

C5 B



Cost and Efficiency

**C5B Technical Annex 07
Customer Meters Investment Case:
Technical Approach and Business Case**

NTPBP-INV-CUS-0532

**BRISTOL
WATER**

Contents

1	FOREWORD	1
2	EXECUTIVE SUMMARY	2
3	BACKGROUND	5
3.1	CONTEXT.....	5
3.2	STRATEGY.....	7
3.3	CUSTOMER PRIORITIES	8
3.4	ASSET HEALTH AMP7 PERFORMANCE COMMITMENTS & OUTCOME DELIVERY INCENTIVES	9
3.5	COMPLIANCE OBLIGATIONS	10
3.6	AMP6 INVESTMENT AND PERFORMANCE.....	10
4	DEVELOPING OUR INVESTMENT PLAN	12
4.1	INVESTMENT CASE DEVELOPMENT PROCESS	12
4.1.1	<i>Data & Data Assurance</i>	13
4.1.2	<i>Risk Identification, Verification & Needs Assessment Methodology</i>	14
4.1.3	<i>Optioneering & Intervention Development Methodology</i>	15
4.1.4	<i>Intervention Costing Methodology</i>	15
4.1.5	<i>Benefits Quantification Methodology</i>	16
4.1.6	<i>Investment optimisation & Intervention Selection</i>	17
4.2	APPLYING THE INVESTMENT PROCESS TO CUSTOMER METERS.....	18
4.2.1	<i>Risk Identification, Verification & Needs Assessment Methodology</i>	18
4.2.2	<i>Optioneering and Intervention Development</i>	18
4.2.3	<i>Intervention Costing</i>	20
4.2.4	<i>Benefits Quantification</i>	21
5	OUTCOME	22
5.1	SELECTED INTERVENTIONS.....	22
5.2	CONTRIBUTION TO PERFORMANCE IMPROVEMENT	25
5.3	NON SELECTED INTERVENTIONS	25
5.4	ASSUMPTIONS	25
5.5	AMP 8	26
5.6	BASE MAINTENANCE	26
5.7	HISTORIC & AMP7 INVESTMENT COMPARISON.....	27
6	CONCLUSIONS	28
7	APPENDICES	29
7.1	APPENDIX A: LINE OF SIGHT	30
7.2	APPENDIX B: DATASETS	32
7.3	APPENDIX C1: SELECTED RISKS.....	34
7.4	APPENDIX C2: NON-SELECTED RISKS.....	36
7.5	APPENDIX D: OPTIONS CONSIDERED	37
7.6	APPENDIX E: INTERVENTIONS DEVELOPED	40
7.7	APPENDIX F: NON-SELECTED INTERVENTIONS.....	43

Tables

Table 1: Performance commitment targets and percentage contribution from customer meters.....	4
Table 2: Associated Performance Commitments	10
Table 3: AMP6 capital investment.....	11
Table 4: Historic AMP6 Performance related to customer meters	11
Table 5: Example of Options Selection	19
Table 6: Selected interventions, costs, and % performance contribution.....	22
Table 7: Water Service and Business Unit Allocation.....	24
Table 8: Contribution to performance targets from selected interventions	25
Table 9: Contribution to Minimum Non-Infrastructure Base Maintenance Investment.....	27
Table 10: Historical & AMP7 Investment	27

Figures

Figure 1: Approach to meeting customer priorities and mitigating risks	3
Figure 2: Investment case process overview - Level 1 diagram	12
Figure 3: Percentage of Data Types by OFWAT Confidence Grade and Risk Grade	14

1 Foreword

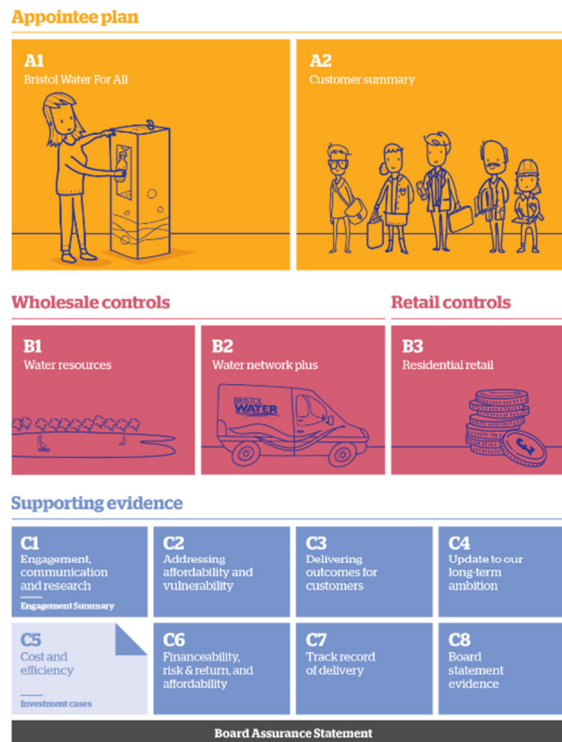
The customer meters investment case will address the requirements for capital investment for the installation of new customer meters, contributing to local community and environmental resilience, and the replacement of obsolescent customer meters, improving asset health.

We define a water meter as an instrument for recording the quantity of water passing through a pipe. By the end of AMP6 we will have 338,100 metered residential properties, representing a 66% a meter penetration rate.

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

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

This investment case document is a technical annex to section C5.B 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 Document¹ which outlines in detail our methodology for defining investment.

¹ Bristol Water PR19 Investment Cases Summary Document NTPBP-INV-PR1-0635
NTPBP-INV-CUS-0532 Customer Meters Investment Case

2 Executive Summary

In order to provide customers with a resilient water supply and meet their priority of saving water before developing new supplies, we will focus on improving water efficiency and reducing water consumption. In conjunction with this we will also focus on ensuring that our meters are accurate - and enable accurate billing. We will achieve this by investing £13.469m, installing 40k meters into existing residential properties, and replacing 66k existing meters. This will achieve a 'per capita consumption' benefit of 1.85l/h/d and an increased meter penetration rate of 7.54%.

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 local community and environmental resilience. Customers want us to save water before developing new supplies and that they consider water efficiency is a high priority for them as a means to ensure a resilient water supply in the long term.

During our work to develop our Water Resource Management Plan 2019, we have carried out an assessment of the likely population growth in the area we supply. This indicates that the population we serve will grow by 7% by 2025 and in order to meet this potential increase in demand we need to improve water efficiency and help customers reduce their water consumption.

By 2020 on average each person in our operating area will be consuming 142 litres of water per day (l/h/d) – Per Capita Consumption. Through our engagement programme they have told us that they are willing to pay for a performance improvement of 5% (135l/h/d).

Along with water efficiency, customer education and leakage management, metering is a key enabler to achieving a reduction in water demand because it provides the customer with a personalised water bill and places their bill within their control. Metered water supplies also mean that we can engage more effectively with consumers about their water consumption because there is a direct financial benefit to customers who are able to reduce the amount of water they use.

A significant part of our plan to deliver our strategic aim of improving water efficiency and reducing water consumption is to target a greater penetration rate of customer meters than at present.

By the end of AMP6 we will have over 338k metered residential properties, representing a 66% meter penetration rate. This is an ambitious target installing 76k meters, and we will be investing circa £24.5m to achieve this. A key feature of our success is the meter 'Options' programme which is our programme to promote the benefits of meters and install meters free of charge at the request of customers.

In AMP7 we will increase our meter penetration rate by 9%, from the end of AMP6 forecast of 66%, to 75% by 2025. We will achieve this by installing 68k new meters in AMP7, 40k into existing residential properties, and 28k into new residential properties. This investment case presents the AMP7 investment for the 40k new meters to be installed into existing residential properties, as well as base maintenance replacement of existing meters. The investment for the remaining 28k into new residential properties is set out in our new development investment case.

We will improve our meter penetration rate in several ways:

- Continue meter ‘Options’ programme;
- Selective metering on change of occupancy programme;
- Installation of meters at new building developments site - (this aspect of our metering programme will be addressed in investment case 11 – New Development).

We also need to invest to ensure we maintain the accuracy of our meters, and we will achieve this by:

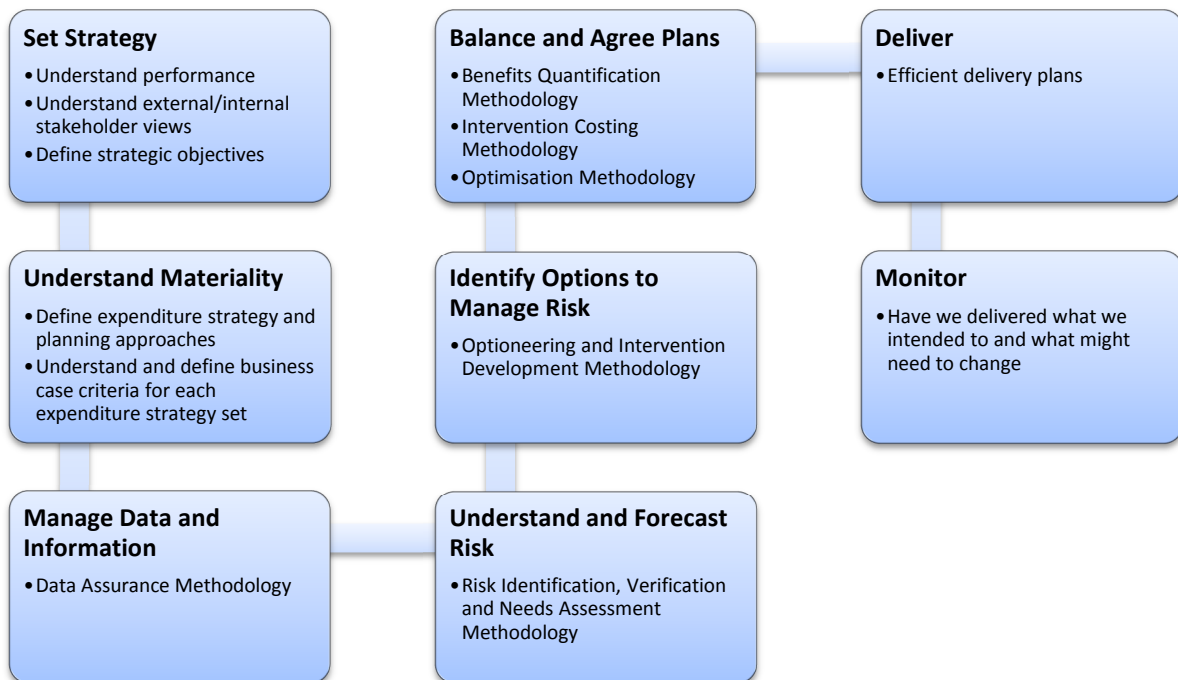
- Replacement of faulty and obsolescent customer meters (typical asset life is 13 years);
- Testing programme for large commercial meters, where the inlet pipe size is greater than 60mm.

If we fail to invest in customer meters or not achieve the two associated performance commitments mentioned above, the key risks are that we will not meet our customers’ priority for saving water before developing new supplies; and we will not be providing our customers with the fairest and most consistent means of charging for water.

Given the function of a meter we must ensure that they are fit and well maintained in terms of providing an accurate view of water consumption, therefore there is a risk that by failing to identify and correct recording of commercial and household meters, we will fail to provide fair and equitable water bills to our customers.

In order to ensure that we meet customers’ priorities and mitigate the risks associated customer meters, we have adopted an asset management totex focused approach as set out in Figure 1:

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 investment optimisation, to outcomes and benefits provided for our customers.

We plan to invest £13.469m from 2020 to 2025 in order to deliver our customer’s priority of saving water, providing 26.43% of our per capita consumption improvement target of 7l/h/d, and 83.78% of our increased meter penetration rate of 9%. There is an associated impact of £35k for operational expenditure (opex), due to the need to carry out additional testing and calibration of large commercial meters.

Table 1 below summarises our proposed outcome delivery incentives related to the customer meters investment case:

Table 1: Performance commitment targets and percentage contribution from customer meters

Performance Commitment	Unit	2019/20 Baseline	2024/25 Target	Total targeted performance commitment improvement in AMP7	Customer meters % contribution to performance commitment target
Per capita consumption (PCC)	Litres/head/day (l/h/d)	142.0	135.0	7.00	26.43%
Meter penetration	%	66.00	75.00	9.00	83.78%

Our AMP7 investment in customer meters will help ensure these assets are being maintained appropriately to deliver resilient water services to current and future generations.

For per capita consumption, in total 26.71% of performance improvement is achieved through interventions within our investment cases. The remaining performance improvement will be achieved as a result of a wider customer education programme.

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

3 Background

3.1 Context

Our customers have told us that they want us to save water before developing new supplies, and saving water to reduce per capita consumption is a strand in our strategy for achieving this customer priority.

Evidence such as the Walker review suggests that when customers are put onto metered water their consumption reduces. Therefore to reflect this customer priority and help manage long term demand for water we have set Performance Commitment targets for both per capita consumption and meter penetration, which is defined as the percentage of household properties on a metered water supply.

Our Water Resources Management Plan options appraisal work indicates that demand management options can address the company's minor and long term supply demand balance deficit at a lower cost than implementing new water resources.

Much research into the benefits and fairness of metering has been undertaken. For example, the Walker Review of 2009 ("The Independent Review of Charging for Household Water and Sewerage Services²") recommended a charging system to incentivise the efficient use of water and concluded that charging by volume use, which requires the installation of meters, is the fairest approach to charging. The report identified that much of the water reduction achieved is through reduced hot water consumption and this saves on the energy used to heat the water. This helps generate reductions in water and energy bills for the customer. On a national basis stress on water sources is reduced and a reduction of carbon emissions through reduced energy usage is achieved.

Metering is now widely adopted by UK Water companies as a means to drive down consumption. In Ofwat's PR19 Final Methodology report³, Ofwat has set a common performance commitment for per capita consumption. A key means of driving down consumption is through the installation of water meters as it encourages customers to become more aware of the volume of water they use and take control of their water bill. In response to the Ofwat methodology we have set performance commitments for Meter Penetration and Per Capita Consumption.

Metering provides the fairest and most consistent means of charging for water and allows us to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.

Our assessment of smaller customer meters indicates that beyond an age of 18 years the meter is likely to become progressively much less accurate or suffer a fault that makes it inoperable. Having assessed the probability of such failures we have determined that a maximum replacement period of 18 years provides the best balance of cost and benefit. This will be a mix of household and non-household meters and includes both reactive replacement of failed meters and scheduled replacement of meters which have reached the end of their operational life.

² Defra, UK Government, Walker Review Final Report

³ Ofwat, 2017, Delivering Water 2020: Our final methodology for the 2019 price review,

It is fairly uncommon for meters to fail, but where they do the most common causes are:

1. **Meter Rotary Piston:** the meters we use contain a rotary piston, and the movement of this piston causes the volume passing through the meter to be registered and therefore how much water the customer uses. If debris such as dust or sand enters the piston, it can cause it to slow down. The impact of this is that the meter begins to under read. In extreme cases it can cause the piston to seize up and the meter will fail.
2. **Communication Pipe Burst:** If there is a burst in a Communication Pipe, this can cause a higher flow in the meter. This can over-rev the meter and cause it to break. This is more common in higher pressure areas.
3. **Meter Register:** The meters contain a register to show how much water is used, similar to an odometer in a car. These registers contain fine gears, and should debris enter the gears it can cause drag causing the meter to under-read, especially at times of higher flow.
4. **Brass Pipes:** Meters screwed into brass pipes can cause issues in high temperatures. As plastic will expand faster than brass, the plastic on the meter will eventually split and cause a small leak. These incidents are normally found where a customer has reported low pressure.
5. **Scratched Glass:** To protect the meter register there is a pane of glass covering it. It is common for the glass to get scratched removing any mud from the glass. If the glass is overly scratched the register cannot be read and the meter becomes obsolescent until the glass or meter is replaced.
6. **Broken Glass:** It does not take much malicious action to break the glass protecting the meter register. If any mud gets into the Register it can cause the gears to seize, and the number on the register will not change.

We have established minimum levels of expenditure in relation to the base maintenance of customer meters, as set out in our Non-Infrastructure Base Maintenance investment case. The investment through our customer meters investment case will contribute towards these minimum levels (see Section 5.6).

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

- Network Monitoring – shared target of per capital consumption.
- New Development – shared target of meter penetration; and

New properties will all be metered as a matter of course and this contributes to the meter penetration target. Meter penetration from new properties is excluded from this investment case but included in the New Development investment case.

The level of customer metering is a significant variable in our supply-demand balance, and this investment case aligns with our Water Resources Management Plan which assesses this balance in detail.

3.2 Strategy

Developing the investment needs for customer meters 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 customer meters to clearly focus in 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 is a specific outcome ‘Local Community and Environmental Resilience’ and specific performance commitments (meter penetration and per capita consumption) that has strategic targets and incentives that will be directly influenced by our investment needs for customer meters.

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 customer meters 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.

Our customers have told us that they want us to save water before developing new supplies. Reducing per capita consumption is a strand in our strategy for delivering this customer priority.

We have an increased meter penetration target in AMP7 compared to AMP6 and our Water Resources Management Plan options appraisal work indicates that demand management options, including an increase in metering, can address this deficit at a lower cost than implementing new water resources.

Our customer meter strategy will include:

- Metering all properties on change of occupier as a permanent company policy;
- Continued promotion of metering to encourage customers to take control of their bill, with annual target figures to ensure delivery of meter penetration targets;
- Installation of Automated meter read smart meters instead of traditional non-smart meters; and
- Replacement of non-household meters on a cost benefit basis.

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; and
- You get the best possible experience every time you need us.

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

- Excellent customer Experiences;
- Safe and Reliable Supply;
- Local Community and Environmental Resilience; and
- 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 customer meters and our outcome Local Community and Environmental Resilience.

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. We consulted on three potential scenarios in relation to Local Community and Environmental Resilience outcomes, as summarised below:

Service	Performance Commitment	2020 target	2024/25 target		
			Slower improvement plan	Suggested improvement plan	Faster improvement plan
Leakage	The amount of water lost from pipes (million litres per day)	43.0	41.0 5% reduction	36.5 15% reduction	36.0 16% reduction
Water used by customers	Water use per person (litres per day)	142	138 3% reduction	135 5% reduction	129 9% reduction
Enhancing your local environment	Biodiversity Index (score)*	17,658	17,683 25 point increase	17,711 53 point increase	17,858 200 point increase
Customers satisfied with our contribution to the local community	Community satisfaction survey	N/A - new measure	Continue current initiatives such as 'Refill' and Water Bar	Enhanced recreational benefits from our sites Working in partnership to deliver community benefit, such as reduced use of resources	Accelerated programme to deliver wider community benefits
Forecast increase to the average bill from additional investment			£3	£10	£12

10 points is equivalent to approximately 1 hectares of great new habitat

When discussing local community and environmental resilience outcome with our customers in our draft business plan consultation, the performance commitments under this outcome had some of the highest levels of support for the faster plan, and for the slowest plan, reflecting the mixed views our customers have about how much of a priority these issues should be for investment.

Results show affordability concerns have driven some customers to choose the slower plan, whereas customers also value the service improvements in the suggested plan. In summary, we consider that a plan with a lower bill level with the suggested improvement plan is more likely to be acceptable to more customers (particularly low-income groups). You can see more about how the feedback from our draft business plan consultation influenced each of our performance commitments in section C3.

The level of support for our plan expressed by our customers, both those we have engaged with over a period of time and those we met for the first time, gives us confidence that our final business plan strikes the right balance of delivering service improvements that customers value at a price that is acceptable to the majority.

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 AMP7 Performance Commitments & Outcome Delivery Incentives

The health of our assets is a key element in delivering resilient water services to our customers. Our investment in customer meters will help ensure our assets are being maintained appropriately for the benefit of current and future generations.

Additionally, our investment in customer meters will support our AMP7 outcome 'Local Community and Environmental Resilience', by investing in new and replacement customer meters in order to make our services robust to what the future may hold. The Local Community and Environmental Resilience outcome will be measured through a set of associated performance commitments.

Performance commitments associated with customer meters 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
Meter penetration	%	65.9	67.7	69.5	71.3	73.1	75.0	9.1
Per capita consumption (PCC) (annual)	Litres/head/ day (l/h/d)	142	140.6	139.2	137.8	136.4	135	7

We encourage our customers to be more efficient in the way they use water by increasing the number of customers who are billed based on their actual consumption of water. We measure this by meter penetration, expressed as the percentage of customers who are billed based on a water meter installed at their property. Our AMP7 target is set as part of our long term strategy to meet the changing demand for water between now and 2045, working closely with customers to help reduce demand for water.

Per capita consumption is the average amount of water used by each person each day. It measures how much water we use every year. This is also part of our long term strategy to meet the changing demand for water as described above. Our intention is to encourage behaviours to reduce the amount of water we use, thereby helping customers save money for the future and further adapt to the challenges of climate change.

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

A detailed diagram illustrating the full line of sight between customers, outcomes, performance commitments, and outcome delivery incentives related to this investment case is included in Appendix A.

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

A summary of our AMP6 investment in our customer meters is provided in table 5 below. Our AMP6 investment in customer meters supports our ability to meet our performance commitment for meter penetration and per capital consumption. Our investment in AMP6 will also underpin our performance commitments for meter penetration and per capital consumption in AMP7.

Our AMP6 capital investment related to customer meters 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: AMP6 capital investment

Year	Customer Meters capex (£m)
2015/16 actual	2.212
2016/17 actual	2.402
2017/18 actual	3.252
2018/19 forecast	7.847
2019/20 forecast	8.489
AMP6 forecast	24.203

Our AMP6 investment is forecast to deliver 76k new meters and to also undertake base maintenance replacement of faulty meters.

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

Table 4: Historic AMP6 Performance related to customer meters

Performance Commitment		2015/16	2016/17	2017/18	2018/19 (Forecast)	2019/20 (Forecast)
Meter Penetration (%)						
Bristol Water	Target	50.4	54.8	58.8	62.5	65.9
	Company Performance	47.3	49.3	52.7	58.0	65.9
Per Capita Consumption						
Bristol Water	Target	145.2	144.4	143.6	142.8	142.0
	Company Performance	141.1	144.1	144.5	142.8	142.0

We have also set up a dedicated project 'Meter 66' to provide the increased focus that delivering our challenging metering target by the end of AMP6. This team will continue the work we have already done to improve our metering processes, as we work towards installing 76k meters to meet our March 2020 target of 65.9%. So far in AMP6, customers opting for a meter fell below the expected levels and therefore we are increasing our metering on change of occupancy and promotion of meters, including providing individual customer information on the benefit to them of metered bills, in order to meet our AMP6 target. We are forecasting to meet our AMP6 per capita consumption targets for the final two years of this AMP. Although there has been an upward trend in recent years in the amount of water that customers are using each day, we are continuing to do our part to inform our customers about the importance of reducing water consumption.

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

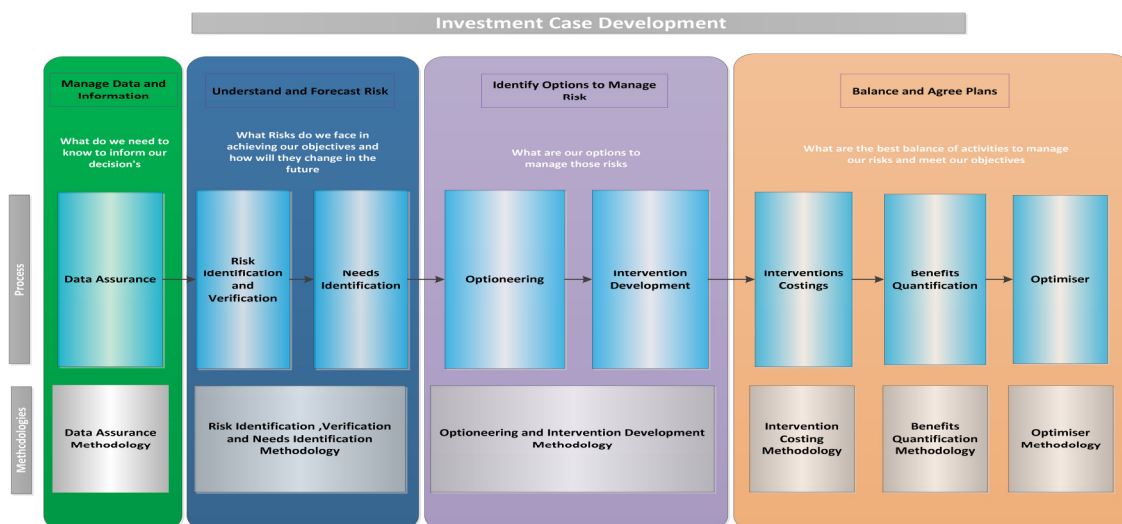
We have created and implemented a process that is supported by a set of six methodologies. When developing the methodologies, we wanted to ensure that they:

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

Figure 2: 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 the 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.

The following sections detail the results of the data assurance and Annual Performance Report assessments undertaken for this investment case.

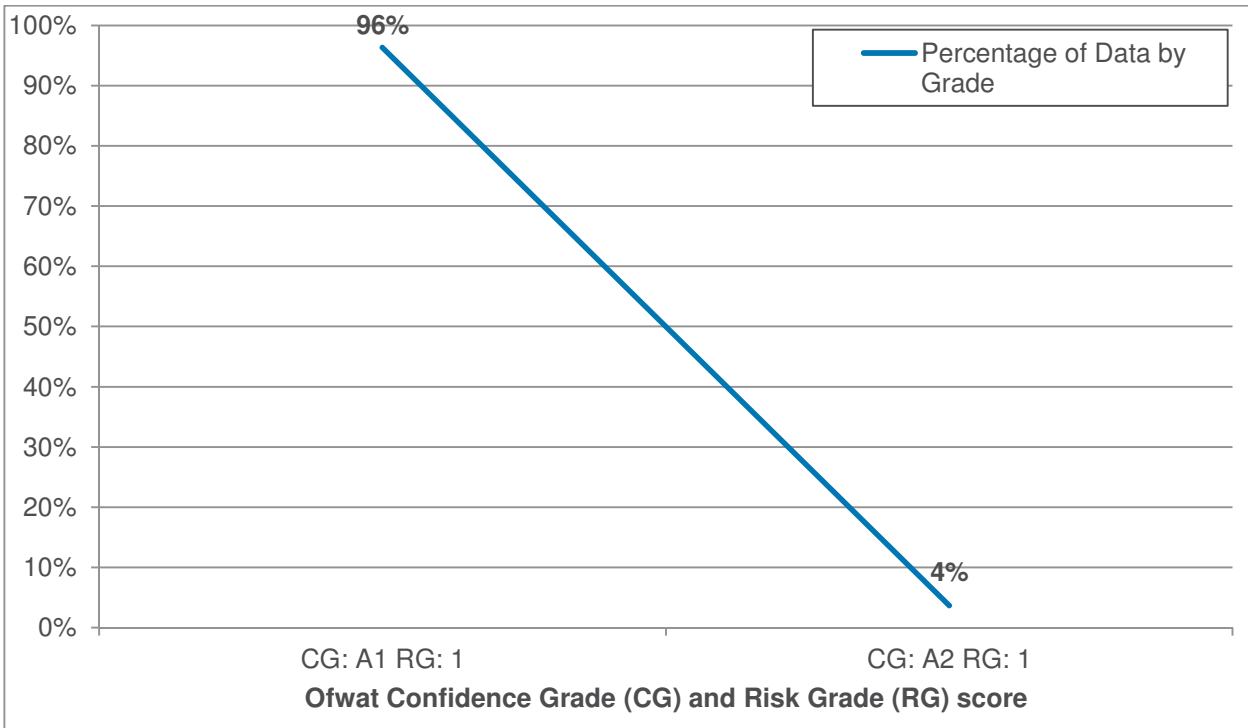
Quality Assessments

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 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 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 27 specific data types were identified of which 100% have been assessed as having good quality (Confidence Grade A1-B4 and Risk Grade 1-3).

Figure 3 summarises the number of data types scored against Ofwat Confidence Grades and Risk Grades.

Figure 3: Percentage of Data Types by OFWAT Confidence Grade and Risk Grade



APR Assessments

The 27 data points identified in Appendix B have also been assessed in their utilisation for Annual Performance Reporting 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 Annual Performance Report data tables. The assessment of the Annual Performance Report submission and application of the methodologies are formally governed and recorded.

Of the 27 data types, 2 (7%) were assessed as having already been required for Annual Performance Reporting and therefore subject to the assurance requirements as set out in Annual Performance Report Methodologies.

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 and where it was considered that mitigation of the risk will enhance our ability to meet our performance commitments, the risk was selected and developed into a needs statement.

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.

Unselected risks 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 risk within the AMP, we will respond with appropriate action, such as increased base maintenance.

The 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 & 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.

Viable options were converted into interventions. Each intervention had its costs and benefits assessed.

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 capital expenditure -(capex after)

If we deliver the capital expenditure (capex) 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 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:

- 'Patch and 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 Expenditure- 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 optimisation model assesses interventions primarily on the overall benefit, which takes account of performance and whole life costs. The investment optimisation 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 investment optimisation 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 Appendix C1 (slower Improvement plan, suggested improvement plan and faster improvement plan).

4.2 Applying the investment process to customer meters

Each of the following sections describes the specific details associated with the application of the investment case development process for customer meters

4.2.1 Risk Identification, Verification & Needs Assessment Methodology

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

All three of the identified risks were selected and developed into need statements. The risk descriptions, scoring and associated needs statements are captured in the strategic risk register. These are discussed further in Section 4.2.2. Details of the selected risks are provided in Appendix C.1.

4.2.2 Optioneering and Intervention Development

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

All viable options were identified with a unique reference number as proposed interventions and were taken forward for further scope development, benefits calculation and costing. A total of three interventions were identified in this way.

All risks and their associated options were selected for intervention development, as included in Appendix D. There were no non-selected risks.

For example, against the selected risk SRR782 regarding providing our customers with the fairest and most consistent means of charging for water (as linked to our customer meter penetration targets), two options were identified and these were both developed into interventions, as shown in Table 5. These two interventions also address the selected risk SRR783 regarding meeting our customers' priorities for saving water before developing new supplies (as linked to our per capital consumption target).

Once interventions were developed, costs could be prepared which are discussed in Section 4.2.3

Table 5: Example of Options Selection

Strategic Risk Register	Need Description	Proposed Option Name	Proposed Option Description	Option Viability?	Ref No	Intervention Title	Intervention Description
<p>SRR782</p> <p>If Bristol Water fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;</p> <p>(Risk Score = 12)</p>	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills 	Continue meter options programme (at previous AMP rate)	Installation of 31k new meters at the request of customers under the 'Meter Options' programme	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	07.002.01	Continue meter options programme	Install 31k new customer meters across the AMP.
		Continue selective metering on change of occupancy programme	Installation of 9k new meters on change of occupancy	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	07.003.01	Continue selective metering on change of occupancy programme	Install 9k new meters on change of occupancy

4.2.3 Intervention Costing

Costs for all interventions were calculated by Bristol Water. We collaborated with ChandlerKBS to validate the Bristol Water unit costs for customer meters. Through this process we were able to sense-check and verify our £225 unit cost was valid.

For the meter options and selective metering on change of occupancy programmes, the cost has been calculated from a unit cost per analogue meter installed, and is based on Bristol Water 2017/18 historic data. A 10% unit cost efficiency has been applied to these historic costs, which we will deliver in AMP7 through the management of our supply chain procurement contracts. An allowance of £25 has been added to the unit cost for the additional cost of an AMR meter compared to an analogue meter. The resulting unit cost is £225 per meter installed.

Opex costs for the testing programme for large commercial meters are based on the cost of a Bristol Water in-house resource and associated vehicle to carry out the testing.

In one case, Replacement of customer meters, the costs were derived from the base maintenance costing approach, which is further explained in Section 5.6.

We have also challenged delivery efficiency across the AMP7 programme, and as a result have applied an 8% efficiency to the capex total cost of interventions.

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

Cost Example: Continue Meter Options Programme

Metering provides the fairest and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.

Investment is needed to install 31k meters at customer's properties to ensure we are on track to meet our meter penetration target.

We have established a direct cost of undertaking the works of £6.944m; the direct cost uses our historical meter installation costs for the last 3 years, it includes survey cost, contract composite installation rate, contract management fee overhead, materials, Bristol Water/BWBSL overheads and vehicle maintenance cost. (Capex After).

We have established that if undertook the above intervention there would be no increase or decrease 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

Three interventions were assessed for direct and indirect benefits. These are presented in Appendix E. In terms of indirect benefits the performance commitments that relate to this investment case are discussed below

Per Capita Consumption

This is defined as the average amount of water used by each of our customers in a household property each day. This covers both measured and unmeasured customers.

The benefit on Per Capita Consumption generated by the installation meters is based on the assumption that a meter installation will achieve a 15% reduction in demand per meter. This aligns with the figure used in the Water Resources Management Plan and is based on a figure in the Waterwise report, 'Making the Case for Metering'⁴.

Meter Penetration

This is defined as the percentage of residential properties that are billed according to their metered consumption, as a percentage of our overall total residential connected properties. This measure includes household properties. Non-household, void properties and multiple properties served by a single meter are excluded.

⁴ Waterwise Fairness on tap. Making the case for metering
NTPBP-INV-CUS-0532 Customer Meters Investment Case

5 Outcome

5.1 Selected Interventions

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

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; and
- **Partnering:** we undertake leading research into areas that we provide effective solutions for the future.

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

The four selected customer meters interventions are set out in Table 6, along with details of the associated costs and contribution to performance improvement.

Table 6: Selected interventions, costs, and % performance contribution

ID	Intervention Title	Total Capex (£)	Change in Opex per annum (£)	Meter penetration	Per capita consumption
07.002.01	Continue ‘Meter Options’ programme	£6,944,400	£0	64.87%	20.43%
07.003.01	Continue selective metering on change of occupancy programme	£2,025,000	£0	18.92%	6.00%
07.004.01	Testing programme for large commercial meters >60mm	£0	£35,000	-	-
07.006.01	Replacement of customer meters	£4,500,000	£0	-	-
Customer meters capex investment (pre-efficiency)		£13,469,400	£35,000	83.78%	26.43%
Customer meters capex investment with 8% capex efficiency		£12,391,848			

Meter Options and Selective Metering interventions are selected because they provide contributions to achieving our meter penetration and per capita consumption targets.

Testing programme for large commercial meters is selected because it is cost-beneficial, helping to offset future bill increases for our customers.

Replacement of customer meters is selected because it is mandatory, to ensure we replace failed meters and meters which have reached the end of their operational life, and carry out activities to move, calibrate and repair in-service meters.

These interventions are described in the following section:

Meter Options intervention and Selective Metering intervention

We have identified through customer research and engagement a beneficial target of 75% meter penetration by the end of AMP7. This will help to drive down consumption helping make bills more affordable and reduce demand on our water sources.

Meter penetration can be increased through investment in two key programmes:

- The 'Meter Options' programme where the benefits of meters are promoted and Bristol Water install meters free of charge at the request of customers; and
- The 'Selective Metering' programming where meters are installed in properties without meters whenever there is change in occupier.

We will achieve our 75% meter penetration by installing 68k new meters in AMP7. 40k of these will be into existing residential properties through the above programme. The remaining 28k will be into new residential properties, as defined in our new development investment case.

Large Diameter Meter Testing and Calibration Programme

Research conducted by WRc into the performance of commercial meters suggested that as meters age they become less accurate and tend to under-record the volume of water used⁵. If metered consumption by our customers cannot be assessed accurately it is not possible for us to assess key aspects of system performance such as leakage and customer demand - and customers who are billed on an unmetered basis will be providing an unfair subsidy to customers who are using more water than their meter readings indicate.

This is seen most clearly with large-diameter meters, which typically supply commercial properties that use large volumes of water. In this case, even a small inaccuracy in the water meter can lead to a large-volume inaccuracy in the total amount of water recorded by the meter and we propose in this Investment Case to carry out a programme of testing and calibration of our largest customer meters (60mm diameter and over) in order to ensure that the meters record accurately and that billing is fair. We have 142 meters of this size and we propose to assess and recalibrate all of these meters during AMP7. Because we anticipate that this improvement to the condition of large-diameter meters will lead to a recovery in lost income, we consider that this programme of testing and calibration will be cost beneficial.

⁵ A study undertaken by WRc (47) identified nearly 300 existing in-service meters of 20mm to 50mm diameter and varying age, manufacturer and type were removed from existing pipework and tested in the laboratory at a range of flows. This concluded that meters of this size range tend to under record as they age.

Other meter maintenance such as normal faults in large meters and maintenance or testing of smaller diameter meters will be carried out as part of our base maintenance programme.

Replacement of customer meters

Our assessment of smaller customer meters indicates that beyond an age of 18 years the meter is likely to become progressively much less accurate or suffer a fault that makes it inoperable. Having assessed the probability of such failures we have determined that a maximum replacement period of 18 years provides the best balance of cost and benefit, which means that during AMP7 we will need to replace 66k meters. This will be a mix of household and non-household meters and includes both reactive replacement of failed meters and scheduled replacement of meters which have reached the end of their operational life. In addition, works related to moving, calibrating and repairing in-service meters will be undertaken as part of the scope of this investment.

The total customer meters investment 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 all related to Non-Infrastructure assets and is categorised as other capital expenditure. Water Service and Business Unit Allocation for customer meters, is summarised in Table 7.

Table 7: Water Service and Business Unit Allocation

Wholesale Control	Water Network Plus	Total (Pre-Efficiency)
<i>Business Unit Allocation</i>	<i>04 Treated Water Distribution</i>	
Customer meters capital investment (%)	100.0%	100%
Customer meters capital investment	£13.469m	£13.469m
Maintaining the long term capability of the assets - non-infra	£4.500m (33.4%)	£4.500m (33.4%)
Other capital expenditure - non-infra	£8.969m (66.6%)	£8.969m (66.6%)
Customer meters - capital investment with 8% capex efficiency	£12.392m	£12.392m

5.2 Contribution to performance improvement

Table 8 set outs the percentage contribution to performance improvement provided by the selected customer meters interventions. These percentage contributions are discussed in the following sections.

Table 8: Contribution to performance targets from selected interventions

Performance Commitment	Unit	2019/20 Baseline	2020/21	2021/22	2022/23	2023/24	2024/25	Performance improvement required in AMP7	Customer meters % contribution to improvement
Meter penetration	%	65.9	67.7	69.5	71.3	73.1	75.0	9.1	83.78%
Per capita consumption	Litres/head/day (l/h/d)	142	140.6	139.2	137.8	136.4	135	7	26.43%

Asset Health

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

Meter penetration

Our AMP7 investment in customer meters contributes 83.78% towards our meter penetration target, with the remainder of the target being achieved through New Development investment case (installation of meters in new properties).

Per capita consumption

In total 26.71% of performance improvement is achieved through interventions within investment cases. The remaining of performance improvement will be achieved as a result of a wider customer education programme.

5.3 Non selected Interventions

All customer meter interventions were selected.

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 Document⁶. Assumptions specific to this investment case are discussed below.

⁶ Bristol Water, PR19 Investment Cases Summary Document
NTPBP-INV-CUS-0532 Customer Meters Investment Case

The 'Selective Metering' programme is based on the number of meters installed under the same programme historically. This historical installation rate is based on the number of changes of occupancy and this rate is assumed to remain the same going forwards.

The overall cost of meter installation under the 'Meter Options' and 'Selective Metering' programmes is based on a single unit cost of analogue meters. Due to the large number of meters proposed, a small variation in this unit cost will have a significant impact on the overall cost. The costs are based on our typical installation cost of an analogue meter over the last 3 years. This cost has been supplemented by the typical cost difference between analogue meters and the proposed AMR meters.

The per capita consumption benefit generated by the installation of meters is based on the assumption that a meter installation will achieve a 15% reduction in demand per meter. This aligns with the figure used in the Water Resources Management Plan and is based on a figure in the Waterwise report, 'Making the Case for Metering'⁷.

All new and replacement meters installed in AMP7 will be AMR meters. There is an operational cost reduction associated with AMR meters compared to analogue meters. AMR meters can be read using drive-by technology, allowing more AMR meters to be read daily compared to analogue meters. However, there is also an operational cost increase created by the need to read and bill for all of the new meters installed. The net effect of these two influences on operational cost has not been fully analysed but the assumption has been made that there is no net operational cost difference.

The level of new development is not within our control and is based on predicted growth as listed in the Local Plans produced by local authorities covering the area we serve. If the scale of new development is less than expected, the number of meters installed under the 'Meter Options' programme will need to increase to achieve the meter penetration target. Conversely, if the scale of new development is greater than expected, the number of meters installed under the 'Meter Options' programme can decrease, whilst still achieving the target for meter penetration.

An occupancy rate of 2.63 is used in the conversion of meter penetration into per capita consumption reduction. 2.63 people per unmetered property is as used in the Water Resources Management Plan.

5.5 AMP 8

In line with our long term ambition, in AMP8 we expect to continue to invest to maintain our plan to increase metering, and to continue to actively promote the benefits to customers. This will support our aim of reducing water consumption. We aim to increase the percentage of properties which are charged according to their metered consumption to 90% by 2050.

5.6 Base Maintenance

We have established minimum levels of investment in relation to the base maintenance of customer meters, as set out in the Non-Infrastructure Base Maintenance investment case. These minimum levels provide investment for routine and reactive maintenance, to ensure the continuation of 'business as usual'. The minimum value for customer meter replacement is £4.5m. These minimum levels have been determined through a combination of analysis of historical activity and costs, deterioration

⁷ Waterwise Fairness on tap. Making the case for metering

modelling to establish underlying asset deterioration, and investment planning analysis. Full details are provided in the Non-Infrastructure Base Maintenance investment case.

This investment case contributes all of the required base maintenance investment for age-based replacement of customer meters. The minimum investment levels for this investment case are summarised in Table 9.

Table 9: Contribution to Minimum Non-Infrastructure Base Maintenance Investment

Non-Infrastructure Base Maintenance Asset Group	Minimum AMP7 investment to maintain asset health (£m)	AMP7 investment provided through customer meters interventions (£m)	Total AMP7 investment provided through all interventions (£m)	Additional investment requirement as Base Maintenance (£m)
Customer meters	4.5	4.5	4.5	0

5.7 Historic & AMP7 Investment Comparison

A summary of historical investment values in customer meters are provided in Table 10 along with the planned AMP7 investment value from customer meters interventions.

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 10: Historical & AMP7 Investment

AMP	Capital investment values	Investment (£m)
AMP5	AMP5 actual	13.952
AMP6	2015/16 actual	2.212
	2016/17 actual	2.402
	2017/18 actual	3.252
	2018/19 forecast	7.847
	2019/20 forecast	8.489
	AMP6 forecast	24.203
AMP7	AMP7 pre-efficiency	13.469
	AMP7 8% capex efficiency applied	12.392

Our AMP6 investment is forecast to be significantly higher than in in AMP7, due to more meters being installed in existing residential properties AMP6 (76k in AMP6 vs. 40k installed through the interventions in this investment case). However our investment in meter replacement is expected to be greater in AMP7 compared to AMP6 to address deterioration risks and improve asset health.

6 Conclusions

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

In AMP7, the customer meters measures are meter penetration (target 75%) and per capita consumption (target 135l/h/d).

An initial list of three risks was developed into four interventions. These interventions were developed and assessed through our asset management totex focused processes, and put forward for investment optimisation. Of these four interventions, three were selected on the basis that they achieve the best balance of investment to meet our customer priorities; the interventions selected are cost beneficial and provide benefits that support us in maintaining our outcome delivery incentives. The remaining intervention, replacement of customer meters, ensures we invest to maintain performance and improve the health of our assets.

We plan to invest a pre-efficiency total of £13.469m on customer meters. These interventions will increase opex costs by approximately £35k per annum. 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 £12.392m.

We will achieve our 75% meter penetration by installing 68k new meters in AMP7. 40k of these will be into existing residential properties through the programme set out in this investment case. The remaining 28k will be into new residential properties, as defined in our new development investment case.

The selected interventions contribute to ensuring our assets are maintained appropriately for the benefit of current and future generations. The interventions also contribute significantly to meeting two of our performance commitments. The interventions contribute 84% of the meter penetration target and 26% of our per capita consumption target

If we fail to invest in our customer meters assets, we will not meet our customers' priority for saving water before developing new supplies, and our asset health will ultimately continue to deteriorate to unacceptable levels.

Our business plan provide assurance that it will deliver and monitor delivery of its outcomes, meet relevant statutory requirements and licence obligations and takes into account any UK Government strategic policy statements.

7 Appendices

Appendix A: Line of Sight

Appendix B: Datasets

Appendix C1: Selected Risks

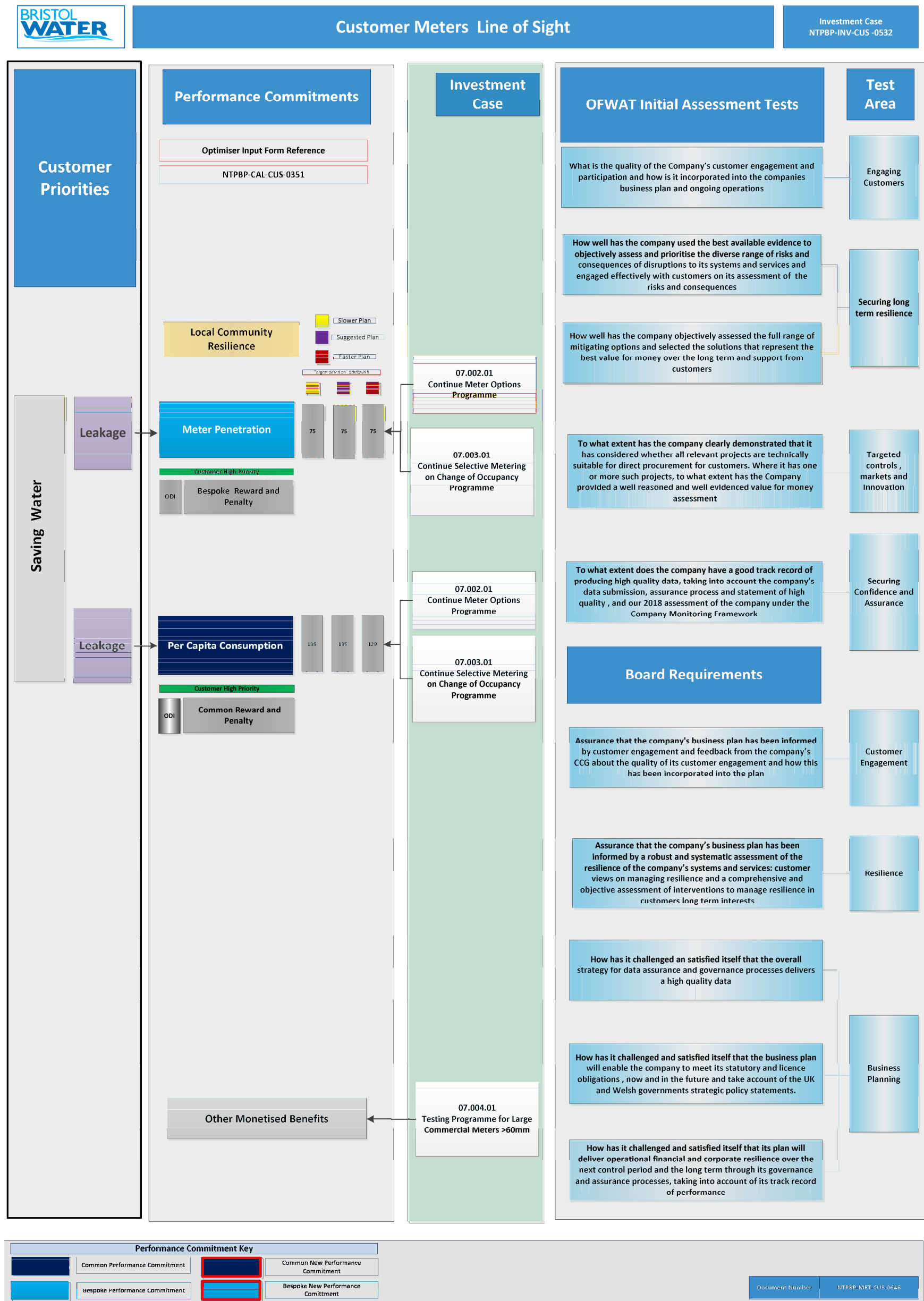
Appendix C2: Non-Selected Risks

Appendix D: Options Considered

Appendix E: Interventions Developed

Appendix F: Non-Selected Interventions

7.1 Appendix A: Line of Sight



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
Meter options and selective metering expenditure + meters installed.xlsx	Historic Spend on Customer Meters	-	-	-	✓
Customer Meters_20170731 Pivot analysis.xlsx	Analysis of the number of domestic and non-domestic meters installed.	✓	✓	-	✓
Bristol-Water-Schedule-of-Wholesale-Charges-v2.pdf		✓	-	-	✓
Commercial Customers Volume Data Apr - Jul 2017	Commercial Customers Volume consumption data	✓	-	-	✓
Extension of HH meter replacement age overview Oct 2015.docx	Report into extending the age of Customer Meter replacment to 18 years	✓	-	-	✓
P8236 CP360 Commercial meter under-registration.pdf	Number of commercial meters installed.	✓	-	-	-
Large_MUR_2015_16 (Meter Under-Registration Data).xlsx	Bristol Water's larger customer meter under-registration profiles/data.	✓	-	-	-

7.3 Appendix C1: Selected Risks

This appendix shows the 3 selected risks of the 3 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
SRR782	Whole supply zone	IF BW fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;	3	3	3	3	4	1	4	12
SRR783	Whole supply zone	IF BW fail to achieve our per capita consumption targets THEN we will not meet our customers' preference for saving water before developing new supplies and we will incur an associated ODI penalty;	3	3	3	3	4	1	4	12
SRR784	Whole supply zone	BW currently lose significant revenue by meter under recording. IF meter under recording is not corrected THEN we will fail to provide fair and equitable water bills to our customers	5	1	2	1	4	2	4	20

7.4 Appendix C2: Non-Selected Risks

Not applicable - all risks in the customer meters Investment Case were taken forward.

7.5 Appendix D: Options Considered

This appendix shows the 5 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?	Option to be Developed into an Intervention?
SRR782	IF BW fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;	SRRN211	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 	Continue meter options programme (at previous AMP rate)	Installation of 30,864 new meters at the request of customers under the 'Meter Options' programme	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	Y
SRR783	IF BW fail to achieve our per capita consumption targets THEN we will not meet our customers' preference for saving water before developing new supplies and we will incur an associated ODI penalty;	SRRN212	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage 				

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?	Option to be Developed into an Intervention?
SRR782	IF BW fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;	SRRN211	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 	Continue selective metering on change of occupancy programme	Installation of 9,000 new meters on change of occupancy	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	Y
SRR783	IF BW fail to achieve our per capita consumption targets THEN we will not meet our customers' preference for saving water before developing new supplies and we will incur an associated ODI penalty;	SRRN212	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 				
SRR784	BW currently lose significant revenue by meter under recording. IF meter under recording is not corrected THEN we will fail to provide fair and equitable water bills to our customers	SRRN213	As water meters age they generally become progressively less accurate and will under-record the volume of water used. Where a meter is fitted, Bristol Water can only bill for the recorded volume of water used and therefore those customers who are not metered will be unfairly subsidising those whose meters are under-recording. Investment is needed to identify and correct under recording meters.	Testing programme for large commercial meters >60mm	Testing and calibration of 142 large diameter (60mm or over) commercial meters.	Option is viable	Y
				Replacement of all meters greater than 18 years old	Replace circa 66,000 customer meters that will be 18 years or over by 2020.	Option is viable	Y
				Testing programme for meters of >25mm diameter	Testing and calibration of 2,251 large diameter (60mm or over) commercial meters.	Option not cost effective compared to the >60mm programme	N

7.6 Appendix E: Interventions Developed

This appendix shows the 4 interventions developed from the 5 options.

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 (£M)	Change in Opex (£k)	Meter Penetration (%)	Per Capita Consumption (L/head/day)	Other Monetised Benefits
SRR782	IF BW fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;	SRRN211	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 	Continue meter options programme (at previous AMP rate)	Installation of 30,864 new meters at the request of customers under the 'Meter Options' programme	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	07.002.01	Continue meter options programme (at previous AMP rate)	6.944	0	5.48	1.43	0
SRR783	IF BW fail to achieve our per capita consumption targets THEN we will not meet our customers' preference for saving water before developing new supplies and we will incur an associated ODI penalty;	SRRN212	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage 										

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 (£M)	Change in Opex (£k)	Meter Penetration (%)	Per Capita Consumption (L/head/day)	Other Monetised Benefits
SRR782	IF BW fail to achieve our Customer Meter penetration targets THEN we will not be providing our customers with the fairest and most consistent means of charging for water and we will incur an associated ODI penalty;	SRRN211	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 	Continue selective metering on change of occupancy programme	Installation of 9,000 new meters on change of occupancy	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	07.003.01	Continue selective metering on change of occupancy programme	2.025	0	1.7	0.42	0
SRR783	IF BW fail to achieve our per capita consumption targets THEN we will not meet our customers' preference for saving water before developing new supplies and we will incur an associated ODI penalty;	SRRN212	<p>Metering provides the fairest , and most consistent means of charging for water and allows Bristol Water to engage with customers on water efficiency to reduce their bills and drive down water demand. Further it provides information on consumption at each property which helps identify customer side leakage. This benefits both customers and Bristol Water and helps provide a long-term resilient supply to customers.</p> <p>Investment in Customer Meters is needed to:</p> <ul style="list-style-type: none"> • Help achieve the performance commitment of 75% meter penetration by 2025 • Help achieve the performance commitment target to reduce per capita consumption to below 135 l/h/d by 2025 • Provide multiple benefits through the use of automated meter reading technology to provide, for example, improved information on system performance and help to reduce customer-side leakage • Place water bills within the control of the customer rather than as a fixed property-based charge which helps achieve affordable bills. 	Continue selective metering on change of occupancy programme	Installation of 9,000 new meters on change of occupancy	Yes - option is viable - it's a continuation of the existing AMP6 intervention.	07.003.01	Continue selective metering on change of occupancy programme	2.025	0	1.7	0.42	0
SRR784	BW currently lose significant revenue by meter under recording. IF meter under recording is not corrected THEN we will fail to provide fair and equitable water bills to our customers	SRRN213	<p>As water meters age they generally become progressively less accurate and will under-record the volume of water used. Where a meter is fitted, Bristol Water can only bill for the recorded volume of water used and therefore those customers who are not metered will be unfairly subsidising those whose meters are under-recording. Investment is needed to identify and correct under recording meters.</p>	Testing programme for large commercial meters >60mm	Testing and calibration of 142 large diameter (60mm or over) commercial meters.	Option is viable	07.004.01	Testing programme for large commercial meters >60mm	0	35	0	0	107.287
				Replacement of all meters greater than 18 years old	Replace circa 66,000 customer meters that will be 18 years or over by 2020.	Option is viable	07.006.01	Replacement of Customer Meters	4.5	0	0	0	0

7.7 Appendix F: Non-Selected Interventions

Not applicable - all interventions proposed in the customer meters Investment Case were selected in the investment optimisation process to be taken forward into our Business Plan.