above package in terms of achieving compliance in the shortest possible time will be benchmarked against a charging CAZ. However as previously detailed, JAQU guidance indicates **that a charging CAZ should only be considered if other measures are unable to achieve compliance.** The previous section clearly shows that the CASAP package achieves compliance by 2021. Therefore the benchmarking exercise will need to demonstrate that a CAZ can:

- a) Achieve compliance and;
- b) Be implemented in a timeframe quicker that than the proposed measures.

In terms of this timeframes for implementation this will need to include all provisions for designing, consulting and implementing a CAZ (including procurement of all necessary hardware and software and the development of appropriate operational capabilities, including recruitment of necessary back office staff).

3.4.1 Clean Air Zone Scenarios

On the 16th November 2018, the Council held an internal workshop with officers and cabinet members with the purpose of gaining an understanding of CAZs, and the potential options that could be taken forward for full transportation and AQ modelling and economic assessment.

The workshop assumed that the draft CAZ framework for Wales, produced by the Welsh Government³⁰ would form the basis for the proposed benchmark CAZ. Having considered the

results of the baseline do nothing scenario, the consensus of the workshop was that the most effective CAZ to model would be a Small City Centre zone, with only private cars that did not meet the emission standards laid out in the draft CAZ framework would be affected. It was agreed that a nominal £10 daily charge would be applied to all non-compliant private vehicles. Figure 8 below details the extent of the CAZ that was modelled.



Figure 8 - CAZ Boundary for Benchmark Exercise

Following additional internal discussions after the completion of the workshop, it was further agreed that a second CAZ option should also be assessed as a comparison for the benchmarking exercise. As a consequence a further scenario which focused on commercial vehicle classes, namely HGVs and LGVs, has been modelled, within the same boundary as detailed in Figure 8 above.

3.4.2 Modelling Assumption of CAZs

The components of the CAZ 1 and CAZ 2 scenarios and a summary of the modelling assumptions used to represent them are shown in Table 10 below.

Table 10 - CAZ Modelling Assumptions

Measure	Modelling assumptions
CAZ1	Assumes £10 charge for private cars.
City	
centre	Defra's joint air quality unit (JAQU) has developed behavioural responses to charges on
charging	private car. These have been adopted by the transport and air quality modelling used
CAZ for	in this project. See section 6 within the transport report for the traffic modelling
private	methodology ³¹ . In summary, transport modellers applied linear interpolation to JAQU's
cars	£12.50 behavioural responses to establish responses to a £10 charge.
	As the transport modellers have provided the % split of compliant and non-compliant
	cars in response to CAZ, only an update to the fleet mix within the CAZ was necessary.
	To prevent a step change in concentrations occurring with the implementation of a
	separate fleet mix for compliant/non-compliant cars, a compliant/non-compliant fleet
	mix was used in the future baseline (2021). Consequently, for CA2 1 the change in
	number of compliant cars was achieved by applying the updated CA2 1 compliant/non-
	compliant % split to traine nows (AADT).
	There are no JAQU upgrade assumptions for non-compliant vehicles to a specific euro
	standard or fuel type. There is only a % upgrade assumption to compliant vehicles and
	those which will switch from non-compliant diesel to compliant petrol. As the traffic
	modellers have already included the % upgrade within their traffic modelling, the only
	adjustment made to the fleet mix used for pollutant emission calculations is the split
	between petrol and diesel cars. Consistency was maintained between air quality
	modelling and transport modelling, and linear interpolation of JAQU behavioural
	responses was applied to the % upgrade from diesel to petrol. This adjusts JAQU's
	£12.50 % upgrade from 64.3 to 51.44%.
	Assumes £10 charge for LGVs and £50 for HGVs.
	IAOU has developed behavioural responses for LOV and HOV car sharees. These have
	been adopted by transport and air quality modelling. The traffic modelling
	methodology can be found within the transport report. In summary, the transport
	modellers applied linear interpolation to IAOU's f12 50 (IGV) and f100 (HGV)
	behavioural responses. This establishes responses to a f10 and f50 charge for LGVs
CAZ 2	and HGVs, respectively.
City	
centre	As the transport modellers have provided the % split of compliant and non-compliant
charging	cars for responses to CAZ, only an update to the fleet mix assumed within the CAZ is
CAZ for	necessary. To prevent a step change in concentrations occurring with the
light	implementation of a separate fleet mix for compliant/non-compliant LGVs and HGVs, a
goods	compliant/non-compliant fleet mix was used in the future baseline (2021).
and	Consequently, for CAZ 2 the change in number of compliant LGVs/HGVs was achieved
heavy	by applying the updated CAZ 2 compliant/non-compliant % split to traffic flows (AADT).
goods	
vehicles	There are no JAQU upgrade assumptions for non-compliant vehicles to a specific euro
(CAZ 1)	standard or fuel type. There is only a % upgrade assumption to compliant vehicles and
	those which will switch from diesel to petrol. As the traffic modellers have already
	included the % upgrade within their traffic modelling, the only adjustment made to the
	tleet mix used for pollutant emission calculations is the split between petrol and diesel
	LEVS. NO TUEL TYPE SWITCH TOT HEVS WAS CALCULATED AS DIESEL IS the only fuel type for
	novs. consistency was maintained between the air quality modelling and the transport
	modelling and linear interpolation of JAQU behavioural responses was applied to the

³¹ 367590 Air Quality Transport Modelling Technical Note CASAP CAZ.pdf

3.4.3 Comparison with PCM Results

In line with the modelled baseline and CASAP results, the results for the CAZ scenarios have been generated for each of the PCM road links. A full list of tabulated results for the PCM road links for the modelled year of 2021 is shown in Table 11, along with the baseline results and results from the three CASAP scenarios, for comparison. Mapped results of the two CAZ scenarios are shown are shown in Figure 9 and Figure 10.

The results for CAZ 1 and 2 show that NO_2 concentrations are estimated to be lower than the baseline 2021 scenario at most links, but with CAZ 1 showing increases on 6 links and Caz 2 showing increases on 4 links. The largest decrease observed in both CAZ 1 and 2 is at link ID 30665 (A4161, Castle Street), as might be expected for a measure that is specifically targeting the city centre.

Compared to CASAP 3, most links show higher concentrations in the CAZ 1 and 2 scenarios. But this is to be expected, as the CAZ scenarios do not include any of the CASAP measures and targets a smaller geographical area. CAZ 1 achieves larger reductions along roads within the clean air zone, although CAZ 2 is estimated to have lower concentrations on most other links (32 in total).

To summarise, CAZ 1 is the most effective at addressing city centre air quality issues but does not have as big an impact elsewhere as the CASAP scenarios or CAZ 2.

		PC Base	CM eline	Local I	Baseline	Clean Air Strategy Action Plan (CASAP)			Charging Clean Air Zones	
Census ID	Road Name	2015	2021	2015	2021	2021 CASAP 1	2021 CASAP 2	2021 CASAP 3	CAZ 1	CAZ 2
30660	A4119	22.4	17.9	37.1	30.7	29.7	30.2	29.7	30.7	30.6
10629	A4054	19.1	15.0	25.3	19.5	19.1	19.2	17.9	19.3	19.0
50647	A4119	29.9	24.0	34.4	24.4	23.6	27.6	26.8	23.5	23.6
10660	A4161	40.3	32.7	34.9	26.2	25.5	25.5	25.3	25.6	25.2
522	A48	27.9	22.3	32.9	25.4	24.1	24.1	24.0	25.1	24.7
30659	A4119	27.2	21.8	23.8	18.8	18.2	18.2	17.8	18.4	18.5
77018	A470	31.1	25.2	45.4	30.6	27.5	26.5	25.1	28.2	28.7
99955	A4160	32.2	25.7	36.7	26.9	25.5	25.1	24.9	25.4	24.9
50660	A4161	43.7	33.8	42.2	30.8	28.8	28.3	27.8	25.8	27.9
70055	A4161	37.5	29.7	43.9	30.4	28.1	27.3	26.9	27.8	28.0
99671	A469	33.1	27.1	27.2	21.5	20.7	20.7	20.4	21.1	20.7
10659	A4160	30.4	25.0	30.4	23.7	22.6	22.3	22.3	22.6	22.3
10655	A4119	31.9	25.9	36.6	29.0	27.5	27.5	26.8	27.9	27.6
80898	A4232	47.3	37.7	34.3	29.5	28.0	28.3	28.2	29.5	28.6

Table 11 - PCM and Local Model NO_2 Concentration Results for CAZ 1 and 2

		PC Base	CM eline	Local Baseline		Clean Air	Strategy A (CASAP)	Charging Clean Air Zones		
Census ID	Road Name	2015	2021	2015	2021	2021 CASAP 1	2021 CASAP 2	2021 CASAP 3	CAZ 1	CAZ 2
20527	A48	48.8	39.1	40.0	30.6	31.3	31.6	31.5	31.5	30.8
40655	A4160	28.2	22.7	24.2	19.3	18.9	18.6	18.5	18.8	18.4
50580	A469	28.5	22.4	33.0	25.8	24.8	24.8	24.6	25.5	25.2
50657	A4161	29.5	23.3	26.5	20.3	19.6	19.6	19.3	19.6	19.6
10661	A4161	24.9	20.1	26.6	20.2	19.5	19.9	19.8	19.6	19.3
10527	A48	31.9	25.7	29.4	22.7	21.9	22.0	21.7	22.2	21.6
40582	A469	31.8	25.5	32.2	24.7	24.5	24.3	24.0	24.5	24.5
50651	A4119	28.4	22.9	31.6	24.5	23.5	23.9	23.8	25.1	24.6
40656	A4161	40.9	33.4	43.7	29.6	28.1	28.0	27.6	27.8	27.5
40549	A470	40.8	32.5	38.1	27.6	26.1	25.6	25.2	25.5	25.3
50527	A48	45.3	37.1	37.1	28.8	28.0	28.2	28.0	28.4	27.7
642	A4160	38.3	32.1	40.0	28.8	27.8	30.0	29.8	28.2	28.6
80899	A4232	43.1	34.3	32.1	27.5	26.8	27.2	27.1	27.4	27.1
99960	A4055	34.9	28.4	31.4	25.5	24.0	24.1	24.1	24.8	24.4
50541	A470	35.6	28.5	37.3	29.1	28.3	28.2	28.0	28.2	27.8
20548	A470	31.3	24.6	41.3	30.0	27.9	27.8	27.3	25.9	27.1
50524	A48	59.6	45.4	36.4	27.9	27.6	27.6	27.5	27.7	26.9
74101	A4232	52.5	40.7	30.1	24.8	22.9	23.0	23.0	24.1	23.7
638	A4119	27.5	21.6	28.8	22.3	21.6	21.7	21.4	21.3	21.0
30665	A4161	41.2	31.9	55.7	41.1	37.3	36.0	35.0	32.5	35.3
73233	A4055	35.8	29.1	31.6	24.5	23.4	23.4	23.3	23.8	23.2
99956	A4234	44.6	36.8	38.2	26.3	25.4	26.3	26.2	26.1	26.2
78439	A4232	33.6	26.4	21.7	17.5	17.3	17.4	17.3	17.5	17.4
70056	A4232	42.2	29.9	35.3	28.9	29.6	29.8	29.7	30.1	29.5
73232	A4160	26.9	21.2	21.0	18.1	16.3	16.4	16.3	17.9	17.7
80896	A470	26.5	22.2	26.9	21.8	21.4	21.9	21.7	22.0	21.9
80726	A470	35.4	25.3	34.8	25.2	23.3	23.0	22.4	21.6	22.7
78435	A4050	30.2	23.1	32.5	25.0	24.1	24.3	24.2	25.0	24.7

Note: local results are colour coded as green for less than 35 μ gm-3, amber between 35 μ gm-3 and 40 μ gm-3 and red for greater the 40 μ gm-3 (the compliance threshold). Numbers are rounded to the nearest integer, hence any values less than 40.5 μ gm-3 are not counted as exceedances.

3.4.4 Results at Local Monitoring Locations

Modelled NO_2 concentrations for CAZ 1 and 2 have been calculated for each of the monitoring locations, and are shown in Table 12 below.

These results provide an indication of whether compliance is predicted at monitoring locations in 2021. In this case CAZ 1 and 2 shows compliance with the 40 μ g/m³ limit value for all sites by 2021.

Table 12 - Predicted NO ₂ Annual Mean Concentrations at Monitoring site Locations in 202	21
with CAZ 1 and CAZ 2	

	NO ₂ annual mean (μg.m ⁻³)				
Monitoring site name	Site ID	Site type	Baseline 2021	CAZ 1 2021	CAZ 2 2021
	2015 site	s used for model verific	ation		
Ninian Park Road	16	Roadside	14.2	13.9	13.8
Mitre Place	33	Kerbside	31.5	30.3	29.9
City Road	44	Kerbside	20.4	19.7	19.9
Mackintosh Place	45	Kerbside	23.4	23.1	23.2
Penarth Road	49	Roadside	17.1	16.5	16.6
Birchgrove Village	56	Roadside	17.1	16.7	16.5
Westgate Street	58	Kerbside	30.3	24.5	25.2
Stephenson Court	81	Roadside	25.3	24.1	24.3
104 Birchgrove Road	82	Roadside	18	17.5	17.4
497 Cowbridge Road West	85	Roadside	15.2	15	14.7
19 Fairoak Road	86	Roadside	19	18.8	18.9
Manor Way Junction	96	Roadside	23.2	22.2	21.9
Newport Road (premises)	97	Roadside	21.4	20.8	20.4
Western Avenue (premises)	98	Roadside	18.2	17.8	17.8
Cardiff Road Llandaff	99	Roadside	27.8	26.7	26.5
Cardiff AURN	101	Urban Centre	18.4	17.2	17.6
Cardiff AURN	102	Urban Centre	18.4	17.2	17.6
Cardiff AURN	103	Urban Centre	18.4	17.2	17.6
30 Caerphilly Road	106	Roadside	24.6	23.6	23.4
Lynx Hotel	107	Roadside	21.6	21.1	20.9
98 Leckwith Road	111	Roadside	15.3	15.1	15
17 Sloper Road	112	Roadside	17.2	17	16.8
21 Llandaff Road	115	Roadside	15.2	15	15
25 Cowbridge Road West	117	Roadside	20	19.2	18.7
Havelock Street	119	Kerbside	22.3	20.6	21.1
287 Cowbridge Road East	124	Roadside	14.4	14.2	14.2
Westgate Street Flats	126	Roadside	27.6	22.7	23.3
117 Tudor Street	128	Roadside	16.1	15.7	15.7

			NO ₂ anr	nual mean (µg.m⁻³)
Stephenson Court 2	129	Roadside	23.9	22.8	23
Burgess Court	130	Roadside	24.5	23.3	23.5
Dragon Court	131	Roadside	24.7	23.5	23.7
St Mark's Avenue	133	Roadside	28.1	27.7	26.9
Sandringham Hotel	134	Roadside	18.8	17.7	18
Lower Cathedral Road	139	Kerbside	19.8	18.8	18.3
Clare Street	140	Kerbside	21.2	20.5	19.9
Fairoak Road 2	141	Roadside	18.9	18.5	18.4
Windsor House	143	Roadside	27.9	23	23.5
Marlborough House	144	Roadside	26.6	22.4	23.2
Tudor Street Flats	145	Roadside	24.3	23.9	24.1
Neville Street	146	Roadside	19.8	19	18.7
211 Penarth Road	147	Roadside	17.5	16.9	16.7
161 Clare Road	148	Roadside	18	17.3	17.3
10 Corporation Road	149	Roadside	16.5	16.1	16.1
James Street	152	Roadside	22	22	21.8
Magic Roundabout	153	Roadside	21.6	21.5	21.5
2a/4 Colum Road	156	Roadside	18.5	18.2	18
47 Birchgrove Road	157	Roadside	20.8	20.2	19.9
64/66 Cathays Terrace	158	Roadside	18	17.4	17.5
IMO façade replacement	159	Roadside	22.6	22	21.5
High Street Zizzi	160	Urban Centre	20.6	18.4	19
52 Bridge Road	161	Roadside	18.9	18.4	18.2
58 Cardiff Road	162	Roadside	18	17.5	17.2
118 Cardiff Road	163	Roadside	19.4	19.3	18.7
725 Newport Road	164	Roadside	16.6	16.3	16.1
6 Heol Tyrrell	165	Roadside	13.2	13	12.9
163 Lansdowne Road	166	Roadside	16.9	16.4	16.5
359 Lansdowne Road	167	Roadside	17	16.4	16.4
570 Cowbridge Road East	168	Roadside	18.7	18.1	18.1
11 Pengam Green	170	Roadside	17.6	17.5	17.8
23 Tweedsmuir Road	171	Roadside	17.9	17.8	18.1
Ocean Way 1	172	Roadside	18.9	18.9	19
Ocean Way 2	173	Roadside	19.6	19.6	19.7
76 North Road	174	Kerbside	23.9	22.1	21.9
Castle Arcade	176	Roadside	42.7	32.9	37.1
Angel Hotel	177	Roadside	33.1	26.4	27.7
Park Street/Westgate Street	178	Kerbside	32	29	31.2



Figure 9 - PCM Links Colour Coded With CAZ 1 Results In 2021



Figure 10 - PCM Links Colour Coded With CAZ 2 Results In 2021

3.5 Further Qualitative Assessment of Measures

Prior to undertaking a WeITAG appraisal the project team have further considered a number of the measures included in the full CASAP package in terms of the ability of the measures to achieve the primary success factor of delivering compliance in the shortest possible time. In order to develop a Full Business Case and owing to the time-intensive nature of modelling further refinement of the measures is necessary to allow more comprehensive analysis of fewer options in this Outline Business Case.

In undertaking this assessment options that realistically cannot be implemented by the 1st January 2021 or have minimal direct impact on reducing NO₂ concentrations Castle Street, have been discarded without further appraisal. This timeframe includes full statutory consultation, submission of the full business case and funding approval, procurement, planning and implementation of the measures. Such measures have not been considered further in the context of this Outline Business Case but may have scope to deliver longer-term air quality benefits should they be required in future and are thus further referenced, in the Clean Air Strategy.

The measures excluded in terms of not meeting the primary critical success factor are summarised in Table 13.

Measure	Reason for Omission
50mph on A4232	Measure has no direct impact on Castle Street.
A48 P&R	Owing to land acquisition, design, planning, consultation, procurement, construction/ implementation not feasible to implement by end of 2020.
J33 P&R	
Nantgarw P&R	
Parking Charges for Polluting Vehicles	Does not have significant impact on Castle Street. Will require significant consultation, approval and assessment which would make implementation by end of 2020 unlikely.
A470 additional southbound traffic lane	Measure provides insignificant improvement on emission and does not directly impact Castle Street

As a result the revised CASAP package and the CAZs have been subject to an additional qualitative assessment to screen and test the measures against the primary and secondary objectives of this study to ensure that measures could address the problem identified.

This assessment considered each of the measures initially against the identified Primary objective using a simple screening system of a pass or fail. This assessment was based on professional judgement and an understanding of the success of similar measures elsewhere in the UK and further afield. The summary appraisal of the long list of options is presented in Table 14.

Measure Description	Primary Objective Achieved			(Scores 1.	Secondary Objecti Low, 2. Medium, 3.	ves High 4. V. High)			Scores	Judgement	
	(If Pass- W expected m year of de complianc ar e) ov re n er s t	(If Pass- Will the expected measure	Will the Will the measure measure	Will the measure	Will the measure contribute to well-being		Does the option fit or compliment	Value for Money - Do the	Constrai nts on		
		deliver an overall reductio n in NO ₂ emission s to air.	result in additional benefits or other environmental impacts (i.e., GHG Reductions	Positive impact on wider public health.	Mitigate financial impact on low income households and reduce inequalities	other local policies.	likely benefits of this option exceed the costs	Impleme ntation of Measure			
Revised CASAP Package	Pass 2021	3	3	4	2	4	1	2	20	Preferred Option	
CAZ 1 – Private Cars	Pass-2021*	2	2	1	1	1	2	3	12	Unlikely Option	
CAZ 2 – Commercial Vehicles	Pass-2021*	2	1	1	2	1	1	1	9	Option not considered further	

*Considered overly ambitious given full consultation, planning, procurement and operational practicalities faced.

3.6 Revised WelTAG Appraisal

Having considered the results of the detailed quantitative assessment of the CASAP measures and the two CAZs and the further assessment against the CSFs, the CASAP Package and the CAZ 1 scenario have been further assessed under the WeITAG Appraisal ³²process to further assess the Environmental, Social and Cultural and Economic Impacts of the options

The following section provides a further appraisal of these measures in order to identify a preferred option that can be developed which will be refined and developed into a Full Business to comply with the legal requirements of the Direction. The options have been appraised against the key three WeITAG areas.

- Economy
- Environment
- Social and Cultural

The measures that have been appraised against the WelTAG Aspect of Well-being are outlined in Table 15 . As detailed modelling of the measures is undertaken it will be necessary to reevaluate the assessment and quantify the effectives of the measures as data becomes available.

Table 15– WelTAG Well-being Aspects

Environment	Social and Cultural	Economy
Air Quality	Physical Activity	Journey time changes and journey time reliability
Noise	Journey Quality	Capital Costs
Landscape	Accidents	Land
Townscape	Access to employment and services	
Historic Environment		
Biodiversity		
Water Environment		
Green House Gas (GHG) Emissions		

3.6.1 Environmental Appraisal

In accordance with Section 3.3 air quality modelling has been undertaken to establish a detailed understanding for NO_2 concentrations for the implementation of CASAP Measures and two CAZ scenarios, which could be fully implemented by 2021.

Further qualitative appraisals have also been undertaken to assess the other environmental impacts areas namely:

- Noise;
- Landscape;
- Townscape;
- Historic Environment;
- Biodiversity;
- Water Environment; and
- GHG Emissions

³² WelTAG 2017 Welsh Transport Appraisal Guidance

3.6.2 Social and Cultural Appraisal

3.6.2.1 Physical Activity

A qualitative appraisal has been undertaken in order to assess the amount of walking, cycling and other physical exercise that is undertaken as a result of the measure.

3.6.2.2 Journey Times

A qualitative appraisal has been undertaken in order to assess the extent of impact of each of the measures on journey quality, taking into consideration the following aspects:

Traveller care: aspects such as cleanliness, level of facilities, information and the general transport environment;

Travellers' views: the view and pleasantness of the external surroundings throughout the duration of the journeys; and

Traveller stress: frustration, fear of accidents and route uncertainty.

3.6.3 Accidents

A qualitative appraisal has been undertaken in order to assess the extent of potential anticipated change which occurs in the number and severity of injuries as a result of the measure.

3.6.3.1 Access to Employment and Services

A qualitative appraisal has been undertaken in order to assess how many jobs people can reach, the respective journey times, and the impact on journeys to key services such as health facilities and schools which occurs as a result of the measure.

Whilst the WeITAG 2017 guidance outlines access to employment and access to services as two separate appraisal areas, both areas have been combined within this assessment, as the appraisals will be proportionate to one another, with little to no difference in appraisal outcomes between the two considered likely to take place.

3.6.4 Economic Appraisal

3.6.4.1 Journey Time and Journey Time Reliability Changes

A qualitative appraisal has been undertaken in order to assess changes in journey times across all affected modes both for users and non-users of the measure. The appraisal also takes into account changes in the variation in journey times between times of day and between journeys made at the same time each day i.e. morning and evening peak periods.

Whilst the WeITAG 2017 guidance outlines journey time and journey time reliability changes as two separate appraisal areas, both areas have been combined within this assessment, as the appraisals are proportionate to one another, with little to no difference in appraisal outcomes between the two considered likely to take place.

3.6.4.2 Capital Costs

The measures have been assigned within the following cost bands:

- Low up to £500k
- Medium £500k £2m
- High £2m+

Cost banding has been used to denote the costs of each measure in order to differentiate between more cost effective measures which could be implemented within a shorter timeframe, and those which will require more funds and longer lead-in periods. The banding

takes into account the capital costs of each measure, and does not take account of revenue costs.

3.6.4.3 Land

A qualitative appraisal has been undertaken to assess the extent to which the measure will potentially reduce the amount of agricultural land, and open up development sites.

3.6.5 Value for Money

At this stage a full value for money assessment has not been feasible owing to the need to undertake a full economic assessment to calculate relevant net present values for the CASAP measures and the CAZ1. This will be presented in the Full Business Case to follow.

3.6.6 Summary Appraisal Tables

Individual Summary Appraisal Tables for the CASAP measures, and the CAZ 1 scenarios are presented below. Table 18 provides an overall summary of these assessments.

Table 16 - CASAP	Measures Sun	nmary Appraisal
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Name o	f Measure :	Revised CASAP3 Package					
Timescales		2019-2021					
Feasibili	ity	Yes – Timescales for full implementation are extremely challenging					
Effective	e:	Yes – the package of measures achieve compliance on Castle Street					
Objective		Summary of Key Impacts	Assessment				
	1		Qualitative				
	Air Quality	The modelling results of the CASAP 3, indicate a reduction of NO_2 concentrations of 6 µg/m ³ on Castle Street which achieves compliance.	Significantly Beneficial +3				
	Noise	The implementation of Zero Emission Buses, plus the retrofitting of remaining buses, and the improved highway arrangements, will improve noise levels.	Moderately Beneficial +2				
	Landscape	The implementation of the CCN and CCW schemes, will have significant improvements in terms of landscape/ green infrastructure which will be implemented as part of the schemes.	Moderately Beneficial +2				
	Historic Env	Whilst the highway improvements works on Castle Street, will cause initial disruption in front of Cardiff Castle it is anticipated that upon completion the works will improve the built environment in the City Centre and the area around Castle Street.	Moderately Beneficial +2				
nment	Biodiversity	The scheme will not negatively impact on biodiversity nor will it impact any protected sites.	Neutral 0				
Enviro	Water Environment	It is unlikely that the measure will impact the River Taff, River Ely or Rhymney River or the Severn Estuary and thus there will be no negative impact to the water environment. As part of the CCW scheme drainage improvements will be undertaken, and thus it could be argued that improvements to discharge to the River Taff will be improved. There will also be a requirement for sustainable drainage solutions to be included in the schemes.	Slightly Beneficial +1				
	Townscapes	No direct impacts are anticipated to listed buildings or other buildings as part of the proposed CASAP measures. However the CCN and CCW schemes will have significant public realm and landscape aspects. Further the schemes will improve the environment of the City Centre	Moderately Beneficial +2				
	Greenhouse Gas Emissions	The implementation the full package of measures should results in an overall reduction of GHG, which will be fully assessed in the Economic Assessment in the Final Business Case.	Significantly Beneficial +3				
Economy	Journey Time Changes	Journeys by public transport, and active travel modes are likely to increase owing the improvements in the highway network, efficiency of movement and prioritisation. Owing to the prioritisation of sustainable and active travel modes, there is likely to be an impact on private and commercial vehicles who may have taken alternative routes or face delays in the city centre which will lead to an increase in journey times.	Slightly Adverse -1				
	Capital Costs	High >£2M It is anticipated total costs of the projects as follows: Electric Buses £1.8M Bus Retrofit £1.4M Taxi Mitigation Schemes £5.5M* City Centre Schemes £18.9M Active Travel and CS1 completion £4.2M	High				
	Land	No loss of land is anticipated from this measure.	Neutral 0				
cial and ultural	Journey Quality	Implementation of Zero Emission Buses, will provide high quality transportation, and the retrofitting of the remaining Cardiff Bus Fleet, should improve journey quality on the remaining buses. Active travel measures included should improve the journey quality within the city centre and wider areas of the City.	Significantly Beneficial +3				
S C	Physical Activity	The active travel packages and elements to improve active travel within the City Centre Schemes should see a significant uptake and increase in active travel.	Significantly Beneficial +3				

	Accidents	Improvements to the City Centre traffic, expansion of 20 mph areas, and segregation of cycling should see an overall reduction in accidents across the City.	Significantly Beneficial +2
	Access	It is not anticipated that the implementation of the package of measures will have an impact on access to services, employment, or healthcare within Cardiff. There could be increased access for some members of society by encouraging walking and cycling.	Moderately Beneficial +1
Value for Money	Value for Money	To be determined by Full Economic Appraisal	TBC

Table 17 - CAZ Scenario 1	L Summary	Appraisal	Table
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Name of Measure :		CAZ Scenario 1	
Timesca	les	2019-2021	
Feasibili	ty	No - unlikely that the CAZ including all operational issues can be fully implemente	d by 2021.
Effective	eness	Yes - the assessment of the scheme indicates NO ₂ concentrations achieve compliant	ce.
0	bjective	Summary of Key Impacts	Assessment Qualitative
	Air Quality	The modelling results of the CAZ 1, indicate a reduction of NO_2 concentrations of 8.6 $\mu g/m^3$ on Castle Street.	Significantly beneficial +3
	Noise	This measure may see the reduction of vehicles on the road, and thus lead to a decrease in road traffic noise.	Slightly Beneficial +1
	Landscape	The introduction of this measure will have no impact on landscapes.	Neutral 0
t	Historic Env	The scheme will not have any direct impact on Cardiff's historic landscapes. However any CAZ will require new infrastructure which would be required on Castle Street.	Moderately Adverse -2
onme	Biodiversity	The scheme will not negatively impact on biodiversity nor will it impact any protected sites.	Neutral 0
Envir	Water Environment	It is unlikely that the measure will impact the River Taff, River Ely or Rhymney River or the Severn Estuary and thus there will be no negative impact to the water environment.	Neutral 0
	Townscapes	The installation of the ANPR cameras will be required to operate the scheme and thus could have a negative impact on the townscape of the City Centre	Moderately Adverse -1
	Greenhouse Gas Emissions	Given that Euro 4 petrol cars are compliant there could be an increase in older petrol cars (Euro 4), which have higher CO2 emissions compared to diesel vehicles. However could also see an increase of Euro 6 diesels or ULEVs, which would negate the impact on GHG emissions.	Moderately Negative -2
ž	Journey Time Changes	It is possible that journeys times will increase for non-compliant vehicles that avoid the CAZ in order not pay the charge. However compliant vehicles may see an increase in journey times as road space is freed up.	Neutral 0
Econom	Capital Costs	National Estimated costs for CAZ are in the £2.5M region. The implementation of the ANPR network and the development of the required operations team will require significant upfront costs. In addition consideration of vehicles upgrade costs for wider society need to be considered.	<high< td=""></high<>
	Land	No loss of land is anticipated from this measure.	Neutral 0
	Journey	The removal of non-compliant vehicles could improve the vehicle journeys within	Slightly
	Quality	the CAZ.	Beneficial +1
tural	Physical Activity	Users of non-compliant vehicles making short trips to the City Centre may switch travel mode and switch to active travel modes. Alternatively non-compliant vehicles will park further from the CAZ area, and thus walk further into City Centre.	Slightly Beneficial +1
Social and Cult	Accidents	It is not anticipated that the introduction of CAZ will have a direct impact on accident rates. It could be argued that if there are fewer vehicles owing to reduction in non-compliant vehicles in the CAZ area, then there could be a positive impact on potential accidents	Slightly Beneficial +1
	Access	Potential this could impact on the ability for citizens to access services, employment, or healthcare within Cardiff if their vehicles are non-compliant and the have to pay the user charge. However as the CAZ is a small zone where public transport access is good, then those persons who are not able to upgrade vehicles, could still access the area by alternative means.	Significantly Adverse -3
Value for Money	Value for Money	To be determined by Full Economic Appraisal	ТВС

	Key	y Crite	eria				Envirc	onme	nt				Economic		Socia	al anc	l Cult	ural	VfM	Outcome
Measure	Timescales	Feasibility	Effectiveness	Air Quality	Noise	Landscape	Historic Environment	Biodiversity	Water Environment	Townscape	Greenhouses Gas emissions	Journey Time Changes	Capital Costs	Land	Journey Quality	Physical Activity	Accidents	Access		
Implementation of CASAP Package of Measures	Y	Y	Y	+3	+2	+2	+2	0	+1	+ 2	+3	-1	High >£2M	0	+2	+3	+2	+1	TBC	Preferred Measure
CAZ 1 Scenario	Y	N	Y	+3	+1	0	-2	0	0	-1	-2	0	High >£2M	0	+1	+1	+1	-3	TBC	Unlikely Measure

Table 18 - Summary of WelTAG Well-being Aspects Appraisals

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+3 = Large Beneficial +2 = Moderate Beneficial +1 = Slight Beneficial 0 = Neutral -1 = Slight Adverse -2 = Moderate Adverse -3 = Large Adverse

3.7 Conclusion on the Assessment of Measures

The results of the assessments indicate that both the CASAP package of measures and the CAZ scenarios provide compliance Castle Street, which under the baseline do nothing scenario demonstrated continuous non-compliance issues for the NO₂ Limit Value beyond 2021. Whilst both CAZ scenarios enable compliance to be achieved, the CASAP measures provide wider air quality improvements across Cardiff as a whole and thus this becomes the preferred option to be taken forward.

Government guidance³³ is quite clear that a charging CAZ should only be considered as a preferred option if other non-charging measures are not sufficient to bring about compliance in the shortest possible time. Given that the modelling undertaken has demonstrated that a package of measures achieves compliance in the same period if not sooner than a charging CAZ, then ultimately the Council is justified in implementing a package of measures as a preferred option rather than a CAZ.

Furthermore the nature of the CASAP measures as a preferred option means that the delivery is more rapid than the timescales associated with the implementation of a charging clean air zone. The modelling assumed that both the CASAP package and the Benchmark CAZ 1 scheme were fully operational by 2020. Whilst it is possible to implement the CASAP package in this timeframe, the same cannot be said for the benchmark CAZ 1 charging scheme. The Council has therefore pursued the CASAP package as its preferred scheme in order to ensure that we achieve compliance in the shortest possible time and with least disruption. The Council is able to implement the preferred option scheme through existing delivery and procurement frameworks. In addition it may be feasible to implement some of the measures, such as electric buses and retrofitting at an early stage. As part of the requirements of the legal tests in the ruling of the ClientEarth 2³⁴ (CE2) case, the court has stated that in order to comply with Article 23 of the EU Directive; local authority plans must ensure that they 'Choose a route to compliance which reduces human exposure as quickly as possible'. In essence this means that a plan which aims to achieve compliance by a certain date throughout the entirety of the zone would not meet the legal test, if there were short term additional or alternative measures identified that could lead to compliance and reduction in human exposure in a shorter time period.

Based on the emphasis to start implementing measures in the short term, in order to comply with the legal test the Council should not delay in implementing the measures included in the revised CASAP package. Hence this further supports the decision that the CASAP package is the preferred option.

A full economic Assessment of the revised measures will be included in the Full Business Case and this will include full distributional analysis and health impact assessment.

³³ JAQU Guidance – Evidence Based Approach to Setting Clean Air Zone Charges

³⁴ <u>1 ClientEarth (No. 2). https://www.judiciary.gov.uk/wp-content/uploads/2016/11/clientearth-v-ssenviron-food-rural-affairs-judgment-021116.pdf</u>

Section 4 Commercial Case

4.1 Introduction

JAQU's Inception package guidance requires the Commercial case of the SOC to provide an assessment of relevant current procurement arrangements for the likely services required and likely attractiveness of the project to potential services providers.

4.2 Market Assessment

Based on the PESTLE tool, the following gives an overview of the potential for the current market to meet the requirements of any preferred option. Prior to commencement of procurement and to be presented within the Full Business Case in the Final Plan, it is proposed that market engagement will be undertaken for the appropriate measures to determine the extent to which the preferred option is an attractive proposition.

Political

The UK and Welsh Governments role is to regulate and ensure local authorities meet the requirement to be compliant with the EU Air Quality Directive in the shortest possible time and is the primary driver behind this business case. Locally there is ambition to deliver significant improvements in air quality.

Economic

As a result of the requirement for delivering NO_2 compliance, the Welsh Government has announced a £20M Air Quality Fund³⁵ for improving air quality across the country. It is anticipated that the implementation of the preferred option will mitigate against detrimental economic impacts by the provision of grant support or otherwise from the Welsh Government and other funding mechanisms.

Social

The cultural trend is currently toward increasing uptake of sustainable practice largely in light the respect of reducing carbon emissions to tackle climate change, but over recent years air quality has become more prominent environmental risk. The market is recognising this shift toward a consciousness in emissions by individuals and organisations and as a result growth in provision for renewable energy, increasing availability for alternative vehicle refuelling infrastructure (e.g. EV charge points) and changing local and national policy indicates that the market for sustainability and air quality initiatives is increasingly becoming a social preference.

Technological

Installation of ANPR cameras has already been undertaken in Cardiff to address moving traffic offences (e.g. bus lane/ junction enforcement).

The market is already seeing a growth in low emission and zero emission vehicles and charging infrastructure and so it is anticipated that any proposed preferred option will not be impacted by technological advancements.

Legal

The legal Direction imposed by Welsh Government on Cardiff Council, to achieve compliance with the NO_2 annual average limit value within the shortest possible time has resulted in the

³⁵ https://gov.wales/newsroom/environmentandcountryside/2018/180424-20m-air-quality-fund-among-newmeasures-to-improve-air-quality-in-wales/?lang=en

launch of the Clean Air Fund, (see above "economic") providing the market with assurance that the plans will be funded.

Environment

Environment and Environmental Health concerns have resulted in the legal obligation for the Council to meet NO_2 compliance (see above "political"). Environmental concern is also influencing a growth in the sustainable and low emission economy.

4.3 **Procurement Options**

The Council is a Public Body and must comply with all pertinent EU and UK Procurement Legislation and therefore, staff must, by law, adhere to the same. A number of policies and procedures have been developed to help us achieve these objectives and to ensure that our procurement activities:

- Comply with European Union (EU) and UK procurement legislation;
- Conform to s Contract Standing Orders and Procurement Rules (CPR) updated July 2018, as well as all relevant internal policies, procedures and objectives.
- Achieve evidenced value for money in terms of quality and the price paid
- Test and demonstrate whether social value has been achieved
- Are open and transparent and safeguard against allegations of corruption, fraud or bias
- Are well documented to provide a clear audit trail
- Manage and address risks as well as opportunities

The most appropriate procurement approach for the Final Plan will be dependent upon several factors, namely:

- The final measures included within the Plan;
- The type of system to be implemented ;
- The extent to which the technical and operational solution is specified (e.g. whether fully specified or open to market proposals as a performance-based solution);
- The method by which it is proposed to operate ("in-house" or third-party service provider);
- On-going maintenance and development;
- Whether it is to be designed, implemented and operated by a single service provider or by multiple providers; and
- Timescales for delivery.

There are four key procurement routes available:

- Local authority tendering through an Approved List (shortlist) of invited suppliers;
- Through any applicable existing Council Frameworks;
- Through Welsh Government's National Procurement Services (NPS) for the public sector; and
- Open tender through the Official Journal of the European Union (OJEU

Given the likely scale of the preferred option, it is not thought likely that the procurement value of any element of this work will fall under that required for the Approved List procurement approach, so this leaves the existing frameworks, NPS, or OJEU processes as options for procurement.

4.3.1 Existing Council Frameworks

There are several currently active frameworks established by Cardiff Council for highways design, installation and maintenance services. These frameworks offer the advantage of being readily available to provide "fast track" procurement of the various services required for the Final Plan. The suitability of using existing frameworks to procure appropriate services to implement the outcome of the Final Plan will explored in more detail within the Final Plan.

4.3.2 National Procurement Services

The NPS has a number of frameworks which offers customers a quick, simple and competitive route to construction consultancy services. The Framework offers access to pre-approved firms that have been rigorously assessed on the quality of the services they provide. Of particular relevance to this Plan, is the CONSTRUCTION CONSULTANCY FRAMEWORKS NPS-PS-0004-14 Construction Consultancy, and the sub framework NPS-PS-0027-15.

4.3.3 OJEU Route

The OJEU tender process can take several forms - open, restricted, competitive dialogue, competitive procedure with negotiation or innovation partnership. Given the nature of the work proposed for the Final Plan, it is expected that only open or restricted procedures would apply.

The final procurement route for the preferred option(s) will be detailed further in the Final Plan.

Section 5 Financial Case

5.1 Funding

Within its latest Interim supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017 ³⁶ the Welsh Government has stated that it has allocated over £20 million for an Air Quality Fund through to 2021 to help accelerate compliance with NO₂ limits and improve air quality in Wales. The report further states that this fund will primarily be used to provide on-going support, guidance and finance to enable Cardiff Council (and Caerphilly CBC) to take action to achieve compliance in the shortest possible time. The funding will support work to conduct feasibility studies, implement early measures which help accelerate exposure reduction and deliver the options which will achieve compliance in the shortest possible time.

Within the Minister's letter that accompanied the formal direction it was confirmed that finance would be made available for the production of the feasibility study and for the <u>implementation</u> of the chosen scheme.

In addition to the above funding mechanism, the Council will continue to work collaboratively with Welsh Government officers to identify all available and an appropriate funding mechanisms including transportation funds, to maximise the financial contribution from Welsh Government towards the implementation of any measures.

5.2 Cost Assumptions

At this stage, the full Financial Case has not been fully assessed and outline costs for each of the proposed measures is provided below.

5.2.1 Electric Buses

Funding has been secured from Department of Transport (DfT), from their ULEB Grant, and thus further funding towards this measure cannot be supplied directly to Cardiff Bus owing to State Aid Issues. Cardiff Council is looking at alternative funding methods to enable the implementation and use of the ULEB fund.

5.2.2 Retro-Fit Scheme for Buses

Cardiff Clean Bus Technology Fund (CCBTF). To assess the impact of such a scheme we have modelled the impact of retrofitting 94 buses, which coincides with an application made jointly in 2017 by Cardiff Council and Cardiff Bus.

The bid was based on exhaust after emission treatment technology, namely selective catalytic reduction (SCR). Research by Low Carbon Vehicle Partnership (LowCVP)³⁷ details that this technology can reduce NO₂ emissions by 88% Euro III, 90% Euro IV and **98% for Euro V.** The proposal also included for the implementation of diesel particulate filters (DPFs) which can lead to a >75% reduction in particulate emissions.

The proposal in the OBC will be for funding of up to 94 buses, on the condition that all operators within Cardiff can apply for the scheme.

³⁶ Interim Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017 July 2018.

³⁷ https://www.lowcvp.org.uk/assets/reports/CVTF_CBTF%20Evaluation%20Study%20-%20FINAL.pdf

As such the following outline cost and expenditure breakdown for this scheme is detailed below in Table 19.

Diesel Bus Retro Fitting	2019/20 (47 Buses) £	2020/21 (47) £	94 in total £
Retrofit Costs*	£585,675	£626,025	£1,211,700
Telematics and data report for 5 years	£75,200	£75,200	£150,400
			Total £1,362,100

Table 19 - Bus Retrofit Scheme Costs

*Based on 2017 bid costs

The above expenditure has been split over two financial years. However the previous programme indicated that this project could potentially be completed over <u>a 25 week</u> <u>programme</u> which could allow for an initial programme to be completed within a single calendar year.

The impact of the above two measures could be further enhanced by the implementation of a Low Emission Zone (LEZ) for Buses which would require buses operating in the LEZ to have minimum emission standard or Euro 6 or ULEV. Such a zone would be achieved by applying to the Traffic Commissioner to issue a Traffic Regulation Condition (TRC) which applies to the license of bus operators providing services in Cardiff. A TRC would be issued under the Regulation 7 of the Transport Act 1985³⁸, whereby Regulation 7(4) states that if the traffic commissioner is satisfied, 'after considering the traffic in the area in question that such conditions are required or are likely to be required in order to(c) reduce or limit ...air pollution.

The need for a Bus LEZ will be considered and assess further as part of the Full Business Case with further consultation with bus operators.

5.2.3 Taxi Licensing Policy and Mitigation Measures

On the 5th March 2019 the Public Protection Committee agreed for Shared Regulatory Services to consult on the proposals to amend the Council's taxi licensing policy which would see the introduction of new emissions and age requirements for the granting of new licenses and/ or change of vehicle applications on new existing licenses. The proposals³⁹ would require that any vehicle included on the application for a new grant is a minimum Euro 6 emission standard (petrol and diesel) as part of the license application. The same emission standard would also apply for any change of vehicle on an existing license.

Following the detailed consultation on this proposal the Public Protection Committee will then be asked to approve the revisions of the Councils licensing policy, with an implementation date to be agreed. Whilst there is no direct cost the Council for implementing the revised license conditions, it could be argued that Council's new taxi strategy to set age and emissions criteria for licensing for private hire and hackney carriages could place a financial burden on drivers and operators licensed within Cardiff. This burden is not faced by taxis licensed outside

³⁸ https://www.legislation.gov.uk/ukpga/1985/67/contents

³⁹<u>Public Protection Committee 5th March 2019 Item 5 Update To The Age, Emission And Testing</u> Requirements Of Hackney Carriage And Private Hire Vehicles

of Cardiff and they are free to compete for trade alongside Cardiff licensed taxis. This potential could see Cardiff taxis placed at a financial disadvantage.

In order to redress the balance, the Council will assess in detail measures to assist taxi operators with making the switch to newer, more efficient vehicles. The economic assessment will include for the provision of mitigating measures for the taxi trade, in terms of a grant scheme to assist with purchase of OEV/LEVs.

A number of Councils in the UK have already introduced similar vehicle emission standards on taxis, but in doing so they have worked to assist the taxi trade by offering incentive schemes. Once such scheme is that offered by Southampton City Council.

Southampton provide a grant to taxi drivers to assist them in upgrading their vehicles⁴⁰. For Fully EVs Southampton provide **£3k** and for plug in hybrids, **£2.5k** is offered.

If Cardiff Council was to provide a similar grant scheme, through the Air Quality Fund, based on the number of private hire vehicles and hackney carriages that do not meet the latest Euro 6 emission standards (~1800 vehicles) further funding of **between £5.5M (Fully EV) and £3.6M** (**Plugin hybrids**) would be required to support a grant scheme to change all vehicles currently not compliant.

However, in discussions with Licensing, the average combined change of vehicles for Hackney and Private Hire vehicles is ~420 p.a. Based on this turnover and the number of non-Euro 6 registered vehicles currently licensed by the Council, the following spend profile for the initial grant scheme has been estimated in Table 20.

Potential Grants	19/20 £000's	20/21 £000's	21/22 £000's	Total Initial Grant Costs £
Change of Vehicle 420 No Full EV Grant £3k	£630*	£1,260,	£1,260	£3,150,000
Change of Vehicle 420 No Plugin Grant £2.5k	£525	£1,050	£1,050,	£2,625,000

Table 20 - Taxi Incentive Grant Scheme Spend Forecast

*Based on 210 vehicles only allowing for proposals to be consulted on and approved

Cardiff Council would like to ensure that the grant scheme remains in place until such a time as all vehicles, are upgraded. Further it is possible that the licensing policy could be revised further in the future as the report being taken to the Public Protection Committee states the following:

- A consultation on whether to require all hackney carriage and private hire vehicles licensed for the first time to be ULEV from January 2021;
- A consultation on whether to require all existing hackney carriage and private hire vehicles to be ULEV from January 2025.

Therefore a longer term grant scheme may need to be considered should the Council implement further policy revisions. Further the Welsh Government's current consultation on Improving Public Transport⁴¹ states that Welsh Government proposes that a 'national

⁴⁰ https://www.southampton.gov.uk/environmental-issues/pollution/air-quality/concessions/

⁴¹ https://beta.gov.wales/sites/default/files/consultations/2018-12/improving-public-transport_0.pdf

standard should apply which specifies requirements for the vehicular emissions of taxis and PHVs' and thus Welsh Government may need to consider a wider national scheme to support any such policy.

5.2.4 City Centre Schemes

The main purpose of these schemes is to allow for better and more efficient movement of public transport (buses) and increase active travel capacity in the City Centre. Such schemes will also look to reduce highways capacity for private vehicles which will is intended to be a catalyst for increase modal shift to public and active travel.

Three schemes are proposed to complete the City Centre 'Loop' and are intrinsically linked to the Integrated Transportation Hub in Central Square. The schemes are:

City Centre West (CCW)

The main aim of this scheme is to accommodate the new Transport Interchange and Central Square Development, whilst also Improving Air Quality within the City Centre AQMA. This will be achieved through removing through-traffic from Westgate Street and installing a new highway layout that will improve and connect the current bus network with the new Interchange, Central Square, Central Station and the City Centre Enterprise Zone. In addition, the scheme will offer improved safety for pedestrians via improved pedestrian crossing facilities, 20mph speed limits and an improvement to the pedestrian environment outside of the national stadium. The scheme will also install a network of stepped cycle tracks to connect the area with the proposed cycle superhighway on Castle Street and the Taff Trail routes.

City Centre North (CCN)

The main aim of this scheme is to bring Castle Street into Air Quality compliance by 2021 and install a cycle superhighway along its length. The installation of the cycle lane and the reduction in highway space will allow for traffic to be reduced enough to target the air quality issue. Improved pedestrian crossings with countdown timers will also provide safety improvements for pedestrians.

Eastside Phase 1

The main aim of this scheme is to provide a new dynamic for the bus network, whilst connecting cycle superhighway and improving the pedestrian environment outside of Queen Street Station. This will be achieved through providing bus priority measure throughout the Station Terrace and Churchill Way areas that will provide new routes for buses, taking them away from the City Centre AQMA and closer to key areas such as Queen Street Station and the shopping district. The new bus routing system is also key to allowing the Interchange to be accessed from its south entrance, and also work effectively on major event days. A cycle superhighway will be installed to connect the east of the city centre with the City Centre Enterprise Zone, and join up all the proposed cycle superhighway routes. Pedestrian improvements on Dumfries Place and Station Terrace will also improve safety for pedestrians and improve connections to Queen Street Station and the City Centre Enterprise Zone.

The expenditure forecasts for the Loop Scheme are detailed in Tables 21-23.

Table 21 - City Centre West Scheme Expenditure Forecast

		£000's		£000's		00's	£000's	£000's
CCW	Pre19/20		19/20		20/21		2021/22	
Surveys/Modelling	£	461	£	-				
Design	£	100	£	104				
Land Purchase								
Accommodation Works (WelTAG)			£	152	£	272		
Construction			£	1,600	£	4,400		
Project Mgmt.			£	130	£	381		
Monitoring Evaluation			£	-	£	20		
Promotion			£	5	£	5		
Gross Totals	£	561	£	1,991	£	5 <i>,</i> 078	£-	£ 7,630

Table 22 - City Centre North Scheme Expenditure Forecast

CCN	£000's	£000's	£000's	£000's	£000's	£000's
	Pre19/20	19/20	20/21	2021/22	22	
Surveys/Modelling	£ 48	£ 50	£ -	£ 50	£ -	
Design	£86	£9	£9	£80	£	
Land Purchase	£	£	£		£	
Accommodation Works (WelTAG)	£ -	£53	£53		£118	
Construction		£ 3,000	£ -		£ 3,000	
Project Mgmt.		£127	£127		£255	
Monitoring Evaluation		£	£10		£10	
Promotion		£5	£5		£10	
Gross Totals	£134	£3,244	£204	£130	£3,393	£7,105

Table 23 - Eastside Phs 1 Scheme Expenditure Forecast

Eastside Phase 1	£000's	£000's	£000's	£000's	£000's
	Pre19/20	19/20	20/21	2021/22	
Surveys/Modelling	£81	£330	£20		
Design	£130	£157	£0		
Land Purchase	£0	£0	£0		
Accommodation Works (WelTAG)	£44	£0	£108		
Construction		£0	£3,000		
Project Mgmt.		£23	£243		
Monitoring Evaluation		£0	£0		
Promotion		£0	£10		
Gross Totals	£255	£510	£3,381	£0	£4,146
The total outline cost for the three schemes is **£18.9M.** Existing bids to the Local Transport Fund (LtF) and City Deal have been made for some of the schemes but Cardiff Council have not received confirmation on these bids and thus these contributions have not yet been removed from the Gross cost of the scheme.

The implementation of the schemes are extremely challenging in terms of full completion by the end of 2021 to demonstrate compliance. As such it is imperative that the Council has confidence on available funding in order to that appropriate procurement procedures can commence in order that contracts for design and build can be awarded at the earliest opportunity, with the aim of construction works **commencing no later than January 2020**.

5.2.5 Active Travel Measures

The total projected costs to complete a wider 20mph area/Active Travel role out (2 additional ward areas of Grangetown and SE Cardiff (Splott/Adamsdown)), and completion of the CS1 to University Hospital Wales (UHW) is forecasted at £7.3M. **To date £3M** has been bid for from the Active Travel Fund for CS1, with a remaining funding deficit to compete CS1 of £2.8M and £1.4M for the Active Travel/ 20 mph areas required. The full expenditure forecast for these measures are detailed in **Table 24** and Table 25.

20mph Areas	£000s Pre 19/20	£000s 2019/20	£000s Total
Surveys	3	6	9
Design	27	124	151
Land Purchase	0	0	0
Accommodation Works	0	7	7
Construction	160	1,021	1,181
Project Management	0	103	103
Monitoring and Evaluation	0	13	13
Promotion	0	4	4
GROSS TOTAL	190	1,278	1,468

Table 24 - Expenditure Forecast for the 20 Mph Areas

Table 25 - Expenditure Forecast for Completion of Cycle Way 1

Cycle Way 1 -	£000s Pre 19/20	£000s 2019/20	£000s 2020/21	Total £000s
Surveys	0	33	6	39
Design	0	194	0	194
Land Purchase	0	0	0	0
Accommodation Works	0	61	0	61
Construction	80	1,057	4,074	5,211
Project Management	27	109	193	329
Monitoring and Evaluation	0	5	15	20
Promotion	0	5	9	14
GROSS TOTAL	107	1,464	4,297	5,868

Excluding existing funding bids the estimated OBC costs to implement the package of measures as a preferred option is summarised below in Table 26.

Measure	Est. Funding Requirements £M
Electric Buses	£1.8M
Bus Retrofit	£1.4M
Taxi Mitigation Schemes	£5.5M*
City Centre Schemes	£18.9M
Active Travel and CS1 completion	£4.2M
	Total: £31.8M

Table 26 - Final Preferred Package of Mea	sures Estimated Costs
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*Based on all drivers applying for £3k EV Grant, and ~1800 vehicles applying.

5.2.6 Monitoring and Evaluation

As part of the Plan it will be important to demonstrate the actual effectiveness that the measures will provide in terms of NO_2 and other emission reductions. In order to demonstrate that compliance will be achieved on Castle Street, it is proposed that a real-time monitoring station, equivalent to AURN site standards be established within this City Centre location, ideally on Castle Street. This monitor would complement and enhance existing monitoring capabilities and would give accurate and robust data to assess the effectiveness of the proposed measures.

As part of enhancing the Council's monitoring capabilities and adding to its wider monitoring network, it is also proposed to implement indicative real-time monitors to assess and monitor any displacement effects of the proposed measures on peripheral areas, and in particular the City Centre AQMA.

The location of the proposed monitors are detailed in **Figure 11** and the proposed costs for implementing the monitoring network is detailed in Table 27 and **Table 28**.



Figure 11 - Locations of Proposed Air Quality Monitoring Network

Castle Street Automated Monitoring Station	2019/20	2020/21	2021/22	
Equipment Purchase and Installation	£26,000	£0	£0	
Planning and Construction	£4,000	£0	£0	
Service and Maintenance	£2,600	£2,600	£2,600	
Data Handling	£1,950	£1,950	£1,950	
Utility Charges	£750	£765	£765	
Project Mgmt.	£350	£225	£225	
Monitoring Evaluation	£550	£560	£570	
Promotion	£250	£0	£0	
Gross Total	£36,450	£6,090	£6,090	£48,630

Table 27 - Cost Estimates for an Equivalent AURN Monitoring Station

Castle Street Automated Monitoring Station	2019/20	2020/21	2021/22	
Equipment Purchase and Installation	£35,795	£0	£0	
Planning and Construction	£112	£0	£0	
Service and Maintenance	£0	£3,600	£0	
Data Handling (Server Fee)	£3,000	£2,400	£2,400	
Utility Charges	£0	£0	£0	
Project Mgmt.	£350	£360	£350	
Monitoring Evaluation	£155	£160	£165	
Promotion	£250	£0	£0	
Gross Total	£39,662	£6,520	£2,915	£49,097

Table 28 - Cost Estimate for Additional Near Real-time Air Quality Analysers

In addition to measuring the direct air quality improvements, further monitoring and evaluation will be undertaken, in terms of detailed traffic surveys to identify any changes in local traffic composition and traffic volumes, which will be reviewed in conjunction with the air quality data. Further surveys will also be conducted to assess whether the measures have results in increased patronage on public transport and increase of active travel modes. The nature of these surveys will be develop further and reported in the Full Business Case.

5.3 Contingency

A full estimation of contingency required will be undertaken as part of the Full Business Case for the preferred option and will be detailed in the Final Plan.

5.4 Assurance of Cost Estimates

A full determination of assurances will be undertaken as part of the Full Business Case for the preferred option and will be detailed in the Final Plan.

5.5 Budget and Risk Management

Costs will be managed by ensuring all procurement follows the procurement strategy outlined in the Commercial Case. The assessment of tenders through this process will be based on both quality and price to ensure value for money.

The budget management responsibility will fall to the overall Project Manager.

5.6 Other Funding Options

The Council will explore all other funding opportunities to obtain additional resources to implement the measures including associated bids to the Local Transport Fund, City Deal and Active Travel funding. Further funding resources will also be assessed to implement further measures detailed in the Clean Air Strategy that whilst not achieving compliance in the shortest time possible, will assist in reducing overall NO₂ and other air pollutants across Cardiff.

Section 6 Management Case

6.1 Introduction

The purpose of the Management Case within this OBC is to set out how the scheme/s will be delivered successfully. In accordance with the Inception package of JAQUs guidance this OBC considers the following;

- Outline the arrangements required to ensure successful delivery of the scheme;
- Benefits realisation should be set out here for the identification of potential benefits, modelling and tracking as well as a risk management strategy and risk mitigation.

6.2 Project Management

The project will be run in accordance with the Council's Project Quality Assurance (PQA) scheme which is Cardiff Council's Project and Programme Management Standard and is based on PRINCE2 (PRojects IN Controlled Environments) and MSP (Managing Successful Programmes) which are the methodologies approved by government for public sector projects. PQA provides guidance on how the Council will manage projects, recognising that projects are:

- Change focussed
- Unique
- Composed of inter-dependent activities
- Carried out by people who don't normally work together
- Temporary, with defined start and end dates
- Established to achieve a specific outcome

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

6.2.1 Project Board

The Project Board is responsible for the overall direction and management of the project, and has responsibility and authority for the project within the remit (the Project Mandate) set corporately. The Project Board are accountable to the Project Executive.

Membership of the Project Board should include the Project Executive and Service Area representative (Senior User). Other participants may be invited by the Project Executive.

6.2.2 Project Executive (PExec)

The Project Executive (PExec) is accountable for the successful delivery of the project and is most likely to be a senior officer within. The Project Executive's role is to ensure that the project is focussed throughout its life cycle on achieving its objectives - delivering the agreed scope and outputs, as detailed in the project's Business Case. The Project Executive has to ensure that the project delivers value for money.

The role includes acting as the lead officer for the project in stakeholder engagement, such as discussions with elected Members, AM's or MP's. As Chair of the Project Board they give approval to proceed to the next stage and sign off project closure.

The Project Executive will:

- Ensure the project remains focussed on delivering agreed scope and outputs
- Oversee the project and ensure it remains on target time, cost, quality and scope.
- Take decisions within their delegated authority and ensure these are within the corporate decision making framework.
- Be proactive in providing leadership and direction throughout the project
- Ensure that the project is financially viable, consistent with the Corporate Plan and compliant with Council standards and procedure rules.
- Approve the Initial Project Brief at the end of the Start-up Stage.

6.2.3 Service Area Representative (Senior User)

Senior User is the role that represents the service or customer that will receive the changes delivered by the project.

They represent the interests of the end users who will benefit from the completion of the project. The Senior User is accountable for ensuring that requirements have been clearly and completely defined and what is produced is fit for purpose and acceptable to the end users.

6.2.4 Senior Supplier

The Senior Supplier sits on a Project Board.

They represent the officers / contractors actually doing the work of the project. They are responsible for ensuring all suppliers understand the project requirements and that any advice given to the project team is correctly interpreted. It may not be appropriate for an external contractor to act as Senior Supplier, and consideration could be given to involving's procurement team in this position. An example of a Senior Supplier would be ICT for software development projects.

6.2.5 Project Manager

The Project Manager is responsible, on behalf of the Project Executive, for delivering the project on time, to budget and to the required quality standard. They plan and monitor progress, co-ordinate project activities, ensure the project is effectively resourced, and manage relationships with a wide range of stakeholders.

The Project Manager manages the work of specialists, allocating and utilising resources in an efficient manner and maintaining a co-operative, motivated and successful team.

The Project Manager is also responsible for maintaining project governance and documentation, including producing regular highlight reports and maintaining records in the Project & Programme Management Database (where used).

6.2.6 **Project Assurance**

Project & Programme Assurance covers all interests of a project/programme, including senior managers, the business, users and suppliers.

The main function of Assurance is to ensure that corporate governance standards are adhered to; that the project has been set up and is being managed correctly, and identified benefits are realised.

Project Assurance has to be independent of the Project Manager, so reports directly to the Audit Manager, Project Board / Project Executive and are their eyes and ears in the day to day management of the project.

6.2.7 Project Support

The Project Support Officer assists the Project Manager in all activities relating to day to day management, establishing and maintaining the necessary systems to ensure effective administration. Not all projects will have a dedicated Project Support Officer and this function is often carried out by the Project Manager.

6.2.8 Audit Committee

The Audit Committee has responsibility for overseeing all aspects of Risk Management, Governance and Internal Control. The Committee will provide guidance and oversight to the management of risk but also challenge the effectiveness of the project management arrangements within. The Committee will look to seek assurance for that project management is being properly undertaken.

6.2.9 Senior Management

The key roles of Management are to:

- Implement processes for project management
- Receive reports from Internal Audit for consideration and implementation, where this is deemed appropriate.
- Promote the accountability and responsibility of all staff within as set in Cardiff Council's PQA Handbook;
- Identify the project management (PQA) training needs of all Directorate employees and co-ordinate training and awareness-building events;
- Ensure that project management (PQA) is incorporated into performance management, business planning and Wales Programme for Improvement processes.

6.2.10 Investment Review Board

The Investment Review Board is the governance body where decisions about delivery of change initiatives are made. No new initiatives should be started or funded without the Investment Review Board's approval.

- Agree the programme & project management framework (PQA);
- Approve the Organisational Development Strategy and Delivery Plan;
- Receive Strategic / Project Business Cases and prioritisation reports and determine the scope and content of change;
- Ensure that resources are allocated appropriately;
- Ensure conflicts between programme and project delivery and BAU that cannot be addressed at programme level are addressed effectively;
- Promote collaborative working across ; and

• Undertake periodic reviews of the effectiveness of delivery of 's vision, and take appropriate action where required

6.2.11 Organisational Development Management Board

The Organisational Development Board (OD) is the strategic group which monitors delivery of programmes and projects, resolving key issues that may compromise delivery and benefit realisation. The key roles of the OD Board are to:

Plans the delivery of change, aligned to vision, objectives, goals and key measures

- Actively and regularly involves SMT throughout the definition and delivery of change, ensuring continued senior management commitment and engagement;
- Ensure all change is delivered within 's agreed governance framework, including PQA;
- Initiate new programmes;
- Monitor delivery of the Strategic 'Organisational Development' Delivery Plan;
- Review and resolve key strategic issues;
- Ensure risks and dependencies are effectively managed;
- Ensure limited resources are managed effectively and efficiently;
- Monitor and approve changes to forecasted benefits;
- Sponsor and support reviews of the effectiveness of change delivery, and take appropriate action where required;
- Determine and drive 's future service delivery models and strategic commissioning arrangements; and
- Develop and deliver a consistent approach to stakeholder engagement and communications

The basic structure of a project team is as follows:-



6.3 Financial Management

6.3.1 Financial Reporting

The Project Manager will be responsible for undertaking regular financial reporting to inform the Programme Board of the projects progress and performance. A Project Initiation Document will be developed to provide a firm foundation for the initiation of the project. It will set out the direction and scope of the project, and form the 'contract' between the Project Team, Project Manager, Transport Delivery Board and the Programme Board.

Following initiation, the Project Manager will produce monthly highlight reports which will be submitted to the Project Delivery Board.

Scrutiny and oversight of the projects financial management will be provided by the Programme Team.

6.3.2 Variation Monitoring

As with all large scale projects it is expected that elements of the agreed plan, budget, or scope will need to be varied at some point during the project cycle. It is important that means of controlling any variations are signed offer before being implemented so that they can be dealt with simply and at the correct level.

A variation to the project will be identified through the monthly progress reports where activities are not being carried out according to the plan or for the agreed cost, or an issue has arisen to affect the scope. All variation will be recorded on a variation request log that will be used to specify why the change has come about, what actions are proposed to counter it, and at what level decision-making sits.

A set of tolerances will be determined, so that each level of management in the project has the defined authority to agree certain variations before having to refer to a higher level. The agreed tolerances will be recorded in the Project Initiation Document, as will the period within which variations are cumulative.

Variations that do not affect the plan or the budget by more than is reported in one month will likely sit within the tolerance of the project manager. Although additional decision-making will not be required, all such variations will be recorded on the monthly progress report and an entry will be made on the variation request log.

Variations of a higher tolerance will be clearly brought to the attention of the Project Delivery Board (PDB) in the finances section of the progress report. This will allow a discussion to take place and a way to proceed be agreed. Larger variations, which exceed the tolerance of the PDB, will need to be taken to a higher level of decision-making beyond the PDB.

6.4 Project Plan

An indicative project plan for completing of the Final Plan and the Full Business Case for the preferred option is provided in Figure 12. An outline implementation plan, for the refined measures included as the preferred option is detailed in Figure 13. This plan will be developed with more detail and project milestones added in the FBC.

6.5 Risk Management

Risks are tracked in accordance with the Council's corporate risk management principles, which draw upon the PRINCE2 methodology. This strategy requires the identification and recording of risks, an evaluation of their likelihood and any mitigation actions. This approach ensures that all risks are captured and processed in a consistent manner. The risk register is attached in

Appendix D, and includes risks that relate to political, financial and operational issues. Without mitigation, these could result in increased costs to the programme, reductions in the quality of outputs and slippages in timelines, all affecting the overall benefits and outcomes the business case seeks to deliver. Ownership of the risk register falls with the Programme Manager. These risks will be subject to on-going monitoring and mitigated through effective programme management and partnership working.

6.6 Communications Strategy

6.6.1 Aims

A communications strategy and plan has been designed to enable the Council to engage the public and stakeholders on the options that are being considered in the Outline Business Case (OBC). The full communications strategy is included in Appendix E.

6.6.2 Objectives

The following set out the key objectives of the communication strategy:

- To advise the public and stakeholders on the process that has to be followed with the OBC to meet the requirements of the Welsh Government;
- To provide information on the measures that are being proposed in the OBC, what these measures are and how these measures will be benchmarked against a variety of possible Clean Air Zones in terms of the timescales for achieving compliance; and
- To give the public and stakeholders the opportunity to ask any questions through the engagement process and receive responses from the project team.

The proposed strategy is a high level communication exercise, which is ultimately a preengagement exercise in relation to the Council's clean air feasibility study. Further detailed statutory consultation will be undertaken, specifically on the City Centre Schemes separately as their design and implementation are approved and taken forward as separate detailed schemes.

It is proposed to run the engagement exercise, from the Wednesday April 3rd 2019 and will end six weeks later on Wednesday May 15th 2019. This will enable the Council to consider feedback that will be received during the engagement exercise as the FBC is developed and finalised.

This timeframe is seen as the maximum that can be allowed for, owing to the short timescales for the Council to complete the FBC in order to comply with the required legal deadline of 30th June 2019, as set out in the Direction.

6.6.3 Stakeholder Management

Key Stake holders for the plan have been identified and are shown in Table 29. Their power of influence and requisite levels of interest have been considered to maximise the consideration of their needs and influence on the success throughout the programme. This framework of stakeholder management and engagement will be continued throughout the programme to inform the communications and dissemination activities. Offering a flexible approach, activities will be directed to involve and communicate with stakeholders to become more interested if it can add to the success of the project.

Table 29 - Stakeholder Interest Groups Matrix

High Influence	High Interest	High Influence	Low Interest
Statutory bodies, W	/LGA, NRW, Public Health Wales, Public Health Board	Local and na	ational media
Policy officers at W	elsh Government who oversee the funding		
Cabinet			
Elected Members			
Public Services Boa	rd		
Clean Air Steering C	Group		
Shared Regulatory	Service Joint Committee		
Public Protection C	ommittee		
Environmental Scru	itiny Committee		
MP's and AM's rep	resenting Cardiff		
MP's and AM's rep	resenting areas in the City Region		
Local communities	living in close proximity to where the measures will be		
put in place			
Established commu	nity groups in close proximity to where the measures		
will be put in place			
Businesses in close	proximity to where the measures will be put in place		
Environmental cam	paign groups – Friends of the Earth, ClientEarth,		
Healthy Air Cymru			
British Lung Founda	ation Wales		
British Heart Found	ation Wales		
Business Improvem	ent District – For Cardiff (on behalf of city centre		
businesses)			
• Unions – GMB, UNI	SON and UNITE		
Sustrans			

Cardiff Cycling Campaign		
Living Streets		
Low Influence High Interest	Low Influence	Low Interest
Taxi Trade	The wider p	ublic in Wales
Royal Mail		
Bus companies operating in Cardiff - Cardiff Bus; Stagecoach and New		
Adventure Travel		
 Coach companies - National Express, Mega Bus 		
Associated British Ports		
Federation of Small Businesses Wales		
Alliance of British Drivers		
Road Haulage Association		
 Society of Motor Manufacturers and Traders 		
Community Transport Association		
Chartered Institute of Environmental Health		
Institute of Air Quality Management		
Environmental Protection UK		
Environmental Industries Commission		
Confederation of Passenger Transport		
Travel campaign groups – RAC, AA, Alliance for British Drivers		

Figure 12 - Updated Project for Delivery of Final Plan

Clean Air Work Programme



Figure 13 - Implementation Plan of Preferred Options



Section 7 Summary and Next Steps

7.1 Result on the Assessment of Options

Localised air quality modelling and transport modelling was undertaken to establish the impact of the CASAP measures and CAZ as to whether compliance could be achieved by 2021. As detailed in the Initial Plan baseline assessment shows that by 2021 only Castle Street would breach the EU limit value for NO₂ with concentrations of 41.1 μ g/m³ being predicted.

The CASAP measures have been assessed accumulatively in terms of combining the measures identified in CASAP 1 with CASAP 2 and finally all measures have been assessed together as a final package, CASAP 3. The results of the measures in terms of delivering compliance on Castle Street are summarised as follows:

- CASAP 1 by 2021
 - Implementation of 36 Electric Buses;
 - Impact of revised Taxi Licensing Policy;
 - Active travel package;
 - Cycling programme to end of 2020; and
 - 50mph on A4232

 NO_2 concentrations on Castle Street have been modelled to reduce from **41.1 µg/m³ to 37** µg/m³ by the implementation of the above measures.

• CASAP 2 – all of CASAP 1 +

- City Centre West and East Schemes;
- A48 P&R;
- J33 P&R; and
- Revised Parking Charges at Council Car Parking Spaces.

 NO_2 concentrations on Castle Street have been modelled to reduce from **41.1 µg/m³ to 36** µg/m³ by the implementation of the above measures.

• CASAP 3 – all of CASAP 1 +2

- Retrofit Programme for Buses;
- A470 additional southbound traffic lane; and
- Nantgarw P&R.

 NO_2 concentrations on Castle Street have been modelled to reduce from **41.1 \mug/m³ to 35** μ g/m³ by the implementation of the above measures.

In addition to achieving compliance on Castle Street, the impact of the package of measures has also been modelled at local air quality monitoring locations, including those locations within existing AQMAs. The results of the modelling indicate that all monitoring locations are expected to have concentrations below 40 μ g/m³ which further demonstrates that the package of measures will improve local air quality including within existing AQMAs.

As it stands the CASAP results do not include the impact of the City Centre North (Castle Street) proposals, as the detailed modelling work commenced prior to understanding the outline design of this scheme, and thus the impact of this scheme has not currently been assessed in the current package of measures.

The ruling of the Client Earth 2 set out three tests that Clean Air Plans (the Feasibility Study) must meet in order that they are seen to comply with Article 23 of the EU Directive. The third test states that the plans must demonstrate that compliance with the limit values is not just possible, **but likely.** As summarised above through the implementation of the CASAP measures the level of compliance that is modelled to be obtained on Castle Street, is the greatest with NO₂ concentrations reduced from 41.1 μ g/m³ to 35 μ g/m³.

Owing to the level of uncertainty in the air quality modelling achieving a level of **35** μ g/m³ or better is an important target for the Council to obtain. Probability analysis undertaken, indicates that modelled levels of 35 μ g/m³ or less gives a greater than **80%** probability that compliance with the limit value will **actually be achieved**, when the measures are implemented.

As a comparison the results of the modelling undertaken on the CAZ scenarios are summarised as follows:

- CAZ 1 Private cars achieves compliance on Castle Street 32.5 μ g/m³ .
- CAZ 2 Commercial vehicles achieves compliance on Castle Street NO_2 35.3 $\mu g/m^3$

The results for CAZ 1 and 2 show that NO_2 concentrations are estimated to be lower than the baseline 2021 scenario at most links, but with CAZ 1 showing increases on 6 links and CAZ 2 showing increases on 4 links. The largest decrease observed in both CAZ 1 and 2 is on Castle Street, as might be expected for a measure that is specifically targeting the city centre.

However when compared directly to CASAP 3, most links show higher concentrations in the CAZ 1 and 2 scenarios. But this is to be expected, as the CAZ scenarios do not include any of the CASAP measures and targets a smaller geographical area. CAZ 1 achieves larger reductions along roads within the clean air zone, although CAZ 2 is estimated to have lower concentrations on most other links (32 in total).

7.2 Next Steps

Government guidance is quite clear that a charging CAZ should only be considered as a preferred option if other non-charging measures are not sufficient to bring about compliance in the shortest possible time. Given that the modelling undertaken has demonstrated that a package of measures achieves compliance in the same period if not sooner than a charging CAZ, then ultimately the Council is justified in implementing a package of measures as a preferred option rather than a CAZ. Further as detailed above, the implementation of the non-charging measures provides wider air quality improvements across Cardiff as a whole, including within the existing AQMAs.

This OBC therefore proposes that a refined package of measures is taken forward as the Councils preferred option. This refined package of measures includes the following:

- Implementation of Electric Buses 36 Electric Buses to be implemented on a number of routes within the City Centre;
- **Bus Retro Fitting Programme** Target up to 94 buses that currently do not meet latest Euro 6 emission standard;
- Taxi Licensing Policy and Mitigation Scheme;
- City Centre Loop Schemes, inclusive of Castle Street ; and
- Active Travel Measures

The revised package of measures will be further assessed both in terms of transport and air quality modelling, as a final package of measures to enable the Council to develop the Full Business Case, This will include the full detailed socio-economic distribution of the measures and a distributional analysis to understand the extent to which these measures may impact on the residents of Cardiff and those that travel in to the city. For the full business case these additional considerations will be assessed in more detail in terms of a health impact assessment and a distributional impact assessment.

The results of this assessment will then demonstrate the level of compliance that will be achieved by implementing the preferred option on Castle Street, and elsewhere across the City including within the existing AQMAs. The preferred option will be subject to a full economic assessment following appropriate guidance to demonstrate the full impact of implementing the preferred option. This report will be reviewed and assessed by the Welsh Government's Expert Review Panel, prior to final approval of the preferred option being provided from Welsh Government.

Appendix A - Air Quality Modelling Methodology Report

Appendix B - Transport Modelling Technical Approach

Appendix C - Clean Air Strategy

Appendix D - Project Risk Register

Appendix E - Communication Strategy