C5 B

Cost and Efficiency

C5B Technical Annex 03
Distribution Mains Investment Case: Technical Approach and Business Case

NTPBP-INV-DIS-0527

BRISTOL WATER

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1 Foreword

A distribution main is an asset that transmits potable water within a supply network. Distribution mains are generally located downstream of service reservoirs and transmit water to customers' supply pipes.

The purpose of this document is to set out our customer led, outcome focused plan which will mitigate risks posed by and associated with distribution mains.

The investment case, one of 21 will summarise the facts, risks and investment requirements for distribution mains for the next review period for 2020 to 2025. This investment case will also summarise performance for distribution mains for the current review period from 2015 to 2020 and our methodology for determining and delivering the future distribution mains strategy.

This investment case document is a technical annex to section C5B of our overall business plan submission, as illustrated by the diagram below:

This investment case is aligned to the Water Network Plus Wholesale Control aspect of our business plan. It is recommended that this investment case is read in conjunction with the PR19 Investment Case Summary Document[1] which outlines in detail our methodology for defining investment.

[1] Bristol Water PR19 Investment Cases Summary Document NTPBP-INV-PR1-0635

2 Executive Summary

In order to provide customers with a Safe and Reliable Supply we will focus on maintaining the level of risk posed by our 5975km of distribution mains. We will achieve this by using our totex investment approach which includes base maintenance and capital expenditure of £37.694m. We will deliver interventions comprising the renewal of 87.5km of ductile iron and asbestos distribution mains, which will contribute towards the supply interruption, leakage, bursts and customer contacts about water quality appearance performance commitments. We will challenge ourselves to deliver more efficiently and apply innovation to the processes we adopt for distribution mains. When considering our efficient and innovative approach we plan to deliver our distribution mains capital programme for £34.678m.

At Bristol Water we have completed an extensive customer engagement programme which has identified that one of five key priorities for customers is that we keep the water flowing to their tap and one of our four key outcomes is that we provide a Safe and Reliable Supply.

Our long term ambition, as presented in "Bristol Water Clearly", commits to maintaining the long-term health of our assets; improving long term health as we deliver the service improvements that customers value. This investment case will address specific risks and issues by utilising a totex approach to determine necessary capital maintenance investment to manage deteriorating assets.

Failures in our distribution mains primarily affect the service we provide to our customers with interruptions to their supplies and discoloured water at their taps. Additionally, the assets' health is measured in terms of burst frequency and leakage. The interventions proposed in this business case have been developed to maximise the impact of investment, using a totex approach, with the significant proportion improving Interruptions to Supply, Burst reduction and customer Contacts – Appearance. A small reduction in leakage is also attributed. Our plans comprise three main initiatives: improving our current approach in mitigating the risk of supply interruptions; developing our planning approach to ensure that we are securing maximum benefits from our investment decisions; driving innovation and embedding new practices; while also managing our Planned Flushing Programme to ensure that operational activities support capital investment to generate the greatest benefit for our customers.

The reduction in interruptions to supply is of high importance to our customers. Our aim in AMP7 is to achieve a significant reduction in interruptions to our customers' supply from an end of AMP6 level of 12.2 minutes to 1.8 minutes by 2025, of which this Investment Case contributes 33.65%.

Also of significance to customers is the appearance of water. We plan to reduce contacts per 1,000 customers from 0.93 to 0.43 in AMP7, of which this Investment Case contributes 83.17%.

Alongside this improvement comes a reduction in bursts of 8.5 bursts per 1000 km, more than overcoming the current natural burst rate per year. This investment case contributes 94.8% towards meeting this performance improvement. In addition, the planned work contributes 7.33% towards meeting this performance improvement.

It is clear therefore that our plan for distribution mains provides a major contribution to important service improvements that are required and which are supported by our customers. The proposed length of mains affected by the plans is of a similar value to that for the AMP6 period.

The renewal of distribution mains is seen as a key enabler to achieving a reduction in supply interruptions. Reactive operational flushing and the Planned Flushing Programme is the key enabler in achieving the reduction in customer contacts about water quality – appearance.

As of July 2018 we currently have 5,975km of distribution mains, of which 3,833km are unlined ferrous or asbestos cement mains, the most likely to burst and lead to supply interruptions. We are forecasting that we will have reduced this length by 87.5km within AMP7 (by 2025), a 2.3% reduction. This reduction is greater than our replacement rate in the current AMP and will assist with getting us back on to the sustainable rate of mains replacement.

We will reduce our supply interruptions; burst frequency and customer contacts about appearance in several ways:

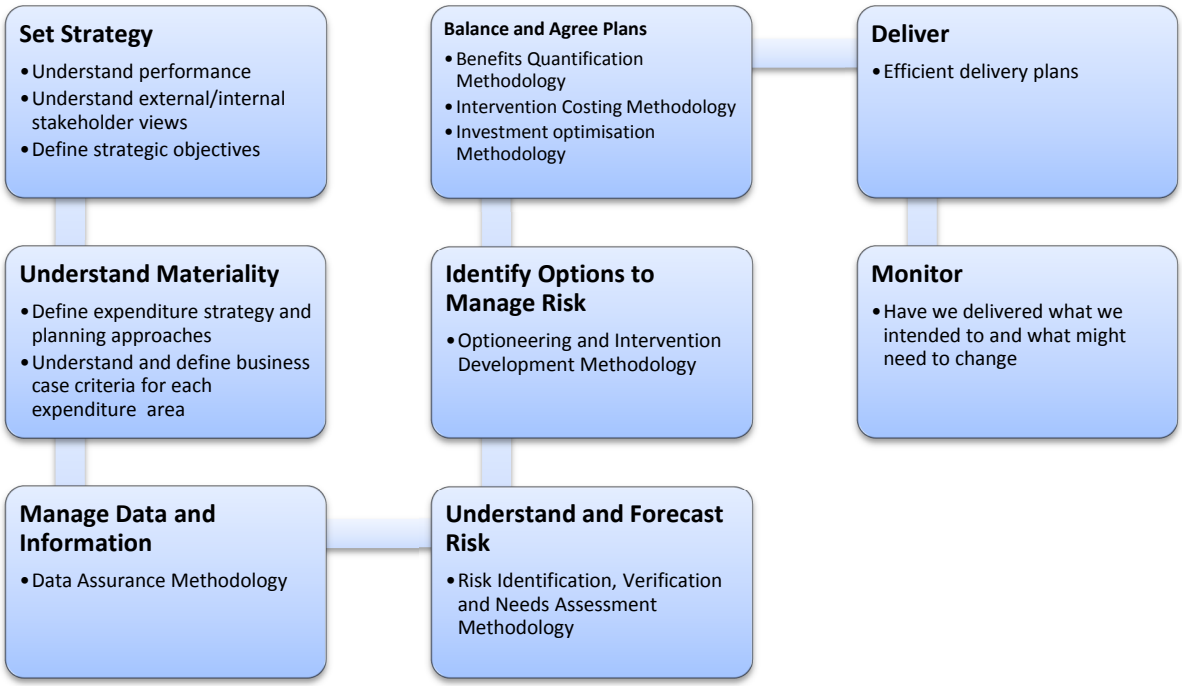
- Targeted mains replacement
- Zonal mains renewal
- Improved risk mitigation during planned works (e.g. mains renewal)
- Deployment of “rapid reaction team” in response to burst events, and
- Planned Flushing Programme

Through our work on asset deterioration, we have a good understanding of the asset health of our distribution mains. Investment in mains replacement and our planned flushing programme is required to ensure we maintain the performance our assets provide to our customers.

Should we fail to invest in distribution mains or not achieve the three associated performance commitments mentioned above, the key risks are that we will not meet our customers’ priority for reduced number of minutes lost supply due to supply interruptions, and our assets will deteriorate at an unsustainable rate, leading to an increase in customer contacts about appearance, bursts and leakage.

In order to ensure that we meet customers’ priorities and mitigate the risks associated with distribution mains, we have adopted the following methodology:

Figure 1: Approach to meeting customer priorities and Mitigating Risks



This approach enables us to demonstrate full "line of sight" from customer priorities, through risk review, options analysis and Optimisation, to Outcomes and benefits provided for our customers.

We plan to invest £37.694m between 2020 and 2025 in order to address the customer priority of having a 'Safe and Reliable Supply', as set out in Table 1.

We have set ourselves a challenging target of improving our cost efficiency by 8% during AMP7. This will be achieved by delivery of our business transformation programme results in in a post-efficiency investment of £34.678m.

Costs are allocated to the Water Resources Business Unit. Investment is all related to Non-Infrastructure assets and is maintenance expenditure. All our investment for distribution mains is associated with treated water distribution, and is categorised as maintaining the long term capability of infrastructure assets.

Table 1: Performance Commitment Targets and Percentage Contribution

Performance Commitment	Unit	2019/20 Baseline	2024/25 Target	Total Targeted Performance Improvement in AMP7	Distribution Mains % Contribution to Performance Improvement
Supply interruptions	Average mins per property	12.20	1.80	10.40	33.65%
Leakage	Ml/d	43	36.5	6.5	7.33%
Mains bursts	Per 1000km	142	133	9	94.80%
Customer contacts about water quality – appearance	Contacts per 1,000 population	0.93	0.43	0.50	83.17%

Our AMP7 investment in distribution mains will help ensure our assets are being maintained appropriately to deliver resilient water services to current and future generations.

Full details of our outcomes, performance commitments, and outcome delivery incentives are provided in Section C3 of our business plan.

3 Background To Our Investment Case

3.1 Context

This investment case will cover the renewal and maintenance of distribution mains that we define as a distribution main as a main that "supplies water directly to customers".

Distribution mains represent the assets closest to our customers, where our supplies are carried to the taps and appliances in their homes and places of work. One of four customer priorities, is "Keeping the water flowing to your tap", and this is supported by the outcomes we are aiming to achieve in "Local Community and Environmental Resilience" and "Safe and Reliable Supply". Reducing the impact on our customers from issues associated with the health and performance of our distribution mains is planned and measured by the relevant performance commitments that provide us with a view of asset health.

Understanding how investment decisions can impact on the performance commitments for distribution mains is more complex because the assets are buried. We have adopted modelling as a way of determining the condition and performance of mains, and our approach includes a Burst Deterioration Model and Zonal analysis approach. Both models are being used in AMP6 and this approach provided us with a good understanding of the asset health of our distribution mains.

We currently have 5,975km of distribution mains within our licensed area. Distribution mains comprise a significant proportion of the total infrastructure or below ground asset base that we maintain. They are fabricated in a variety of materials, the preference of which has changed with time as material science has driven improvements in cost and performance. Figure 2 and Figure 3 below provide more information on the nature of the company's stock laid in the network.

Figure 2: Main Type by Length

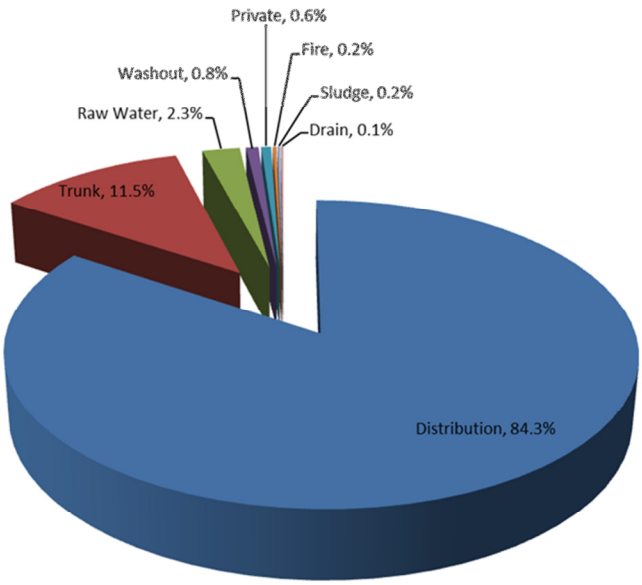
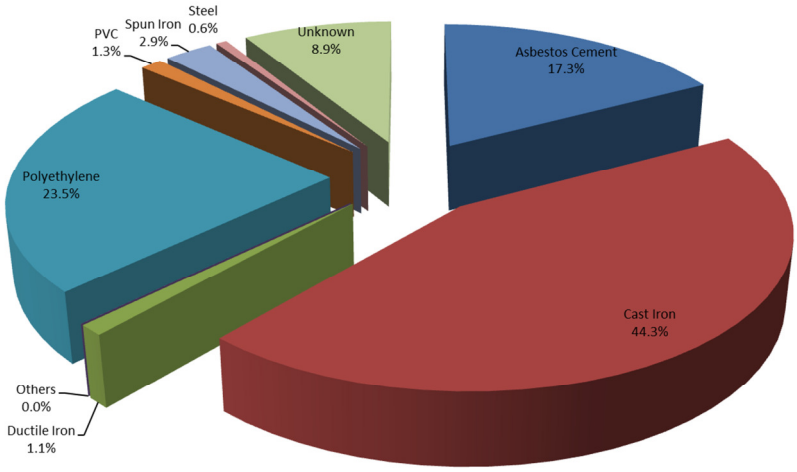


Figure 3: Distributions Mains Material



Bristol Water's distribution mains are primarily cast iron, polyethylene and asbestos cement. These three materials make up over 85% of the distribution network (Note: this does not include trunk mains). The older pipes are mainly cast iron, with asbestos cement laid in the 1950s to the 1970s, and polyethylene pipes laid more recently. Other materials exist in small quantities.

Our network is sub-divided into groups of mains, spatially and with common connectivity as follows:

- District Metered Areas
- Waste Water Meter Districts

We have 400 district meter areas, and approximately 1,200 waste water meter districts.

Analysis undertaken to support this investment case focussed on district metered areas and waste water meter districts. The latter are generally subdivisions of the former with smaller numbers of customers supplied in each.

The main objective of this investment case is to reduce the number of customer contacts about appearance and supply interruptions to customers within the distribution mains network. The investment case will also contribute to reducing the current burst rate within the distribution mains network. We also need to ensure that our investment is sufficient for routine and reactive maintenance to ensure continuation of business as usual (such as burst repairs).

In broad terms, risks associated with distribution mains arise from internal and external corrosion of ferrous mains due to a variety of factors including aggressive waters, aggressive soils and the various characteristics of the pipes themselves, which in turn affect appearance, burst rate, supply interruptions and water quality. Pipe and joint degradation leads to asset failure which affects burst rate and supply interruptions.

There are 2,800km of unlined ferrous distribution mains in our network. The main risk associated with the deterioration of this category of asset is an increase in the number of customer contacts about appearance that will impact the supply of water to our customers. These unlined ferrous mains and the

1,033km of asbestos cement mains (total 3,833km) present the main risks of leaks, bursts and supply interruptions to our customers.

We have identified that we need to improve our performance on supply Interruptions which impacts significantly on customers' supplies. We have determined that the cause is partly due to the reduced ability to quickly mitigate burst events and reduce interruptions to customer supplies. In addition there is a significant amount of supply interruptions that are caused by planned activities, which, ideally, should not lead to supply interruptions if mitigated properly. We believe that this position can be improved primarily through changes in our management approaches to achieve the AMP7 performance commitments on Supply Interruptions. Investigations into the historic performance to determine the likely causes and mitigation options are described below:

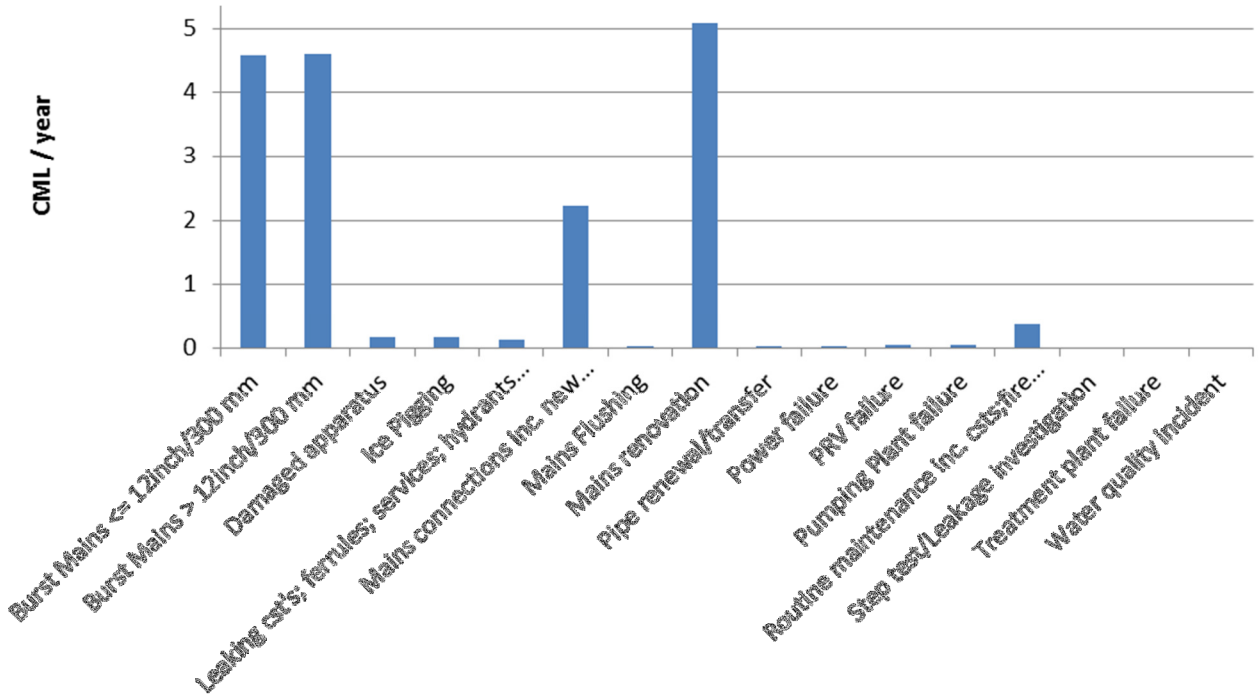
3.1.1 Supply Interruptions Analysis (Customer Minutes Lost)

Data exists for customer interruptions to supply from the year 2001 and are continually updated. We have undertaken analysis using the data between 2001 and 2016 which has provided interesting insights into the reasons behind interruptions and the potential interventions that could be applied to reduce customer Minutes Lost levels.

The analysis has been undertaken using the new Ofwat definition of supply interruptions related to planned and unplanned interruptions affecting customers for three hours or more. The analysis undertaken for this investment case led to examination of the underlying aspects of the causes of supply interruptions; in particular the processes involved in some planned work and the way we react to bursts.

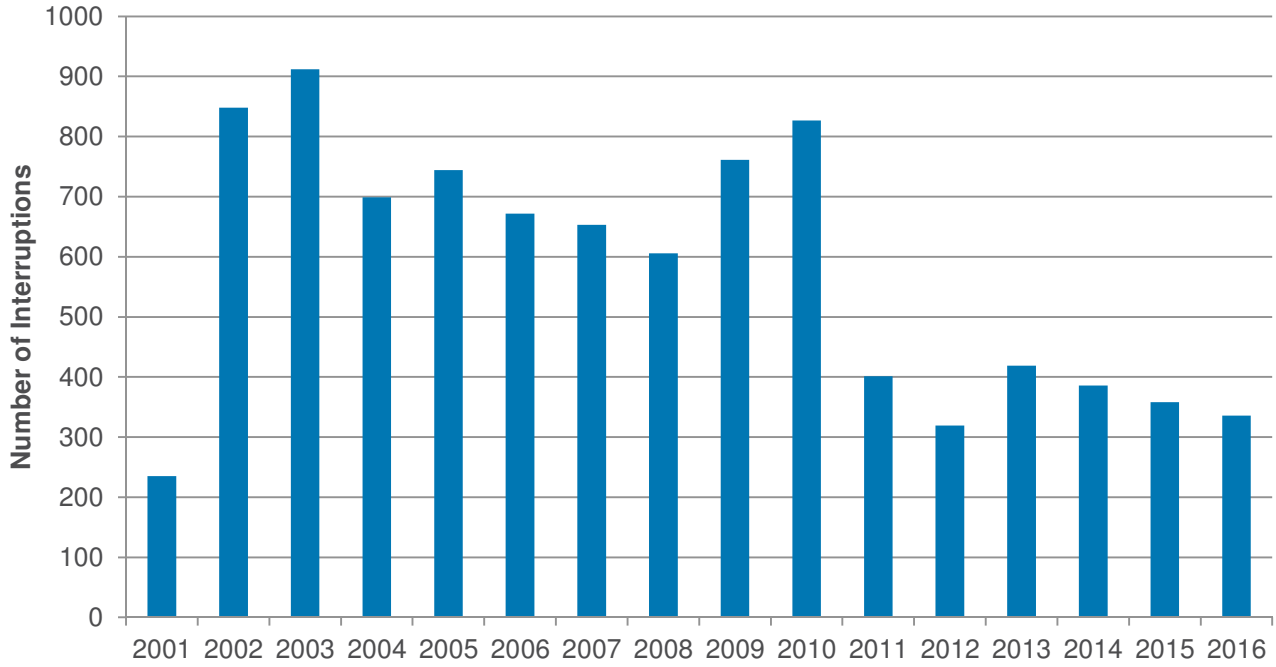
Analysis of work types that contribute to supply interruptions suggest that, on average, a significant proportion (approximately 44%) may be attributed to mains renewal and mains connection work, as can be seen in Figure 4. Both of these are generally associated with planned work; therefore, we see an opportunity to improve the processes and practices involved in these activities with a view to limiting customer supply interruption time to below three hours.

Figure 4: Average customer Minutes Lost per year for Contributing Work Types



The number of interruptions due to bursts varies over time. Figure 5 shows the annual values.

Figure 5: Interruptions Due to Bursts



It can be seen that our efforts in reacting to bursts to limit impact of supply interruptions is improving. This has been achieved by a variety of means including improved management approaches, under pressure repairs, rezoning etc. Further analysis of bursts and the durations of effects on customers conclude that the impact of bursts on customer Minutes Lost is not merely a function of the number of bursts, but is more dependent on the overall severity of burst consequences. The relationship between investment in mains renewals and interruptions to supply is also found to correlate as can be seen in Figure 5 above.

This analysis is discussed further in the "customer Minutes Lost - Initial Analysis of Historical Data" report[2], where bursts are further analysed from the aspect of duration, which while not used in the preparation of this investment case, will serve to further inform our investment decisions during the AMP period.

3.1.2 Planned Flushing Programme

Network-based quality issues (primarily customer contacts about water quality – appearance) have arisen in the past, and historically the first approach deployed to remove sediment or unsatisfactory water was local flushing or planned district flushing. These approaches are reactive and serve only to mitigate issues in response to triggers or events in the network. Where more persistent discolouration issues had arisen, the usual approach was to carry out regular flushing and in some cases to install cartridge filters on the water supply to domestic customers where regular complaints were recorded. These did not prove to be an effective means of removing discolouration from customer supplies and these filters have been removed wherever possible. Our prime objective for the planned flushing programme has been to reduce discolouration through a regular programme of management using industry best practice approaches that will translate to an improved and stable service level for customers.

The main issues comprise:

- Discolouration of potable water;
- Sedimentation within potable water;
- General deterioration in water quality.

There are a wide variety of causes of discoloured waters, but they usually arise from local changes to the network such as bursts, surge events, third party use of water (e.g. firefighting or drain cleaning), and laying new supplies in the neighbourhood. It is also recognised that there is a risk of discoloured waters arising from planned works such as rezoning and reinstatement of mains after repairs, where flushing is part of the planned activity to minimise this risk.

The current Planned Flushing Programme costs £107,000 per year and has been running since 2006.

3.1.3 Related Assets and Investment

The following assets are related to, but are excluded from, the distribution mains investment case as they have been included in other investment cases:

[2] Bristol Water, 2017, Customer Minutes Lost - Initial Analysis of Historical Data

- Trunk Mains (see Trunk Mains investment case)
- Communication Pipes (see Network Ancillaries investment case)

This investment case is also interdependent with the following investment cases as they share the same performance commitment targets:

- Leakage investment case; shared targets for Leakage.
- Network Ancillaries investment case; shared targets for Leakage.
- Trunk Mains investment case; shared targets for Bursts, Interruptions to Supply and number of Customer Contacts about Water Quality – Appearance.

3.2 Strategy

Developing the investment needs for our 5,975km of distribution mains is underpinned by our long term corporate strategy which has the vision "Trust beyond water-we provide excellent experiences". Our Outcomes Delivery Framework together with our Strategic Asset Management Plan provide the strategic framework that supports this vision and enables investment in our distribution mains to clearly focus on delivering against outcomes and performance commitments.

Our long term strategy, as set out in the Outcome Delivery Framework (Section C3 of our Business Plan), has a focus on resilience and a growing need to ensure that our assets are, and remain, fit and well maintained and effective in meeting our performance requirements. There are three strategic drivers identified that together, ensure we meet our current and future needs for customers and stakeholders. These are:

- **Operational Resilience** - which have performance commitments to reflect reliability, resilience and quality of water
- **Customer Focused** - performance commitments to reflect customer service and affordability
- **A Sustainable Business** - performance commitments to reflect the environment representing our community and sustainable resources.

Within this strategy there are specific outcomes (Safe and Reliable Supply, and Local Community and Environmental Resilience) and specific performance commitments (Supply Interruptions, Leakage, Mains Bursts and Appearance) that have strategic targets and incentives that will be directly influenced by our investment needs for distribution mains.

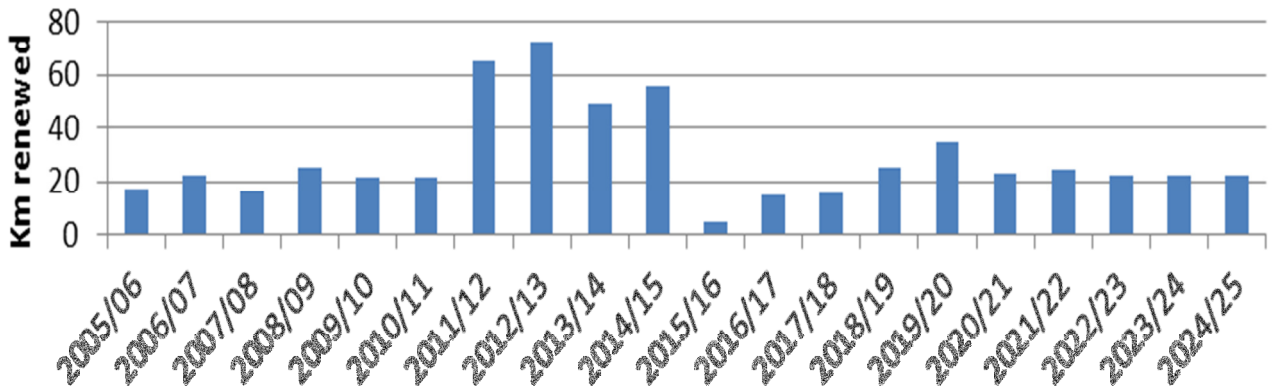
Our Asset Management Strategy has objectives developed in alignment with the long term strategy and delivery of corporate objectives and outcomes. These objectives cover both our short-term needs and longer-term aims, and drive the capability development plan and asset planning activities.

Delivery of the investment for our distribution mains will be driven through the Asset Management Framework, which is designed to enable the efficient and effective planning and delivery of all our asset related activities, to successfully deliver our business and customer outcomes. The framework aligns to, and interacts with, our corporate drivers, which in turn are there to deliver the external expectations and requirements placed upon us by our stakeholders.

We need to ensure that planned investment is sufficient for the continuation of business as usual activities and routine and reactive maintenance, and the continued provision of high quality water to our customers.

Our long term pipe management investment strategy applies to both distribution and trunk mains. It is our intention to replace 20km of pipe per annum to offset deterioration and maintain asset health. This length has been derived on the basis that we are experiencing a deterioration rate in the range of 0.3-0.5% per annum. Figure 6 identifies the length of pipe we have replaced per annum since the beginning of AMP4, and the predicted replacement through to the end of AMP7. This strategy translates into a stable and acceptable level of service for our customers.

Figure 6: Historical and future pipe replacement lengths for distribution and trunk mains



One of our four customer outcomes is maintaining a 'Safe and Reliable Supply'. Reducing the impact on our customers from burst mains is a key strand to our strategy for delivering this outcome.

3.3 Customer priorities

Customer priorities relating to Bristol Water's outcomes and performance commitments have been determined through our extensive programme of customer engagement and research. During the development of our business plan we have engaged with over 37,000 customers and conducted over 50 pieces of research. By delivering customer engagement, we have ensured that we can build on the customer insights that we have gained, producing a business plan influenced by our engagement events. This ensures that at Bristol Water we have engaged effectively with our customers on longer-term issues, and have taken into account the needs and requirements of different customers including those in vulnerable circumstances and also our future customers.

Through this process our customers have told us that their top priorities have remained largely unchanged from PR14 and have been identified as follows:

- You can get a bill you can afford
- Keeping the water flowing to your tap
- Help to improve your community
- Save water before developing new supplies
- You get the best possible experience every time you need us

This engagement has resulted in the development of four specific outcomes for PR19, which capture what our customers and stakeholders have said; these are as follows:

- Excellent Customer Experiences
- Safe and Reliable Supply
- Local Community and Environmental Resilience
- Corporate Financial Resilience

In order to deliver our customers' priorities and outcomes we will measure progress via twenty six performance commitments for which we have set delivery targets.

There is a clear relationship between our investment in distribution mains and one of our outcomes – Safe and Reliable Supply.

We undertook more detailed discussions at phase 2 of our engagement process; gathering evidence (see section **C1 – customer engagement, communication and research** appendix to our business plan) which gave us a wealth of information about how our customers' view Bristol Water, our services, and long term plans. We also explored short and long-term trade-offs in decision making and asked customers to tell us how we should approach long term issues of resilience and how we could best respond to service interruptions.

When discussing the Safe and Reliable Supply outcome with our customers, we found that customers are understanding of one-off events and often focus more on how we can improve our response to them. Research has shown that reliability is an area our customers feel comfortable investing in. Detailed analysis of customers' views on this area can be found in section C3.

We focused on talking to customers about areas of service where they could directly understand the impact on them, such as supply interruptions. Customers told us that they value avoiding interruptions, particularly when they last a long time and are unexpected. Customers who have experienced disruption are more concerned about avoiding them in the future, whereas customers who have not experienced interruptions personally often see current level of service as good enough.

We consulted in three potential scenarios in relation to our Safe and Reliable Supply outcome, as summarised below:

			2024/25 target		
Service	**Performance Commitment**	**2020 target**	**Slower improvement plan**	**Suggested improvement plan**	**Faster improvement plan**
Water quality	Compliance risk A lower score reflects a lower risk of water quality problems	1.22	0.7	0	0
Interruptions to supply	Supply interruptions greater than 3 hours (average minutes per property)	12.2	4.2 66% improvement	1.8 85% improvement	1.5 88% improvement
Water that doesn't look clear	Number of customer contacts about the appearance of tap water (contacts per 10,000 customers)	9.3	9.3	4.3 54% improvement	3.2 66% improvement
Water that doesn't taste or smell right	Number of customer contacts about the taste and smell of tap water (contacts per 10,000 customers)	3.0	3.0	2.5 17% improvement	1.4 53% improvement
Protection against a major water supply event	Risk of a major event - population centre size protected against critical asset failure	Centres over 25,000 people*	Centres over 25,000 people	Centres over 10,000 people (10 year programme)	Centres over 10,000 people (5 year programme)
Forecast increase to the average bill from additional investment			**£5**	**£14**	**£18**

* With 9069 customers in these centres remaining at risk

In summary, we consider that a plan with a lower bill level with the suggested service levels is more likely to be acceptable to more customers (particularly low-income groups).

This investment case describes how we will achieve the suggested improvement plan and associated level of performance through our investment in customer meters, specific details on our planned investment and associated performance can be found in section 3.4.

3.4 Asset Health Performance Commitments, AMP7 Performance Commitments & Outcome Delivery Incentives

This investment case supports the outcome 'Safe and Reliable Water Supply', by investing in our distribution mains assets in order to provide high quality, reliable supplies for present and future generations.

The 'Safe and Reliable Water Supply' outcome will be measured through a set of associated performance commitments. Our planned investment in distribution mains will support the achievement of the performance commitments set out in Table 2.

Table 2: Associated Performance Commitments

Performance Commitment	Unit	2019/20 Baseline	2020/21	2021/22	2022/23	2023/24	2024/25	Performance Improvement Required in AMP7
Supply interruptions	Average mins per property	12.20	4.2	3.6	3.0	2.4	1.8	10.40
Leakage	Ml/d	43	42	40.8	39.5	38	36.5	6.5
Mains bursts	Per 1000km	142	133	133	133	133	133	9
Customer contacts about water quality – appearance	Contacts per 1,000 population	0.93	0.83	0.73	0.63	0.53	0.43	0.50

Our investment in distribution mains will help ensure our assets are being maintained appropriately. We measure this through some specific asset health performance commitments, which for distribution mains are customer contacts about water quality – appearance, and mains bursts. These performance commitments enable us monitor our asset health performance across AMP6 and AMP7.

A detailed diagram illustrating the full line of sight between customers, outcomes, performance commitments, and customer outcome delivery incentives related to this investment case is included in Appendix A. Full details of our outcomes, performance commitments, and outcome delivery incentives are provided Section C3 of our business plan.

3.5 Compliance Obligations

There are no statutory or compliance obligations that are influencing the development of interventions in this investment case and the investment for AMP7

3.6 AMP6 Investment And Performance

Our AMP6 investment in distribution mains supports our ability to meet our performance commitment for bursts, customer minutes lost, and Negative Water Quality Contacts. Our investment in AMP6 will also underpin our performance commitments for bursts, interruptions to supply and customer contacts about water quality – appearance in AMP7.

AMP6 investment related to distribution mains is summarised in Table 3. We have re-categorised data used in line with the scope of our investment cases. For historic data we have used the 2016/17 wholesale cost assessment data (data tables 1 and 2). Forecast data has been derived from PR19 data (data tables WS1 and WS2).

Table 3: Historical Spend

Year	Distribution Mains Capex (£m)
2015/16 actual	4.334
2016/17 actual	5.976
2017/18 actual	6.605
2018/19 forecast	10.381
2019/20 forecast	10.616
AMP6 forecast	**37.913**

The AMP6 performance commitments that are related to distribution mains investment, and our performance, is given in Table 4.

Table 4: Historic AMP6 Performance Related to Distribution Mains

Performance Commitment		2015/16	2016/17	2017/18	2018/19 (Forecast)	2019/20 (Forecast)
Unplanned Customer Minutes Lost						
Bristol Water	Target	13.4	13.1	12.8	12.5	12.2
	Company Performance	15.5	13.1	73.7	12.5	12.2
Leakage (current leakage) (Ml/d) (annual)						
Bristol Water	Target	48.0	47.0	45.0	44.0	43.0
	Company Performance	44.2	46.4	46.6	44.0	43.0
Mains Bursts						
Bristol Water	Target	142	142	142	142	142
	Company Performance	113	153	179	142	142

Performance Commitment		2015/16	2016/17	2017/18	2018/19 (Forecast)	2019/20 (Forecast)
Negative water quality contacts						
Bristol Water	Target	2422	2409	2322	2275	2221
	Company Performance	2329	2162	1711	2275	2221

Unplanned customer minutes lost is included as it has been used throughout AMP6 to measure and report on performance related to supply interruptions. It will be replaced by supply interruptions in AMP7. The unplanned customer minutes lost performance commitment was not met for 2017/18. The average amount of minutes lost per property per year (at 73.7 minutes) was significantly affected by an exceptional burst event at Willsbridge in July 2017, which we explained in a detailed case study in our 2017/18 mid-year performance report.

With regard to leakage, at PR14, we set ourselves challenging leakage targets; to reduce leakage by 12% between 2015 and 2020. Our 2017/18 performance was below target due to a number of factors primarily the exceptional weather at the beginning of 2018. We underperformed against our target for 2017/18 due to the exceptional weather in 2017/18. Excluding our estimate of a 1.7Ml/day impact of the cold weather in March 2018, our actual current leakage performance after technical data adjustments improves from 46.6Ml/day to 44.9Ml/day. This would have been in line with our target of 45Ml/day. Towards the end of 2017/18 we began to see benefits from our deployment of additional resource and the impact of improving the effectiveness of our leakage response. We have implemented an action plan to improve on our Leakage performance to ensure we meet our AMP6 target. We are currently forecasting to achieve the final year AMP6 target of 43 Ml/d. Our investment in AMP6 will also underpin our performance commitment for Leakage in AMP7. Full commentary on our Leakage performance is provided in our 2017/18 Annual Performance Report.

Negative water quality contacts is included in Table 4 as it has been used throughout AMP6 to measure and report on performance related to customer contacts about water appearance and taste/odour. It will be replaced by two performance commitments in AMP7, customer contacts about water quality – appearance, and customer contacts about water quality – taste/odour. We have worked with Ofwat and the rest of the industry to align the reporting definition to help customers understand comparative performance in AMP6. See Section C3 of our Business Plan for full details.

4 Developing Our Investment Plan

As we have discussed earlier, the starting point for investment case development is to understand our customers' priorities and determine associated performance commitments. We have adopted totex principles to determine how we should invest in order to deliver these priorities and associated commitments. The totex approach we have adopted considers which the best solution is because it is the lowest cost over the whole life of the asset, regardless of whether it is operational or capital expenditure.

Whilst we do not currently have health and risk indices across our asset groups, we do have a wealth of data. In some cases, analytical models such as the mains deterioration model, provides us with a view of how our assets are performing, as well as a view on their deterioration. The following section describes the process we have created and followed in order to develop our investment cases

4.1 Investment Case Development Process

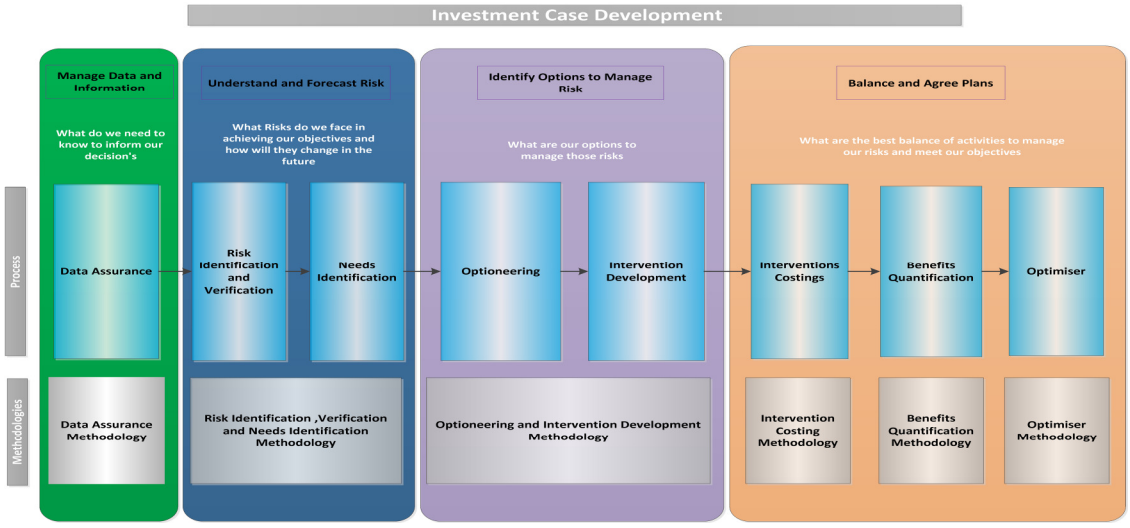
We have created and implemented a process that is supported by a set of six methodologies. When developing the methodologies, we wanted to ensure that they:

- Deliver what the customers have asked for;
- Satisfy our business needs; and
- Deliver a high quality business plan in accordance with Ofwat's company monitoring framework.

The collective application of these methodologies has enabled us to develop investment proposals that are well evidenced through a line of sight approach, ensuring our investment plan achieves the required targets at the optimal cost.

Figure 7 illustrates, at a high level, the process required to identify risks that require addressing in AMP7, and the subsequent development of appropriate interventions.

Figure 7: Investment case process overview - Level 1 diagram



An overview of each of the key stages is described below and all of the methodologies are provided in the PR19 Investment Cases Summary Document.

4.1.1 Data & Data Assurance

The development of our investment cases is dependent on having consistent, accurate and assured data. We therefore recognise that we must be able to demonstrate the quality of the data and information used in the development of our investment cases.

Wherever possible, we have utilised data from our core company systems in order to undertake our analysis and we have sense checked the quality of data as we have used it.

However, in addition we have applied a data assurance methodology. We have assessed data quality in terms of completeness, accuracy and reliability. In addition, the methodology also assesses whether data is used as part of the Annual Performance Report to Ofwat, and hence already subject to existing Annual Performance Report assurance mechanisms.

In total we have developed twenty one investment cases. The values of these investment cases range from less than £1m to over £37m. Our overall capital investment plan totals circa £212m.

We have selected a sample of nine investment cases, and have applied detailed data assurance based on their value and complexity. The total value of these nine investment cases represents 66% (circa £140m) of the total capital investment plan, and represents 286 individual data types. We have evaluated all 286 data types and we have evaluated them for quality and their use in the Annual Performance Report process. The overall data quality assessment identified 93% of the data as being good quality, and 55% as having been used and assured through the Annual Performance Report process.

This investment case was included as part of the sample of nine investment cases.

Quality Assessments

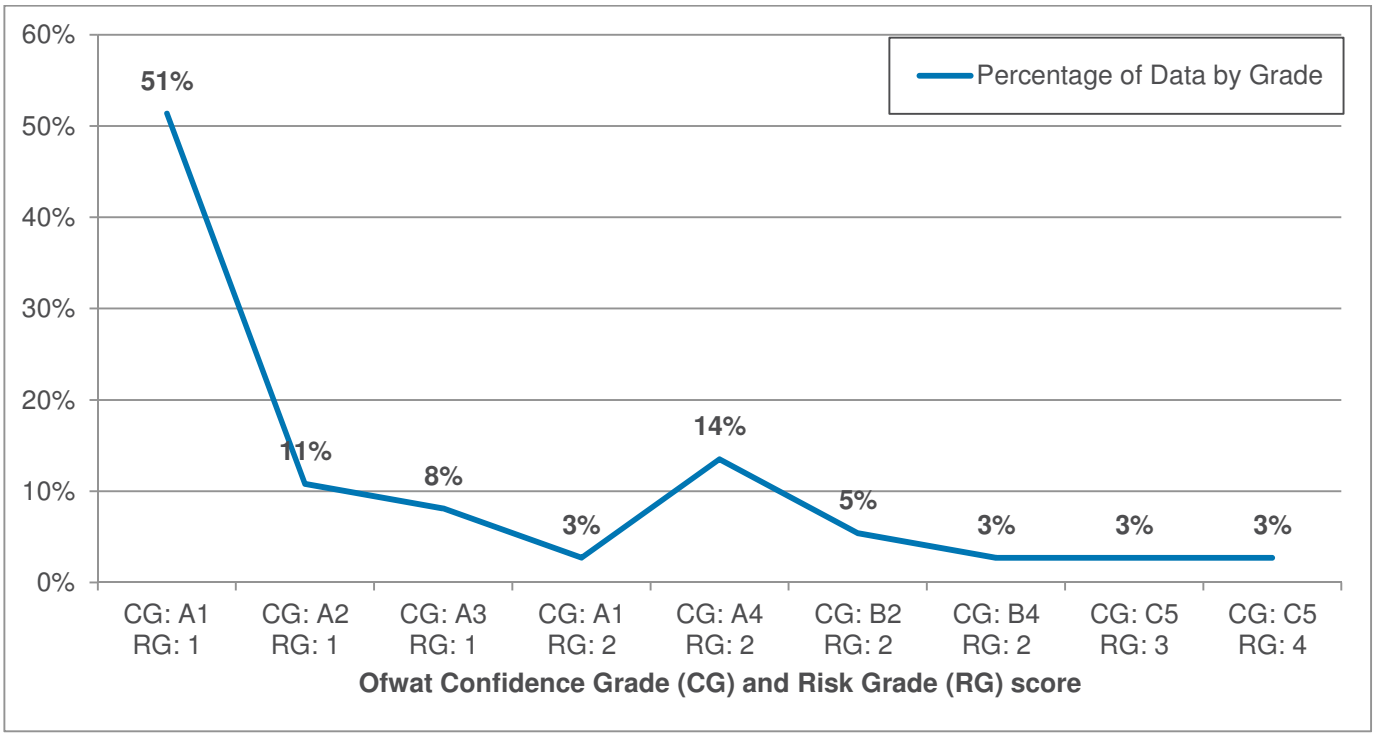
For each data point used in this investment cases, it has been assured for completeness, accuracy, and reliability, and has been given an overall score for quality in terms of a Risk Grade (RG) score between 1 and 5 (1 being good quality, 5 being poor quality). The risk grade has subsequently been aligned to the equivalent OFWAT Confidence Grade (CG) scores A1-D6 (A1 being highest confidence, D6 being lowest confidence).

A list of data used is provided in Appendix B (actual data sets can be provided upon request). A total of 37 specific data types were identified of which 35 (95%) have been assessed as having good quality (Confidence Grade A1-B4 and Risk Grade 1-3).

Following a review it was found that the remaining 5% of data was mainly text or qualitative assessments rather than quantitative. This data will be included for enhancement as part of our business as usual approach to continually improve the quality of our data, which is outlined in our data and information strategy.

Figure 8 summarises the number of data types scored against Ofwat Confidence Grades and Risk Grades.

Figure 8: Percentage of Data Types by Ofwat Confidence Grade and Risk Grade



Annual Performance Report Assessments

The 37 data points identified in Appendix B have also been assessed in their utilisation for the Annual Performance Report and their contribution to overall data lines. This process is subject to internal and external assurance and has governed methodologies that are assessed in their application in the provision of APR data tables. (Reference the methodology doc nos.) The assessment of the Annual Performance Report submission and application of the methodologies are formally governed and recorded.

Of the 37 data types 32 (86%) were assessed as having already being required for being annual performance reporting and therefore subject to the assurance requirements as set out in annual performance reporting methodologies.

We will continue to focus on improving the quality of our data and the associated assurance processes.

4.1.2 Risk Identification, Verification & Needs Assessment Methodology

The purpose of our risk identification, verification and need assessment is to ensure that:

- The risks that we are currently facing are captured in a single risk register; and
- Each risk is assessed and verified to determine details about the nature and magnitude of the risk and whether any mitigation is currently planned in this AMP period; and
- Each risk is scored on a common basis to allow risks to be compared; and
- The most significant risks are identified, and that for each a clear and uniquely referenced statement of need is produced to define the problem as clearly as possible, and to identify what benefits or performance commitments mitigation of this risk will achieve.

The risk score is the product of the likelihood and consequence, each is scored 1 to 5 and then multiplied together to provide a potential maximum risk score of 25.

Risks scoring 15 to 25 are the most significant strategic risks, and these were developed into needs statements.

Those scoring 10 or 12 were subject to a further round of review. Where the risk was confirmed, it was developed into a needs statement. Where the risk was not confirmed (for example it is currently being addressed in AMP6 or the risk was assessed to be not as significant as initially scored), it was not considered further as part of the PR19 investment planning process.

The risks scoring 1 to 9 were considered to be risks of a lower priority and were therefore not considered further as part of the PR19 investment planning process.

The risks that were not considered further as part of the PR19 investment planning will continue to be monitored and assessed as part of the live business and on-going business as usual risk management process. Where there is a need to mitigate these risks within the AMP, we will respond with appropriate action, such as increased base maintenance.

Further development of our business as usual risk management process is on-going and we are looking to innovate by developing smarter systems to optimise this process.

We developed need statements for all selected risks.

4.1.3 Optioneering and Intervention Development Methodology

The next stage in our process is to develop options of how we could meet the needs of the selected risks.

To generate the options, data was gathered from a number of sources (see Appendix B). This included meetings with stakeholders and historical records, including reviews following operational events, previous scheme proposal reports and previous options assessment reports.

We then progressed to data assimilation, analysis and consultation with key stakeholders. Multiple options were developed and recorded. These options were reviewed and all options identified as not viable were discarded.

All viable options were identified as proposed interventions with a unique reference number and were taken forward for further scope development, benefits calculation and costing.

4.1.4 Intervention Costing Methodology

In order to provide assurance of our investment costs and to ensure standardisation, we engaged ChandlerKBS as our costing partner. They were selected in part due to their ability to provide us with industry comparable cost data, often at intervention level. They supported us in several ways:

- In some instances development and analysis of intervention costs, and
- Support to build our cost database

Indirect overheads, such as contractor costs, design costs, contract management, and our overheads have been applied at intervention level. Wherever possible we used our data or if unavailable, we used industry average costs.

Therefore we have to assess the expected capital cost of each intervention.

Expected Capital Cost (capex after)

If we deliver the capital expenditure intervention in a planned way, we have labelled it as 'capex after'. This is the expected capital cost of the intervention.

Cost estimates were usually based on high level scopes, which contained activity schedules, and sketches provided by ourselves, and were developed using the cost model we developed with ChandlerKBS.

4.1.5 Benefits Quantification Methodology

The benefits for each intervention are those which are considered to affect company performance during subsequent AMP periods.

Benefits can be assessed as either being:

- Direct – savings in reactive capex or savings in opex; or
- Indirect – improvement in performance commitments or other resultant effects on the company's performance.

Both direct and indirect benefits are considered and quantified.

Direct Benefits

We have a totex approach which considers both capital and operational expenditure.

Expected Capital Cost (capex before)

If we deliver the capital expenditure intervention in an unplanned way, we have labelled it as 'capex before'. This is the reactive cost that would potentially arise if we had to deliver the intervention in an unplanned way.

We could respond to this scenario in one of two ways:

- 'Repair' or
- Implementation of the intervention in an un-programmed accelerated manner.

The capex before was determined for each intervention. For most interventions the estimate is site specific. A risk factor, taken from the likelihood score recorded in the risk register, was applied to the initial capex value to produce the final capex before value.

Where a 'patch & repair' solution would not be appropriate, should the risk materialise, this would lead to the immediate implementation of the intervention. The cost of the intervention in this scenario is the expected capital cost of the intervention (capex after); with the application of a suitable uplift to cover the costs associated with fast-tracking the intervention, for example, the cost of labour at premium rates.

The expected capex before effectively formed the 'Do Nothing' option.

Expected Operational Cost (opex before & opex after)

In most cases we have made an estimate of the operational expenditure levels either with investment - opex after or without investment - opex before. Opex includes power, chemicals, materials, contract hire and in house labour.

Opex before represents the opex expenditure associated with not mitigating a risk through capital investment, for example, increased maintenance visits or replacement of components.

Opex after represents the additional opex cost to the business after the implementation of an intervention. These could include negative values associated with predicted savings associated with increased plant efficiency or performance, or positive values where there is an operational cost increase, for example greater inspection levels.

Indirect Benefits

To measure our performance against our customers' priorities and the associated performance enhancements associated with interventions; we measure the impact that each intervention had on the performance commitment measure.

Other Benefits

In addition to the performance commitments described above, other indirect benefits which do not relate to performance commitments were calculated and recorded in the benefits calculations where appropriate. This includes avoidance of health and safety penalties, customer compensation payments, and environmental penalties. These benefits have been monetised.

Once the benefits were prepared, the interventions were put forward for investment optimisation.

4.1.6 Investment Optimisation & Intervention Selection

The investment optimisation process determines which interventions are selected to provide the optimal AMP7 investment plan, by delivering the targeted performance commitment improvements, at the lowest cost. We have utilised a water industry standard system (Servelec 'Pioneer') to optimise our AMP7 investment plan. Pioneer provides the functionality for us to assess all interventions developed across all of the investment cases. It will assess the interventions both individually and in comparison to other interventions. It is a decision support tool that produces an optimal investment plan to meet the targeted performance commitment improvements required in AMP7.

The Pioneer investment optimiser model assesses interventions primarily on the overall benefit, which takes account of performance and whole life costs. The investment optimiser calculates the whole life cost as the net present value (NPV) over 40 years. This determines if an intervention is cost beneficial.

We will select interventions for one or more of the following reasons:

- The intervention is mandated (i.e. Drinking Water Inspectorate - water quality requirement).
- The intervention is cost-beneficial
- The intervention is required to achieve the performance commitment targets.

Any performance commitment improvement obtained from mandated or cost-beneficial interventions will contribute to overall performance improvement.

A series of business reviews and sense checks of the investment optimiser results have been undertaken prior to finalising the AMP 7 investment plan.

We can of course model any number of scenarios, and during the process of engaging our customers we ran three scenarios as described in Section C1 of our business plan (slower Improvement plan, suggested improvement plan and faster improvement plan).

4.2 Applying the Investment Process to Distribution Mains

Each of the following sections describes the specific details associated with the application of the investment case development process for distribution mains.

4.2.1 Risk Identification, Verification & Needs Assessment

There were 15 risks identified in the strategic risk register associated with this investment case. Every risk went through a process of assessment, scoring, and review.

Five risks were selected and developed into need statements. The risk descriptions, scoring and associated needs statements are captured in the strategic risk register. Details of the selected risks are provided in Appendix C1.

Ten risks were not selected and these risks return to being monitored and reviewed under our business as usual risk management process. Details of the non-selected risks are provided in Appendix C.2 with an example of an unselected risk is given in Table 5.

Table 5: Example of an unselected risk

SRR ID	Investment Case No	Location/Zone	Revised Risk Description	Likelihood	Human Health / Environment	Ease to Resolve	Publicity & Reputation	Regulatory Impacts	Customers Impacted	Max Impact	Risk Score
SRR610	2	Wells	Interruptions and disruptions to supply - critical 2" main burst - Leak at top side of White House, Unset, Upper Milton, Wells, Somerset..	5	1	1	1	1	1	1	5

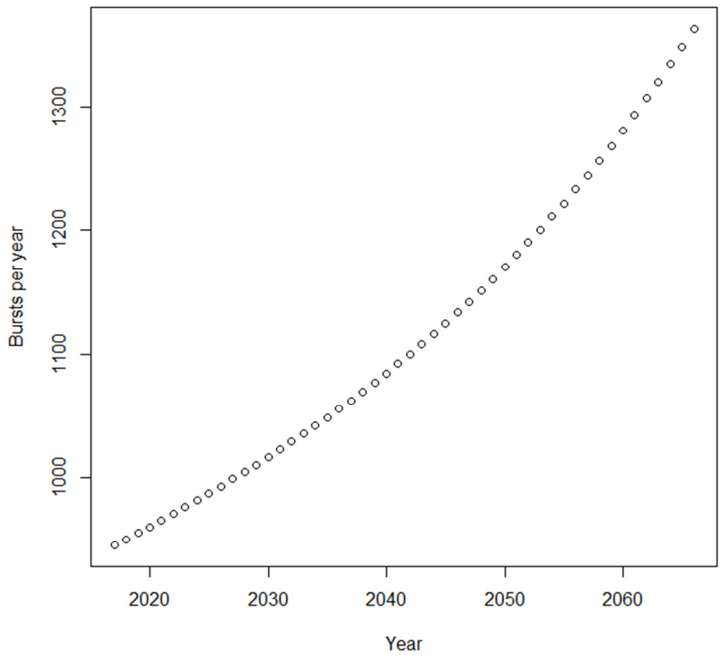
In this case, assessment of the risk determined that the issue had been explored and was being addressed within AMP6, but that the risk may still exist in AMP7. The risk register includes a number of individual issues taken from the Networks Risk Register. These individual issues affect relatively low numbers of customers and will not affect other performance metrics to a level that is worthy of consideration on their own. Therefore, while a high likelihood is applied, there is a low consequence and overall the risk is scored 5, which is below the threshold for review as part of the Investment Case. It is in fact the case that these individual mains will be considered as part of risks associated with supply interruptions across the whole network (see risk reference SRR625).

The 'Line of Sight' for the whole process, beginning with the selected risks, the source of the risk, a record of source documents used to verify the risks, and the needs statements, is captured in the distribution mains interventions register.

We have developed a burst deterioration model which provides analysis of the data available on bursts, pipe information (lengths, diameters and materials) and weather. The burst deterioration model has helped us to identify the mains most likely to burst in the future. The results of the model have been used to define targeted mains replacement with the aim of maintaining current burst rate targets and reducing burst rate targets if required.

This model provides us with a measure of the deterioration rate of our mains, and the chart below shows the predicted number of bursts if no mains renewal work is carried out, and how this can be expected to change over time. The model provides an average deterioration rate for the whole distribution and trunk network starting at about 0.5%, climbing over time to about 1%.

Figure 9: Predicted yearly bursts without investment



The burst deterioration model shows that if no proactive mains replacement is undertaken then the burst rate across Bristol Water will increase beyond the target rate of 133 bursts per 1000km of pipework.

There is also an increased risk to iron compliance if current network maintenance is not maintained. This would also lead to increased numbers of customer contacts about water quality – appearance. A large proportion of the network consists of unlined iron mains. A change in maintenance activities on the network, including systematic flushing and mains renewal, is linked to iron compliance and customer contacts about water quality – appearance.

4.2.2 Optioneering & Intervention Development

Five risks were selected and developed into needs statements. Further investigation of these needs included data assimilation, analysis and consultation with key stakeholders. Multiple options were developed and recorded for each of the five needs statements. These options were peer reviewed and all options identified as not viable were discarded.

For example, against the selected risk regarding the risk of customer minutes lost, four options were identified and all of these were developed into interventions, as shown in Table 6.

Table 6: Example of Options Selection for SRR625

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options			Proposed Interventions	
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?	Ref. No.	Intervention Title
SRR625	Risk of Customer Minutes lost	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part of the cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Replacement of loose jumper hydrants	Replace existing hydrants with throughflow hydrants to enable use of bypass hose	This is a valid option because it will allow much greater use of bypass hose to keep customers in supply in an emergency	02.003.01	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains
			BW are currently performing in the lower quartile on Supply Interruptions. Part of the cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Unplanned customer mins lost reduction	Use of overland bypass equipment and additional teams to reduce unplanned mins lost.	This is a valid option because it allows for the reactive use of overland bypass hose in an emergency	02.005.01	Unplanned customer mins lost reduction
			BW are currently performing in the lower quartile on Supply Interruptions. Part of the cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Planned customer minutes lost reduction	Revised working practises and use of overland bypass pipe to reduce customer mins lost due to planned interruptions	This is a valid option because by revising working practises planned works should not contribute to customer minutes lost	02.005.02	Planned customer mins lost reduction
			BW are currently performing in the lower quartile on Supply Interruptions. Part of the cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Hydrant replacement and Unplanned customer minutes lost reduction	Replacing hydrants will increase the effectiveness of the reactive teams.	This option is valid because it will allow the reactive teams to be more effective and further reduce customer minutes lost	02.005.03	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains AND Unplanned customer mins lost reduction

All viable options were identified as proposed interventions with a unique reference number and were taken forward for further scope development, benefits calculation and costing. A total of 291 interventions were identified in this way. These included in some cases, multiple interventions against a single selected risk, notably Targeted Mains Replacement (interventions with 02.002 prefix: 185 no.) and Zonal Mains Renewal (interventions with 02.006.xx prefix: 100 no.).

A summary of all selected risks and their associated options is included in Appendix D.

Interventions have been developed based on the information provided by the burst model described in section 4.2.1 for mains renewal at district metered area level, a Zonal approach developed in AMP6, and measures to address planned and unplanned interruptions to supply. These are described below:

Burst Model Output

The burst model described in section 4.2.1 provided interventions where mains renewal in district meter areas would deliver benefit to customers in burst reduction, and associated reduction in interruptions to supply. The Length of renewal within each district meter area selected is also quantified.

Zonal Model Approach

The approach taken in AMP5 was to base benefits of zonal mains renewal (renovating a whole district at a time rather than just targeting mains with high burst records) on leakage improvements.

This model was developed in AMP6, to provide a targeted approach on selecting whole zones for replacement by assessing the impact on the AMP7 performance commitments; including customer contacts about water quality – appearance. This new approach has been based on total benefits, with data analysis undertaken to explore the benefits beyond leakage.

This approach has been used for investment planning purposes to determine those areas to be selected for zonal replacement in using multi-parameter criteria (e.g. lengths, materials, historic costs, unplanned customer minutes lost, bursts, and customer contacts about water quality – appearance), assessing the benefits of mains and service replacement at a zonal level. This approach will be used in AMP7 to incorporate deterioration analysis and used on an on-going basis to refine our investment decisions as more data becomes available at district metered area, waste water meter district and pipe cohort level.

As many interventions have multiple benefits, any change in targets for other measures, such as bursts or supply interruptions, will have an effect on the interventions selected. This may have a resultant impact on the need for additional schemes to meet targets for customer contacts about water quality – appearance.

The approach has developed a “Costs Model” per waste water meter district using data from our core company systems.

Supply Interruptions Reduction

As discussed above in section 3.1.1, supply interruptions can be split into two categories, interruptions caused by planned works and interruptions caused by unplanned works. Interventions have been developed for both categories to improve management techniques and approaches.

4.2.3 Intervention Costing

The targeted mains replacement interventions costs were calculated using industry standard information provided by ChandlerKBS to calculate a direct cost per metre, which has been developed for a full range of pipe diameters up to 600mm from historic costs.

The zonal mains renewals are based on Bristol Water historical costs.

Indirect overheads (contractor on-costs e.g. prelims, design costs, contract management) and Bristol Water overheads were then added on to all of these interventions at intervention level. These overheads are based on Bristol Water data when available or, if not, using an industry average.

Costs for planned customer minutes lost reduction interventions are based on discussions with stakeholders and elicitation of the feasible cost reduction of tasks.

Costs for our planned flushing Programme are Bristol Water in house costs based on the current budget (£120k per annum), which includes Bristol Water overheads.

The cost for each developed intervention is presented in Appendix E. An example of how those costs have been developed is outlined below:

Cost Example: Targeted replacement of 885.99m asbestos cement and ferrous distributions main; reference 7060C

Investment is required for targeted mains replacement to reduce the number of bursts, we used our burst model to identify those sections of asbestos cement and ferrous mains most at risk and each targeted main was costed individually for replacement.

We have established a cost of undertaking the works (for mains reference 7060C) of £0.339m; this includes labour and materials as well as contractual costs. The latter includes items such as (but not limited to) contractor accommodation, contractor management, contractor overhead and profit, and design. We have then applied Bristol Water's overhead of £0.075m for internal activities associated with the intervention, such as project management, land and compensation, legal, environmental costs, commissioning/handover, contract management, operations and system support, consultants and administration.

All of the direct costs above gave us an intervention cost of £0.414m to implement the intervention in a planned way (the capex after).

We have established that if we undertook the above intervention there would be no change in operational expenditure (opex after).

Once interventions were costed, benefits could be calculated which are discussed in Section 4.2.4.

4.2.4 Benefits Quantification

291 distribution mains interventions were assessed for direct and indirect benefits. These are presented in Appendix E.

To support us in achieving our outcomes, the interventions proposed in this investment case need to either contribute to achieving performance commitment targets or be cost beneficial.

The performance commitments that relate to this investment case are discussed below.

Customer Contacts About Water Quality – Appearance

The zonal mains renewals interventions contribute towards reductions in customer contacts about water quality – appearance. Historic discolouration records within zones have been used to derive the benefit. The planned flushing programme also contributes to customer contacts about appearance, based on historic performance of this programme.

Leakage and Mains Bursts

The zonal mains renewals interventions contribute towards reductions in leakage and bursts, and the targeted mains replacement contributes towards bursts. Historic leakage and burst records within zones has been used to derive the benefit. Specifically, mains burst reduction has been calculated based on the burst frequency predicted by the burst model.

Supply Interruptions

The targeted mains replacement and zonal mains renewals interventions contribute to reduce supply interruptions. This is assessed by means of analysis of supply interruptions .Two interventions were developed to address planned and unplanned Interruptions, again drawing on the conclusions of the supply interruption analysis.

5 Outcome

5.1 Selected Interventions

The 291 developed interventions were assessed through the investment optimisation process. Of these, 52 interventions have been selected.

The 52 selected interventions have been grouped into 4 types of intervention. The 4 groups are set out in Table 7, along with the associated costs.

When it comes to delivering our programme of works we know that we must continue to be innovative and efficient. We have set ourselves a challenging target of improving our cost efficiency by 8% during AMP7. This will be achieved by delivery of our business transformation programme.

We see innovation as an integral to our everyday working at Bristol Water: We have deliberately embedded it within the business-as-usual processes of our asset management teams by embracing the full flexibility that Totex and Outcomes enables. We will look to be innovative in the following ways:

- **Open Innovation:** We have defined our strategic innovation challenges and run events such as our “Innovation Exchange” that invite suppliers to present their innovative solutions to predefined challenges that we set
- **Market Scanning:** We conduct market scanning through for cutting edge technology against our strategic innovation challenges and feed this into our optioneering process. In particular we subscribe to the Technology Approval Group which regularly scans and meets with water companies to unearth the most promising innovations for the sector
- **Partnering:** we undertake leading research into areas that we provide effective solutions for the future.

We will specifically look for innovations that mean we can contribute to our 8% cost efficiency challenge and keep our customers’ bills low into the future.

This includes development of the zonal model approach. Building on the model used in AMP6, this approach will provide a targeted approach on selecting whole zones for replacement by assessing the impact on the AMP7 customer performance commitments; notably customer contacts about water quality – appearance. We will develop it further in AMP7.

Table 7: Selected Interventions, Costs, and % Performance Contribution

ID	Intervention Title	Total Capex (£)	Change in Opex per annum (£)	Supply interruptions	Leakage	Mains bursts	Customer contacts about water quality – appearance
02.002.xx	13 Targeted Mains Replacement interventions	1,581,060	0	0.03%	-	11.6%	-
02.005.02	Planned customer mins lost reduction	0	120,000	33.39%	-	-	-
02.006.xx	37 Zonal Mains Renewal interventions	36,112,721	-205,768	0.23%	7.33%	83.2%	34.54%
14.001.01	Current Planned Flushing Programme (100 Waste Water Meter Districts per year = 500 total)	0	0	-	-	-	48.64%
Distribution Mains capital investment (pre-efficiency)		**37,693,780**	**-85,768**	**33.65%**	**7.33%**	**94.8%**	**83.17%**
Distribution Mains capital Investment with 8% capex efficiency		**34,678,278**					

All interventions are selected for the contributions they provide to achieving performance commitment targets.

The individual interventions are described in detail in the following sections.

5.1.1 Targeted Mains Replacement

The burst deterioration model was used to identify those sections of main at most risk of failure. These targeted mains are then ranked to identify those sections of main that provide the most benefit if replaced, these are then developed into interventions. This approach is presented in the application of the burst model report. 13 targeted mains replacement interventions have been included in this Investment Case totalling 4.5km of mains.

The primary benefit from targeted mains replacement is a reduction in bursts and there are secondary benefits such as leakage reduction.

5.1.2 Planned customer minutes lost reductions - Supply Interruptions Reduction

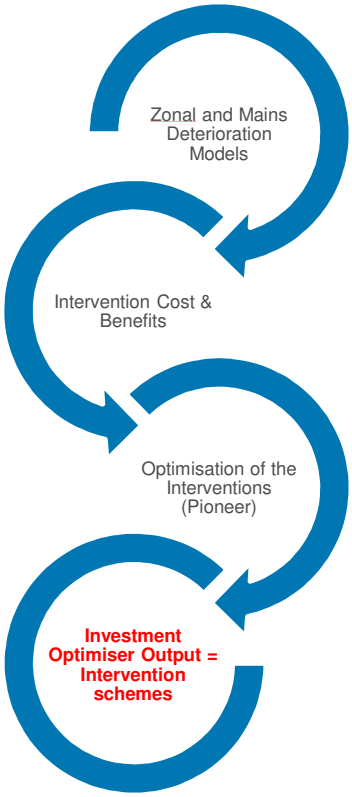
Of the two categories considered, interruptions caused by planned works and interruptions caused by unplanned works, the intervention to address planned Interruptions was selected:

The intervention is based around using additional engineering and modelling work in the design phase of planned works, with the aim of finding alternative means of supply (e.g. network rezoning, bypass hose use etc.) to ensure there is a significant reduction in supply interruptions as a result of planned works.

5.1.3 Zonal Mains Renewal

37 zonal mains renewal interventions are included in this investment case totalling 83km of mains. The benefits of a zonal approach include:

- Economies of scale – it should be cheaper as there will be less mobilisation costs
- Mains bursts reduction
- Water Quality contact reductions
- Low pressure reductions
- Leakage reductions (mains, fittings, services, stop taps)
- Power cost reduction
- Distribution input reduction
- Meter penetration increase (and reduced costs)
- Opex reduction
- Remedial capex reduction
- Lead Service pipe reduction which could lead to long term orthophosphoric acid reductions



Replacing longer lengths will present opportunities for using more efficient renewal techniques, maximising downsizing through slip lining, exploring other lining techniques and minimal and no dig techniques.

5.1.4 Planned Flushing Programme

An intervention has been developed comprising the continuation with the current planned flushing programme of work. Currently 100 waste water metered districts are covered per year and it is proposed that a similar level of network maintenance is undertaken, undertaking the same activities.

The total distribution mains investment is sum summarised in Table 8. This investment case is aligned to the Water Network Plus Wholesale Control category of our Business Plan. Costs are allocated to the Treated Water Distribution Business Unit. Investment is related to maintaining the long term capability of the infrastructure assets.

Table 8: Water Service and Business Unit Allocation

Wholesale Control	**Water Network Plus**	**Total**
Business Unit Allocation	***04 Treated Water Distribution***	
Distribution Mains capital investment (%)	**100.0%**	**100%**
Distribution Mains capital investment	**£37.694m**	**£37.694m**
Maintaining the long term capability of the assets - infra	£37.694m (100%)	**£37.694m (100%)**
Distribution Mains capital investment with 8% capex efficiency		**£34.678m**

5.2 Contribution to Performance Improvement

Table 9 set outs the percentage contribution to performance commitments improvement provided by the selected distribution mains interventions.

Table 9: Contribution to performance commitments targets from selected interventions

Performance Commitment	Unit	2019/20 Baseline	2024/25 Target	Total Performance Improvement Required in AMP7	Distribution Mains Contribution to Performance Improvement
Supply interruptions	Average mins per property	12.20	1.80	10.40	33.65%
Leakage	Ml/d	43	36.5	6.5	7.33%
Mains bursts	Per 1000km	142	133	9	94.80%
Customer contacts about water quality – appearance	Contacts per 1,000 population	0.93	0.43	0.50	83.17%

Asset Health

Our AMP7 investment in distribution mains will help ensure our assets are being maintained appropriately to deliver resilient water services to current and future generations.

5.3 Non-Selected Interventions

Of the 291 interventions developed within this investment case, 239 were not selected because they did not provide the most cost beneficial way of meeting performance commitment targets compared to other interventions available. The risks associated with these interventions represent residual risks that will be carried during AMP7. We will continue to monitor these residual risks throughout AMP7, and where this process requires these risks to be mitigated, we will respond with appropriate action. Details of the 239 non-selected interventions are given in Appendix F. An example is given in Table 10.

Table 10: Example Non-Selected Intervention and Residual Risk

SSR ID	Risk & Need Statement	Non-Selected Intervention & Residual Risk
SRR625	Risk of customer Minutes lost Need statement: Bristol Water is currently performing in the lower quartile on Supply Interruptions. Part of the cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Unplanned customer mins lost reduction Use of overland bypass equipment and additional teams to reduce unplanned mins lost. Failure to address supply interruptions arising from unplanned events in a timely fashion will impact on our customers' experience. **Residual Risk:** increased periods of time that our customers will be without water following an unplanned event in our network.

5.4 Assumptions

There are a number of general assumptions that have been made in the development of our investment cases. These are discussed in detail in section 11 of the PR19 Investment Cases Summary Document.

5.5 AMP8

The rate of renewal of distribution mains is proposed as 0.3% per annum and this is considered sustainable as supported by the deterioration analysis. It is proposed that this will continue at a similar rate in AMP8. It should be noted that the higher proportion of the mains to be replaced will continue to be ferrous and asbestos cement mains.

We will continue to develop and invest in our zonal modelling approach with a continuous review of the data entered and recommendations for investment.

5.6 Base Maintenance

We have established minimum levels of investment in relation to the base maintenance of network assets, as set out in the Infrastructure Base Maintenance investment case. For mains renewal this is £30m. These minimum levels provide investment for routine and reactive maintenance, to ensure the continuation of 'business as usual'. These minimum levels have been determined through a combination of analysis of historical activity and costs, deterioration modelling to establish underlying asset deterioration, and investment planning analysis. Full details are provided in the Infrastructure Base maintenance investment case.

The investment planned through this investment case contributes towards the minimum investment levels, as the selected interventions improve the performance of our infrastructure assets above current levels.

In relation to this investment case, the infrastructure base maintenance investment case defines minimum levels of expenditure for network assets. The minimum investment levels for this investment case are summarised in summarised in Table 11.

Table 11: Contribution to Minimum Non-Infrastructure Base Maintenance Investment

Infrastructure Base Maintenance Asset Group	Minimum AMP7 investment to maintain asset health (£m)	AMP7 investment provided through Distribution Mains interventions (£m)	Total AMP7 investment provided through all interventions (£m)	Additional investment requirement as Base Maintenance (£m)
Mains renewal	30.0	37.694	48.8	0

The minimum AMP7 investment for mains renewal is based on our AMP6 investment for trunk mains and distribution mains, and covers renewal for bursts, leaks and other fractures. The deterioration evidence, as set out in the infrastructure base maintenance investment case demonstrates that £30m minimum investment is sufficient to address the deterioration of trunk mains and distribution mains. As described in section 5.1, we propose to spend more than this minimum level, as we are looking to deliver additional performance improvement to meet our performance commitment targets

5.7 Historical & AMP7 Investment Comparison

A summary of historical investment in Distribution Mains is provided in Table 12 along with the planned AMP7 investment value from Distribution Mains interventions.

Table 12: Historical & AMP7 Investment

AMP	Values	Investment (£m)
AMP5	AMP5	69.562
AMP6	2015/16 actual	4.334
	2016/17 actual	5.976
	2017/18 actual	6.605
	2018/19 forecast	10.381
	2019/20 forecast	10.616
	AMP6 forecast	**37.913**
AMP7	AMP7 (Pre-Efficiency)	**37.694**
	AMP7 (8% Capex Efficiency Applied)	**34.678**

Our levels of distribution mains investment has decreased since AMP5. In AMP5 we made substantial investment to address leakage, which is now addressed under a separate investment case, and in AMP6 we have developed the zonal approach to deliver better return on investment with outcomes as a focus (leakage, bursts and customer contacts about water quality – appearance). In AMP7, we are proposing to invest in similar levels to AMP6, to implement cost-beneficial solutions to identified risks and to maintain the health of our assets.

6 Conclusions

To ensure our distribution mains assets continue to deliver our customers' priorities, we will measure progress via performance commitments for which we have set delivery targets.

In AMP7, the distribution mains measures are the supply interruptions, leakage, mains bursts and customer contacts about water quality – appearance. The latter two performance commitments are also a measure of asset health.

An initial list of fifteen risks was narrowed to five risks and 291 potential interventions. These interventions were developed and assessed through our asset management totex focused processes, and put forward for investment optimisation. Of these 291 interventions, 52 were selected on the basis that it is a cost beneficial intervention that meets our outcome of a Safe & Reliable Supply and contributes to associated asset health performance commitments. These 52 were categorised into 4 types of intervention.

We plan to invest a pre-efficiency total of £37.694m on 87km of distribution mans. We have set ourselves a challenging target of reducing our costs by 8% during AMP7. This will be achieved through delivery of our business transformation programme, resulting in a post-efficiency investment of £34.678m.

The interventions proposed contribute to ensuring our assets are maintained appropriately for the benefit of current and future generations. The investment will also contribute 94.8% of the mains bursts target (142), 83.17% of the customer contacts about water quality – appearance target (0.5), 33.65% of the supply interruptions target (12.20), and 7.33% of the leakage target (42).

If we fail to invest in our distribution mains their asset health will ultimately continue to deteriorate to unacceptable levels. A consequence of asset deterioration is that our mains will leak and burst, leading to us failing to deliver our customers' priority of keeping water flowing to their tap.

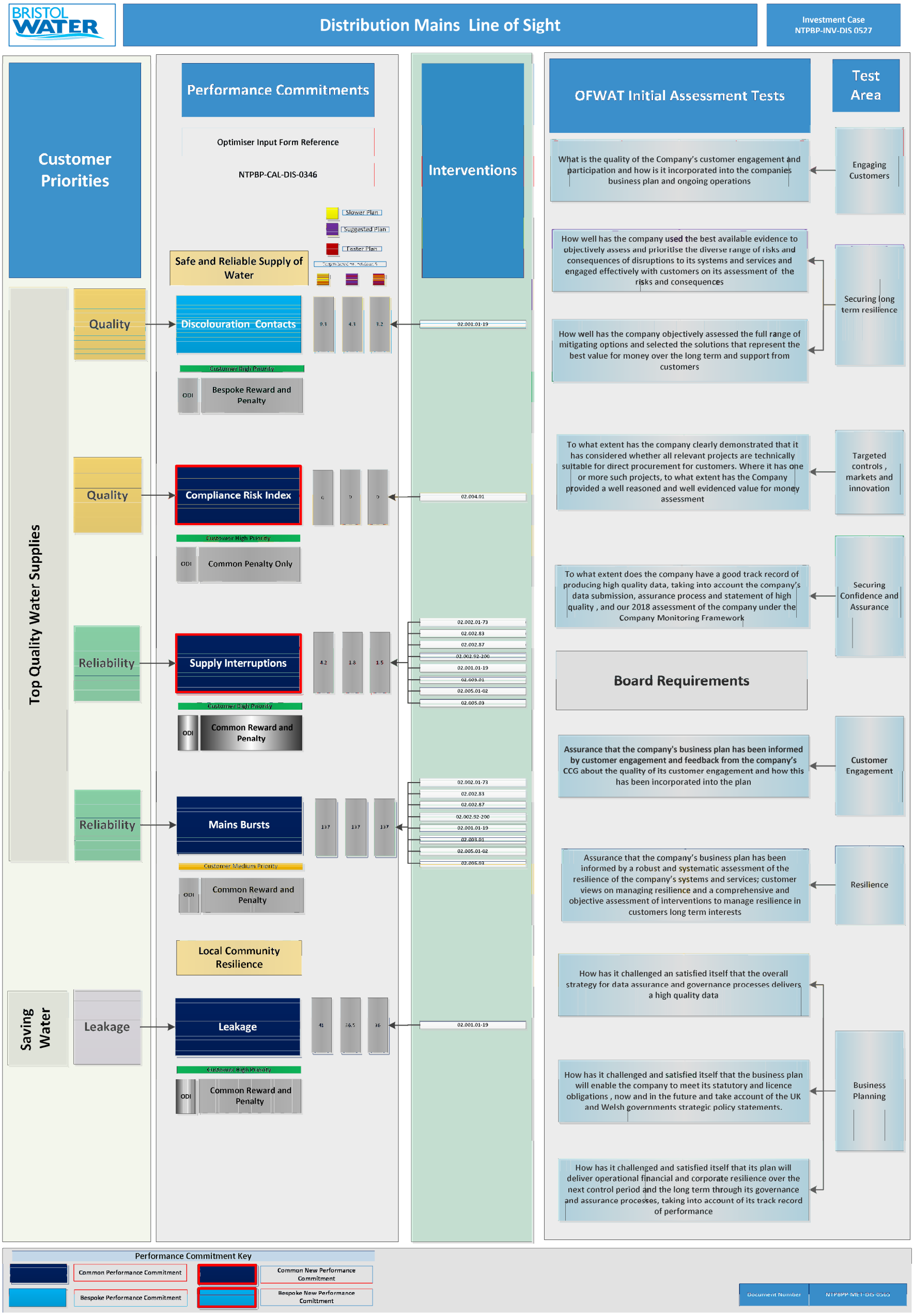
Those interventions not selected during investment optimisation form residual risk that will be carried during AMP7. The risks associated with these interventions will continue to be monitored and if the process requires these risks to be mitigated, we will respond with appropriate action. Interventions developed but not selected for AMP7 will be reappraised for investment in AMP8.

Our business plan provides assurance to both deliver and monitor the delivery of its outcomes, it will meet relevant statutory requirements and licence obligations imposed by the UK Government.

7 Appendices

- Appendix A: Line of Sight Diagram
- Appendix B: Datasets
- Appendix C1: Selected Risks
- Appendix C2: Non-Selected Risks
- Appendix D: Options Considered
- Appendix E: Interventions Developed
- Appendix F: Non-Selected Interventions

7.1 Appendix A: Line of Sight Diagram


Distribution Mains Line of Sight
Investment Case
NTPBP-INV-DIS 0527
Customer Priorities
Performance Commitments
Optimiser Input Form Reference
NTPBP-CAL-DIS-0346
Interventions
OFWAT Initial Assessment Tests
Test Area
Top Quality Water Supplies
Quality
Safe and Reliable Supply of Water
Slower Plan
Suggested Plan
Faster Plan
Discolouration Contacts
9.3
4.3
3.2
02.001.01-19
Customer High Priority
ODI
Bespoke Reward and Penalty
Quality
Compliance Risk Index
0
0
0
02.004.01
Customer High Priority
ODI
Common Penalty Only
Reliability
Supply Interruptions
4.2
1.8
1.5
02.002.01-73
02.002.83
02.002.87
02.002.92-200
02.001.01-19
02.003.01
02.005.01-02
02.005.03
Customer High Priority
ODI
Common Reward and Penalty
Reliability
Mains Bursts
137
137
137
02.002.01-73
02.002.83
02.002.87
02.002.92-200
02.001.01-19
02.003.01
02.005.01-02
02.005.03
Customer Medium Priority
ODI
Common Reward and Penalty
Local Community Resilience
Saving Water
Leakage
Leakage
41
36.5
36
02.001.01-19
Customer High Priority
ODI
Common Reward and Penalty
What is the quality of the Company's customer engagement and participation and how is it incorporated into the companies business plan and ongoing operations
Engaging Customers
How well has the company used the best available evidence to objectively assess and prioritise the diverse range of risks and consequences of disruptions to its systems and services and engaged effectively with customers on its assessment of the risks and consequences
How well has the company objectively assessed the full range of mitigating options and selected the solutions that represent the best value for money over the long term and support from customers
Securing long term resilience
To what extent has the company clearly demonstrated that it has considered whether all relevant projects are technically suitable for direct procurement for customers. Where it has one or more such projects, to what extent has the Company provided a well reasoned and well evidenced value for money assessment
Targeted controls , markets and innovation
To what extent does the company have a good track record of producing high quality data, taking into account the company's data submission, assurance process and statement of high quality , and our 2018 assessment of the company under the Company Monitoring Framework
Securing Confidence and Assurance
Board Requirements
Assurance that the company's business plan has been informed by customer engagement and feedback from the company's CCG about the quality of its customer engagement and how this has been incorporated into the plan
Customer Engagement
Assurance that the company's business plan has been informed by a robust and systematic assessment of the resilience of the company's systems and services; customer views on managing resilience and a comprehensive and objective assessment of interventions to manage resilience in customers long term interests
Resilience
How has it challenged an satisfied itself that the overall strategy for data assurance and governance processes delivers a high quality data
How has it challenged and satisfied itself that the business plan will enable the company to meet its statutory and licence obligations , now and in the future and take account of the UK and Welsh governments strategic policy statements.
How has it challenged and satisfied itself that its plan will deliver operational financial and corporate resilience over the next control period and the long term through its governance and assurance processes, taking into account of its track record of performance
Business Planning
Performance Commitment Key
Common Performance Commitment
Bespoke Performance Commitment
Common New Performance Commitment
Bespoke New Performance Comittment
Document Number
NTPBPP MET-DIS-0565

7.2 Appendix B: Datasets

This appendix show the data used in this investment case and where and how it has been applied

Dataset File Name	Data Summary	Process In Which Data Has Been Used			
		Risk Identification, Verification and Needs Assessment	Optioneering	Intervention Costing	Benefits Quantification
complaints_extract_04042017.csv	Discolouration complaints; Taste and odour complaints	✓	-	-	-
NTPBP-MET-DIS-0100 Discoloured water modelling methodology.docx	Methodology for modelling number of discoloured water complaints per WWMD based on the pipe characteristics within the WWMD.	✓	-	-	-
REQ 0188 customer Minutes Lost 170928.docx	customer Minutes Lost – Initial Analysis of Historical Data (REQ-0188)	-	-	-	✓
NTPBP-INT-DG3-UNP-0703 DG3 Report - All Interruptions to Supply - Oct-01 to Dec-16.xlsx	Unplanned customer Minute Lost (DG3) Report	-	-	-	✓
2017-10-18 G Williams Performance Commitments Lead Failures.msg	Identifies risk classification of lead sample failure	-	-	-	✓

7.3 Appendix C1: Selected Risks

This appendix shows the 4 selected risks of the 15 relevant risks.

SRR ID	Location /Zone	Revised Risk Description	Likelihood	Human Health / Environment	Ease to Resolve	Publicity & Reputation	Regulatory Impacts	customers Impacted	Max Impact	Risk Score
SRR623	All supply area	Risk of discoloured water or water with high iron content supplied to customer.	3	2	4	3	5	3	5	15
SRR625	All supply area	Risk of customer Minuets Lost (Supply Interruptions)	3	2	4	3	5	3	5	15
SRR703	Whole Network	IF no proactive mains replacement is undertaken THEN the burst rate across Bristol Water will increase beyond the target rate.	5	4	5	5	5	5	5	25

7.4 Appendix C2: Non-Selected Risks

This appendix shows the 11 non-selected risks of the 15 relevant risks.

SRR ID	Location /Zone	Revised Risk Description	Likelihood	Human Health / Environment	Ease to Resolve	Publicity & Reputation	Regulatory Impacts	customers Impacted	Max Impact	Risk Score
SRR4	Zone 426	The impact of a single compliance failure in the very small zone 426 supplied by Wessex has disproportionate impact on overall MZC [MZC].	2	1	1	1	1	2	2	4
SRR5	Non Site Specific	Increased risk to iron compliance if current network maintenance is not maintained. This would also lead to increased numbers of negative water quality contacts Judged to be a corporate risk (discussed and recorded at moderation session 12/01/2017)	1	1	1	1	1	1	1	1
SRR258	Non Site Specific	655 Mains identified in GIS associated with river crossings [Mains over Water]	n/a	n/a	n/a	n/a	n/a	n/a	0	
SRR259	Cheddar TW	IF the main between Cheddar Cliffs Res and Cheddar fails THEN the output from site will be reduced (Cheddar-Area 3).	2	1	1	2	3	3	3	6
SRR610	Wells	Interruptions and disruptions to supply - critical 2" main burst - Leak at top side of White House, Unset, Upper Milton, Wells, Somerset.	5	1	1	1	1	1	1	5
SRR611	Street	Interruptions and disruptions to supply - Private Service (SP) supplying x10 properties - Orchard Road, Street WRA ref 22687.	3	2	2	2	2	1	2	6
SRR612	Tetbury	Loss of supply to Tetbury Hospital	1	3	2	3	3	2	3	3
SRR613	DG2 Bristol	Poor Pressure at property 55 St Werburgh's, Bristol [Poor Pressure]	5	1	1	1	1	1	1	5
SRR614	DG2 Bristol	Poor Pressure at 10 properties in Shortwood Road, Bristol, causing poor pressure. [Poor Pressure]	5	1	1	1	1	1	1	5
SRR615	DG2 Bristol	Poor Pressure at property Mill Lane, Bristol, causing poor pressure. [Poor Pressure]	5	1	1	1	1	1	1	5
SRR616	DG2 Bristol	Poor Pressure at 12 properties in Wiltshire Avenue, Yate, Bristol, causing poor pressure. [Poor Pressure]	5	1	1	1	1	1	1	5

7.5 Appendix D: Options Considered

This appendix shows the 6 options considered from the 3 selected risks.

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options		
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?
SRR623	Risk of discoloured water or water with high iron content supplied to customer.	SRRN2	Bristol Water's supply network has 2832km of unlined ferrous mains that are more than 30 years old. Bristol Water received 6181 discoloured water contacts in the last five years (April 2012-March 2017), equating to 51/10,000 population, and has taken, in the period April 2012-March 2017, 279 samples as part of the ZNC sampling programme which had levels of iron over the water quality regulations compliance limit of 200micrograms/litre. Investment is needed for replacement or rehabilitation of aging, unlined ferrous mains, in order to: - help meet the performance commitment for Water quality - discolouration customer contacts; - help meet the performance commitment for Water Quality Compliance (Compliance Risk Index); - avoid Notices served by the DWI; - avoid being fined by the DWI.	Mains Replacement	Replace Fe and AC mains within a DMA	This is a valid option for reducing discolouration contacts and burst rate
SRR625	Risk of customer Minuets Lost (Supply Interruptions)	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Replacement of loose jumper hydrants	Replace exisitng hydrants with throughflow hydrants to enable use of bypass hose	This is a valid option because it will allow much greater use of bypass hose to keep customers in supply in an emergancy
SRR625	Risk of customer Minuets Lost (Supply Interruptions)	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Unplanned customer mins lost reduction	Use of overland bypass equipment and additional teams to reduce unplanned mins lost.	This is a valid option because it allows for the reactive use of overland bypass hose in an emergancy
SRR625	Risk of customer Minuets Lost (Supply Interruptions)	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Planned CML reduction	Revised working practises and use of overland bypass pipe to reduce customer mins lost due to planned interruptions	This is a valid option because by revising working practises planned works should not contribute to CML
SRR625	Risk of customer Minuets Lost (Supply Interruptions)	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Hydrant replacement and Unplanned CML reduction	Replacing hydrants will increase the effectiveness of the reactive layflat teams.	This option is valid because it will allow the reactive layflat teams to be more effective and further reduce CML
SRR703	IF no proactive mains replacement is undertaken THEN the burst rate across Bristol Water will increase beyond the target rate.	SRRN99	The Need is to use the Burst Deterioration model to identify the main most likely to burst in the future. The results of the model will then be used to define targeted mains replacement with aim of maintaining current burst rate targets and reducing burst rate targets if required.	Targeted Mains Replacement	Targeted replacement of AC and Fe mains on a sub DMA basis	This is a valid option for reducing burst rates

7.6 Appendix E: Interventions Developed

This appendix shows the 355 interventions developed from the 6 options. The greyed out rows represent an example of the interventions developed from the same risk as model outputs.

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options			Proposed Interventions		Costs		Benefits				
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?	Ref. No.	Intervention Title	Capex After (£)	Change in Opex (£)	Supply Interruptions (mins/prop/year (all interruptions >3 hours))	Leakage (ML/D)	Mains Bursts (bursts/1000km)	Discoloured Contacts	Replacement Mains Length (Trunk / Distribution)
SRR623	Risk of discoloured water or water with high iron content supplied to customer.	SRRN2	Bristol Water's supply network has 2832km of unlined ferrous mains that are more than 30 years old. Bristol Water received 6181 discoloured water contacts in the last five years (April 2012-March 2017), equating to 51/10,000 population, and has taken, in the period April 2012-March 2017, 279 samples as part of the ZNC sampling programme which had levels of iron over the water quality regulations compliance limit of 200micrograms/litre. Investment is needed for replacement or rehabilitation of aging, unlined ferrous mains, in order to: - help meet the performance commitment for Water quality - discolouration customer contacts; - help meet the performance commitment for Water Quality Compliance (Compliance Risk Index); - avoid Notices served by the DWI; - avoid being fined by the DWI.	Mains Replacement	Replace Fe and AC mains within a DMA	This is a valid option for reducing discolouration contacts and burst rate	02.006.01-131	This risk links to 151 interventions for DMA replacement totalling 551.77km	£124,923,000	-£601,861	0.072	1.088	19.188	4.594	288.475
SRR625	Risk of customer Minutes lost	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Replacement of loose jumper hydrants	Replace exisitng hydrants with throughflow hydrants to enable use of bypass hose	This is a valid option because it will allow much greater use of bypass hose to keep customers in supply in an emergancy	02.003.01	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains	£2,681,500	£0	0.655	0	0	0	0
SRR625	Risk of customer Minutes lost	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Unplanned customer mins lost reduction	Use of overland bypass equipment and additional teams to reduce unplanned mins lost.	This is a valid option because it allows for the reactive use of overland bypass hose in an emergancy	02.005.01	Unplanned customer mins lost reduction	£48,000	£249,000	1.9677	0	0	0	0
SRR625	Risk of customer Minutes lost	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Planned CML reduction	Revised working practises and use of overland bypass pipe to reduce customer mins lost due to planned interruptions	This is a valid option because by revising working practises planned works should not contribute to CML	02.005.02	Planned customer mins lost reduction	£0	£120,000	4.095	0	0	0	0

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options			Proposed Interventions		Costs		Benefits				
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?	Ref. No.	Intervention Title	Capex After (£)	Change in Opex (£)	Supply Interruptions (mins/prop/year (all interruptions >3 hours))	Leakage (ML/D)	Mains Bursts (bursts/1000km)	Discoloured Contacts	Replacement Mains Length (Trunk / Distribution)
SRR625	Risk of customer Minutes lost	SSRN46	BW are currently performing in the lower quartile on Supply Interruptions. Part o fthe cause of this is the inability to detect the location of bursts and leaks quickly to reduce customer supply interruptions. Investment is needed to turn this position around and to achieve the AMP7 performance commitments on Supply Interruptions.	Hydrant replacement and Unplanned CML reduction	Replacing hydrants will increase the effectiveness of the reactive layflat teams.	This option is valid because it will allow the reactive layflat teams to be more effective and further reduce CML	02.005.03	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains AND Unplanned customer mins lost reduction	£2,729,500	£249,000	2.62	0	0	0	0
SRR703	The burst deterioration model shows that IF no proactive mains replacement is undertaken THEN the burst rate across Bristol Water will increase beyond the target rate.	SRRN99	The Need is to use the Burst Deterioration model to identify the main most likely to burst in the future. The results of the model will then be used to define targeted mains replacement with aim of maintaining current burst rate targets and reducing burst rate targets if required.	Targeted Mains Replacement	Targeted replacement of AC and Fe mains on a sub DMA basis	This is a valid option for reducing burst rates	02.002.01 - 200	This risk links to a 200 interventions for DMA replacement totalling 390.8km	£28,955,000	£0	0.031	0	8.126		70.986

7.7 Appendix F: Non-Selected Interventions

This appendix shows the 304 non-selected interventions. The greyed out rows represent an example of the interventions developed from the same risk as model outputs.

See appendix D for costs or performance commitments.

Ref. No.	Intervention Title	Expected Capex after (£)	Change in Opex (£)	Residual Risk
02.006.	There are 63 non selected interventions for SRR623 for replace Fe and AC mains within a DMA	£88,811,000	-£396,092	Risk of discoloured water or water with high iron content supplied to customer.
02.003.01	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains	£2,681,000	£0	Risk of customer Minutes lost
02.005.01	Unplanned customer mins lost reduction	£48,000	£249,000	Risk of customer Minutes lost
02.005.03	Replacement of loose jumper hydrants with through flow hydrants on large diameter mains AND Unplanned customer mins lost reduction	£2,729,000	£0	Risk of customer Minutes lost
02.002.	There are 187 non selected interventions for SRR703 Targeted replacement of AC and Fe mains on a sub DMA basis	£273,740,000	£0	The burst deterioration model shows that IF no proactive mains replacement is undertaken THEN the burst rate across Bristol Water will increase beyond the target rate.