C5 B

Cost and Efficiency

C5B Technical Annex 10
Leakage Investment Case:
Technical Approach and Business Case

NTPBP-INV-LEA-0535

BRISTOL WATER

Contents

Tables

Figures

1 Foreword

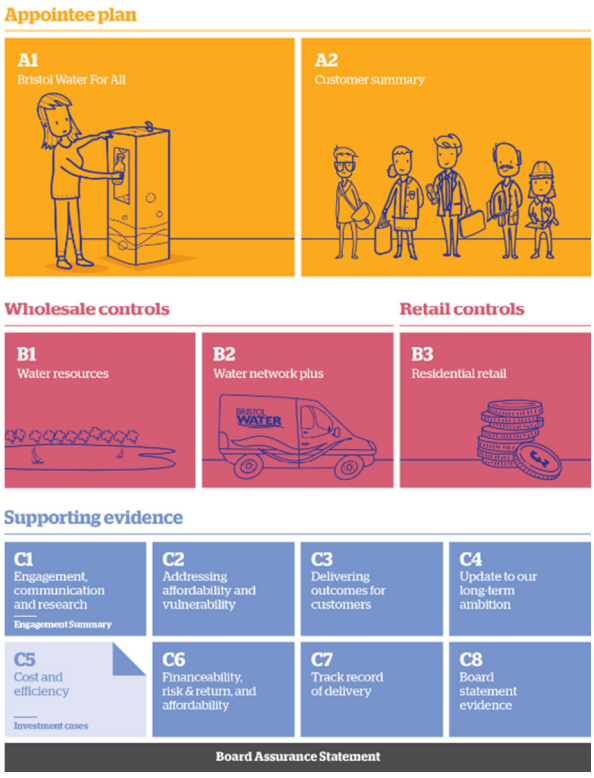
The Leakage Investment Case will address the requirements for capital and operational investment to undertake active leakage control, to monitor, detect and repair leaks more quickly, and carry out additional pressure management and monitoring across the water network, to achieve an overall reducing in leakage of 15%.

Leakage is a measure of the amount of water that enters the distribution system but is not delivered to customers. Water can be lost from either our pipes or customers' 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 customer meters

The Leakage Investment Case, one of 21, will summarise the facts, risks and investment requirements for leakage for the next review period for 2020 to 2025. This investment case will also summarise performance for leakage for the current review period from 2015 to 2020 and our methodology for determining and delivering the future leakage 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 resilient water supply, and meet their preference of saving water before developing new supplies, we will focus on reducing leakage. We will achieve this by investing in active leakage control to monitor, detect and repair leaks more quickly and by additional pressure management and monitoring across the water network at a totex cost of £26.350m, with £5.910m of this total being capitalised, to achieve a leakage reduction of 15%. This will reduce leakage from the end of AMP6 target of 43Ml/d to 36.5Ml/d by the end of AMP7, a total reduction of 6.5Ml/d.

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.

Managing leakage and water usage is important for delivering a resilient network in the long term and avoiding over abstraction of our water resources. Our Water Resources Management Plan indicates that demand management, including reducing leakage, will achieve the supply-demand balance.

Through our engagement programme customers have told us that they would like to see leakage driven lower, and willingness to pay for leakage reduction is high when compared with other options for water resource management.

Reducing leakage is a key strand in our strategy for managing our supply-demand balance and achieving this customer priority. We have committed to reducing leakage by 15% in AMP7 and will challenge ourselves to continue reducing leakage even further in future AMPs.

We will therefore invest to transition from our AMP6 target outcome leakage level of 43Ml/d down to the end of AMP7 target of 36.5Ml/d – a reduction of 15%.

Within this investment case all leakage values are based on our current methodology. In AMP7 a new leakage reporting methodology will be implemented across Bristol Water and the other UK Water Companies to provide consistency of reporting. This will result in resetting the start point in AMP7, currently 43Ml/d based on our current leakage reporting methodology, to the equivalent value using the new method. The update may increase or decrease the value at the start position and will be used as the point from which the 15% reduction will be measured.

We have engaged RPS Environmental Management Ltd (RPS) to undertake studies to identify the optimal interventions necessary to drive leakage down to this target level. The identified interventions are:

- Active leakage control: find and fix based on a continuation and improvement of current policy;
- Pressure management; and
- Asset renewal.

In addition to these interventions we must continue with all of our existing leakage control activities to prevent leakage from increasing. This investment case covers the investment needed to both hold leakage at current levels and to transition to target levels We are therefore presenting a totex investment case where we plan to invest £26.350M on leakage. Of this totex investment value:

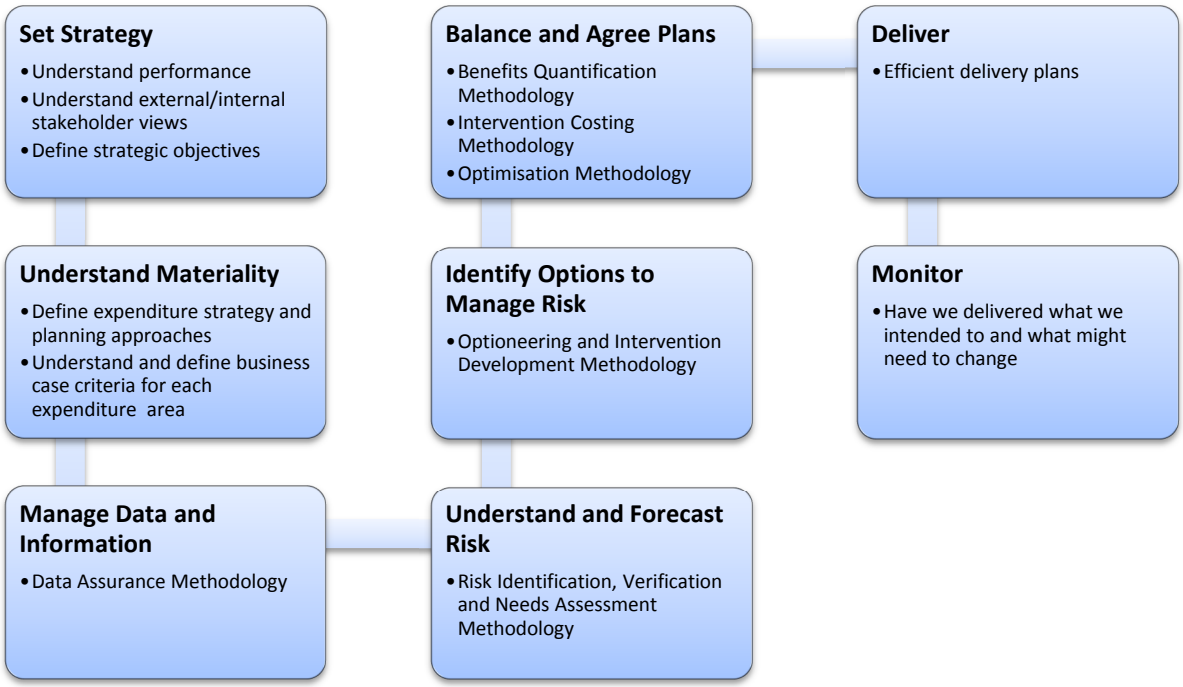
- £18.370m will be spent on finding and repairing leaks to sustain leakage at 43Ml/d for the AMP7 period;
- £5.660m will be spent to reduce leakage by 15% from the end of AMP6 target. This is the cost to transition from 43Ml/d at the end of AMP6 to 36.5Ml/d by the end of AMP7;
- £2.320m will be spent to maintain our reporting infrastructure such as loggers, meters and pressure reducing valves, and on systems and studies to monitor the performance of the network so that leakage can be better identified.

The totex investment of £26.350m presented in this investment case includes a capitalised element of £5.910m.

Should we fail to invest in addressing leakage, levels would rise year on year as the distribution assets deteriorate. Furthermore, leakage levels would become unsustainable and result in significant impact on our customers who would experience low pressure and supply interruptions. We will not achieve our leakage performance commitment and we will not meet our customers' preference for saving water before developing new supplies.

In order to ensure that we meet customers' preferences and mitigate the risks associated with leakage 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



During the current review period we are aiming to deliver a leakage level that will meet the ODI leakage performance measure at the end of AMP6 at or below 43Ml/d resulting in a good position from which to begin AMP7.

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 £26.350m totex (£5.910m capital expenditure - capex and £20.440m operational expenditure - opex) from 2020 to 2025 to achieve the performance commitments associated with the outcome 'Local Community and Environmental Resilience', as set out in Table 1. Our leakage performance commitments will deliver customers' preference of saving water and delivering a resilient water-supply balance, and result in a leakage reduction benefit of 6.5Ml/d which represent a total leakage reduction of 15%.

Table 1: Associated performance commitment targets and percentage contribution

Performance commitment	Unit	2019/20 Baseline	2024/25 Target	Total performance improvement required in AMP7	Leakage contribution to performance improvement
Leakage (annual)	Ml/d	43	36.5	6.5	84.05%

Our AMP7 investment in leakage will help ensure the associated 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

Our customers have told us that they 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. Through our engagement programme customers have told us that they would like to see leakage driven lower, and willingness to pay for leakage reduction is high when compared with other options for water resource management.

Managing leakage and water usage is important for delivering a resilient network in the long term and avoiding over abstraction of our water resources. Our Water Resources Management Plan indicates that demand management, including reducing leakage, will achieve the supply-demand balance.

Reducing leakage is a key strand in our strategy for managing our supply-demand balance and achieving our customers' priority. We have committed to reducing leakage by 15% in AMP7 and will challenge ourselves to continue reducing leakage even further in future AMPs.

As part of our approach in developing the Water Resources Management Plan, we engaged industry leaders RPS Environmental Management Ltd (RPS) to analyse leakage and to assess our sustainable economic level of leakage, following industry best practice, and to deliver a range of related operational planning tools to meet new leakage targets. The sustainable economic level of leakage provides a balance of all the costs and benefits of fixing leaks.

A combination of our sustainable economic level of leakage assessment, together with customer priorities and the needs of the Water Resources Management Plan have been used to shape our leakage strategy as described in Section 3.2

3.2 Strategy

To ensure that we provide a highly resilient and reliable supply of high-quality water even in the face of severe drought, our Water Resources Management Plan planning approach has been used to ensure resilience to a range of more severe droughts than have been previously experienced by reducing our assumptions on water availability.

In order to balance this reduced assumption on water available with the needs of a growing population we have identified that reducing leakage and helping customers with water efficiency will be the most cost-effective way to achieve a balance and that reducing leakage is also the preferred choice of our customers.

Our customer engagement programme has shown that customers consider a reliable supply of water an extremely high priority, but that the approach to managing supply and demand should first focus on reducing leakage and helping customers improve their own water efficiency rather than developing new resources

The sustainable economic level of leakage provides a balance of all the costs and benefits of fixing leaks. Our sustainable economic level of leakage has been assessed following industry best practice to be 39.3Ml/d.

3.3 Customer priorities

Customer priorities relating to our outcomes and performance commitments have been determined through customer engagement and research. This ensures that we have engaged effectively with our customers on longer-term issues, and have taken into account the needs and requirements of 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 leakage and one of our outcomes 'Local Community and Environmental Resilience'.

We undertook more detailed discussions at phase 2 of our engagement process (see C1 appendix to our business plan) and this process gave us a wealth of information about how our customers view us, our services, and long term issues.

Our customer engagement programme has identified that customers value leakage reduction in its own right, not just to the economic level, and if we consider customer priorities on its own we would identify a preferred customer level of leakage significantly lower than sustainable economic level of leakage, as the customer simply do not want any leakage from our system. This leakage reduction would however lead to a significant increase in bill levels for our customers and potentially unacceptable environmental and social implications due to necessary extensive water network infrastructure renewal.

We therefore undertook further customer engagement to help provide a balanced approach to customers' preferences for leakage that we can follow for AMP7.

This customer engagement identified that a majority of customers (56%) were in favour of reducing leakage by at least 15% from our AMP6 target, but that most customers (83%) did not support further leakage reduction more aggressive than this 15% reduction.

We have therefore selected an AMP7 target leakage reduction of 15% below our AMP6 final year target level of 43Ml/d (resulting in a final year AMP7 target of 36.5Ml/d). This will deliver water resource resilience for a 1 in 200 year drought, out-perform the current requirements of the Water Resources Management Plan, provide an ambitious response to our regulators' leakage challenges and, most important, deliver our customers' priorities. This target will deliver affordable bills and enable us to maintain a supply-demand surplus that could provide potential for trading with other water companies in the region.

Our performance commitment is to reduce leakage by 15% from the end of AMP6 target level of 43Ml/d, giving an end of AMP7 leakage target level of 36.5Ml/d.

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

			2024/25 target		
Service	**Performance Commitment**	**2020 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

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).

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

3.4 Asset Health, AMP7 Performance Commitments & Outcome Delivery Incentives

This investment case supports the outcome Local Community and Environmental Resilience, by investing 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. Our planned investment in leakage will support the achievement of the performance commitment 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
Leakage (annual)	Ml/d	43	42	41	39.5	38	36.5	6.5

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

There are also some additional benefits which help avoid low pressure issues, manage customer interruptions, and maintain asset servicability.

3.5 Compliance Obligations

In their PR19 Methodology Ofwat has set a challenge for all water companies to reduce their levels of leakage by 15%.

We also have an obligation to balance supply and demand, and our Water Resources Management Plan sets out how this will be achieved. Reducing leakage by 15% is a key part of meeting this obligation.

3.6 AMP6 Investment and Performance

A summary of our AMP6 totex investment forecast for leakage is provided in Table 3 below. We have re-categorised AMP6 forecast expenditure data used in line with the investment areas used in our AMP7 investment cases for the purposes of this comparison.

Table 3: AMP6 totex investment forecast

Area	Leakage totex (£m)
Find and repair leaks	21.2
Pressure Management	1.1
Meters, loggers, systems, management etc.	4.1
Total investment	**26.3**

The AMP6 leakage performance commitment related to this investment, and our performance, is given in Table 4.

Table 4: AMP6 performance related to leakage investment

Performance Commitment		2015/16	2016/17	2017/18	2018/19 (Forecast)	2019/20 (Forecast)
Leakage (Current Leakage) (Ml/d) (annual)						
Bristol Water	Target	48.0	47.0	45.0	44.0	43.0
	Company Performance	44.2	47.4	49.6	44.0	43.0

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 43Ml/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.

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

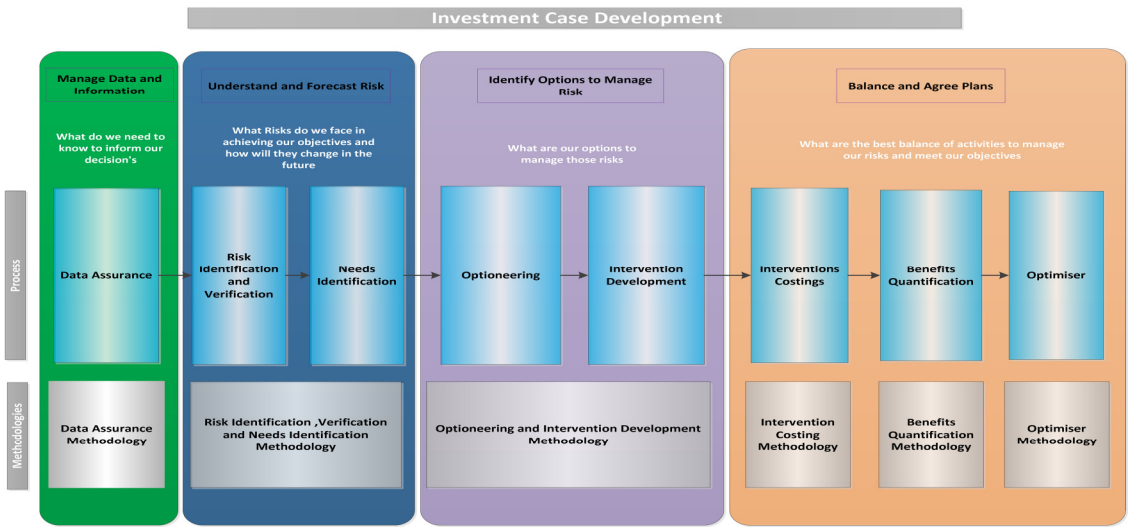
We have created and implemented a process that is supported by a set of six methodologies. When developing the methodologies, we wanted to ensure that they:

- 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.

This investment case was not included as part of the sample of 9 investment case. The quality of the data used in the development of this investment case will be evaluated as part of our wider data enhancement activities, through which we target improvements to the consistency, accuracy and assurance of our data

It is however noted that much of the data used has been used in the Annual Performance Report process, where we are required to report on our leakage performance. In addition, RPS also undertook data quality checks prior to developing their models.

Furthermore, we have carried our additional verification of the results using our in-house leakage model. The model uses historical data to determine natural rate of rise for leakage each month and calculate the number of leaks that need to be repaired in order to achieve a target leakage level. The model then calculates the number and cost of resources needed to achieve the desired outcome. This model has been used to determine the cost of achieving the 15% leakage reduction target and has resulted in similar cost to that determined within the investment case. The numbers within the model have been checked by our leakage personnel to confirm they are realistic and achievable. Our in-house model, and economic level of leakage methodology, have both been assured by Atkins as part of the Water Resources Management Plan process.

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 RPS to provide support on this investment case. 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 the development and analysis of intervention costs.

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 (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 with support from RPS.

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 estimated 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 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 (e.g. 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 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 of our business plan (slower improvement plan, suggested improvement plan and faster improvement plan)

4.2 Applying the investment process to Leakage

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

Options for leakage control were identified and costed by RPS and then optimised using their in-house optimisation tool. This is an Excel based water supply–demand–leakage optimisation model that determines, for multiple water resource zones, the least whole-life cost mix of interventions to meet annual headroom targets. The results of this study are set out in the RPS report AMP7 SELL Assessment[2], and this has been assured as part of the assurance undertaken by Atkins for Water Resources Management Plan.

RPS were then commissioned to extend this study to determine the optimal set of interventions required to reduce leakage to the AMP7 target of 36.5Ml/d. The results of this study are also set out in the RPS report AMP7 SELL Assessment[2]. This report defines the optimal interventions to drive leakage down to the AMP7 target figure.

We have also commissioned RPS to develop an evidence-based asset inventory for all forecast leakage investment in AMP7 both operational and capital cost. This is documented in the RPS report AMP7 Strategy - Phase 2 - Leakage Investment Plan[3]. This combines the cost of interventions identified to drive leakage down to the AMP7 target figure, with the cost of all other leakage related activity. It therefore covers all investment required to both maintain leakage at the current level and that required to drive it down to the target level. The investment covers both capital and operational expenditure to give the total expenditure (totex) that we will invest in leakage in AMP7.

4.2.1 Investment Case Risk Identification, Verification and Needs Assessment

The Water Resources Management Plan assesses the supply-demand balance and this is inherently an assessment of the risk that demand will exceed supply. The Water Resources Management Plan

[2] RPS, 2018, AMP7 SELL Assessment, BRW0504-050.03.
[3] RPS, 2048, AMP 7 Strategy – Phase 2 – Leakage Investment Plan, BRW0511-002.

indicates that demand management, including reducing leakage, will mitigate the supply-demand balance.

Managing leakage and water usage is important for delivering a resilient network in the long term and avoiding over abstraction of our water resources. Through our customer Engagement we know that leakage is one of the highest priorities of our customers and they are driving an improved level of performance. Our customers have given clear feedback during our consultation process that they would like to see leakage driven lower, and willingness to pay for leakage reduction is high when compared with other options for water resource management.

Investment is required to both maintain leakage at the current (end of AMP6 level) and drive leakage down to the target level. Details of the selected risks are provided in Appendix C.1.

Should we fail to invest in leakage or not achieve the leakage performance commitment, the key risks are:

- We will not meet our customers' preference for saving water before developing new supplies;
- The risk of supply restriction in a drought scenario are increased;
- Fail to meet the challenge set by Ofwat to reduce leakage by 15%;
- The company has a penalty in accordance with the outcome delivery incentive and the damage to reputation; and
- Detrimental weather conditions cause additional asset failures and increase cost of target achievement or lead to failing target.

4.2.2 Optioneering and Intervention Development

As part of the process of developing the Water Resources Management Plan, 148 options were initially developed for balancing supply and demand. Through a process of filtering and screening this was refined and reduced to 21 options covering leakage reduction, demand management, improvements to production works and new resource/transfer options. Through further engineering and costing assessments, including detailed assessment of customer preference, the preferred options were selected from the short-list to develop a preferred programme of measures to manage the supply demand balance over the 25 year planning period. These preferred measures include:

- Reducing leakage;
- Reducing raw water losses; and
- Reducing bulk transfer of water.

Reducing leakage was the overall method selected to deliver the required water balance. The economic level of leakage assessment determined that it was economic to reduce leakage to a level of 39.3Ml/d but any further reduction would need to be determined by using the optimisation model.

In order to reduce leakage the analysis considered the following leakage control options:

- Active Leakage Control: find and fix based on a continuation of current policy;
- Pressure management; and

- Asset renewal.

Cost relationships were developed by RPS for each intervention option. These relate the cost of successive interventions to resulting leakage savings, which include both current and future savings associated with leakage. The range of external costs and benefits (i.e. environmental, social and carbon impacts) associated with each intervention and its resulting leakage savings were also quantified in financial terms.

RPS used their in-house optimisation tool to determine the optimum means of achieving the target leakage level with each option quantified to determine the most cost efficient method of achieving the water balance required. Only active leakage control and pressure management were selected as part of this optimisation process. All asset renewal options were discounted based on their whole life cost.

Further details of this process are contained in the RPS report AMP7 SELL Assessment[4].

4.2.3 Intervention Costing

Costing of the leakage interventions has been compiled by RPS based on our in-house specific costs as part of our leakage studies. These have then been categorised in-house in order to correctly assign them to capex or opex.

For Active Leakage Control, sustaining leakage at 43Ml/d (the end of AMP6 target) is assigned to opex. For reducing leakage by 15%, the find element is assigned to capex and the repair element is assigned to opex.

Pressure Management is assigned to capex. Other costs such as meters, loggers and leakage resources have been assigned to capex or opex as appropriate. The overall cost distribution can be seen in Table 6.

4.2.4 Benefits Quantification

The level of leakage control activities of active leakage control and pressure management have been selected in order to deliver an overall leakage reduction of 6.5Ml/d. Overall, pressure management is forecast to deliver 2Ml/d saving with active leakage control delivering the remaining 4.5Ml/d.

In addition to the leakage reduction benefit there are other much wider benefits of reducing leakage. These include:

- Reducing abstraction at water sources leaving more water in the natural environment;
- Reducing energy and chemical use through pumping and treating less water and thereby both the carbon impact and the operational cost; and
- Improving the reliability and resilience of the water supply by reducing demand.

[4] RPS, 2018, AMP7 SELL Assessment, BRW0504-050.03.

5 Outcome

5.1 Selected Interventions

The three interventions developed within the leakage investment case were assessed through the investment optimisation process. Of these three interventions, all three 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 reducing our capex costs 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 leakage innovations that mean we can contribute to our 8% capex efficiency challenge and keep our customer's bills low into the future.

In relation to leakage, we will invest in innovative techniques to monitor the distribution network to help quickly identify the presence of leaks when they occur and to locate any leaks. This investment falls under the Network Monitoring investment case, where it is described in more detail.

In addition, we will invest in Automated Meter Reading technology which will help to identify customer leaks and provide greater and timelier knowledge of the network. This investment falls under our customer Meters investment case where it is described in more detail.

The three selected capex interventions and one opex intervention are set out in Table 5, along with details of the associated costs and contribution to performance improvement.

Table 5: Selected interventions, costs, and % performance contribution

ID	Intervention Title	Total capex (£)	Change in opex per annum (£)	Leakage (AMP7 Target)
10.001.02	Active Leakage Control (transition to 36.5Ml/d)	1,580,000	0.00	84.05% (combined)
10.001.03	Pressure Management	2,200,000	0.00	
10.001.04	Asset Replacement	2,130,000	0.00	
-	Operational Expenditure	-	20,440,000	-
Leakage investment (pre-efficiency capex)		**5,910,000**	**20,440,000**	**84.05%**
Leakage totex investment (pre-efficiency capex)		**26,350,000**		
Leakage investment with 8% capex efficiency		**5,437,200**	**20,440,000**	
Leakage totex investment with 8% capex efficiency		**25,877,200**		

An evidence-based asset inventory for all forecast leakage investment in AMP7 has been produced[5]. This covers all investment, both capital and operational, to give the pre-capex efficiency totex of £26.350M to be invested in leakage in AMP7. Of this value:

- £18.370m will be spent on finding and repairing leaks to sustain leakage at 43Ml/d for the AMP7 period;
- £5.660m will be spent to reduce leakage by 15% from the end of AMP6 target. This is the cost to transition from 43Ml/d at the end of AMP6 to 36.5Ml/d by the end of AMP7;
- £2.320M will be spent to maintain our reporting infrastructure such as loggers, meters and pressure reducing valves, and on systems and studies to monitor the performance of the network so that leakage can be better identified.

The build-up of this investment is set out in Table 6 below. This investment has been assessed over the 5 years of AMP7 and reflects the best balance of cost, risk and performance.

As all the proposed interventions have been selected for inclusion in this investment case, we do not predict any residual risks associated with leakage to be carried though to AMP7.

[5] Bristol Water, 2018, AMP7 Strategy - Ph2 - Leakage Investment Plan Report V4, NTPBP-EXT-AMP-0632 BRW0511-001 01.

Table 6: Leakage totex investment plan

Investment	Leakage: Transition to 36.5Ml/d (£m)	Leakage: Active Control- Maintain 43Ml/d (£m)	Leakage: Reactive Leakage Control (£m)	Leakage: Base Maintenance (£m)	Total Investment (£m)
Active Leakage Control:					
- Maintaining 43Ml/d		5.731			
- Transition to 36.5Ml/d	1.580*				
Detected leak repair:					
- Maintaining 43Ml/d		2.539			
- Transition to 36.5Ml/d	1.880				
Pressure management	2.200*				
Repairing reported leaks			7.055		
Customer-side leakage			1.240		
Maintain Assets – Distribution Input Meters				0.067*	
Maintain Assets – Trunk Main Area Meters				0.245*	
Maintain Assets – Zonal Loggers				1.000*	
Maintain Assets – Zonal Meters remedial work				0.278*	
Maintain Assets – Pressure Reducing Valves				0.260*	
Knowledge Systems				0.280*	
Knowledge Studies				0.190	
Leakage Strategy and Planning Resources			0.715		
Leakage Delivery Resources			1.090		
Leakage investment case totex (pre-capex efficiency)	**5.660**	**8.270**	**10.100**	**2.320**	**26.350**
Leakage investment case totex with 8% capex efficiency					**25.877**

The capital elements are indicated with '*' in the in above.

The proposed interventions have been optimised as part of the leakage study, and represent the optimal interventions to achieve the AMP7 leakage target.

We utilise our in-house leakage forecasting model where the historical and current leakage and repair status is monitored. This data is used to predict future leakage levels based on historical network deterioration or rate of rise, forecast operational performance and potential weather conditions. Using the model we are able to forecast the potential leakage result in a number of weather scenarios and predict how a change in leak repairs will influence those results. The resource levels required to deliver a level of leak repair are calculated within the model which enables appropriate resourcing of both find and fix teams to be determined and the resulting leakage levels to be forecast.

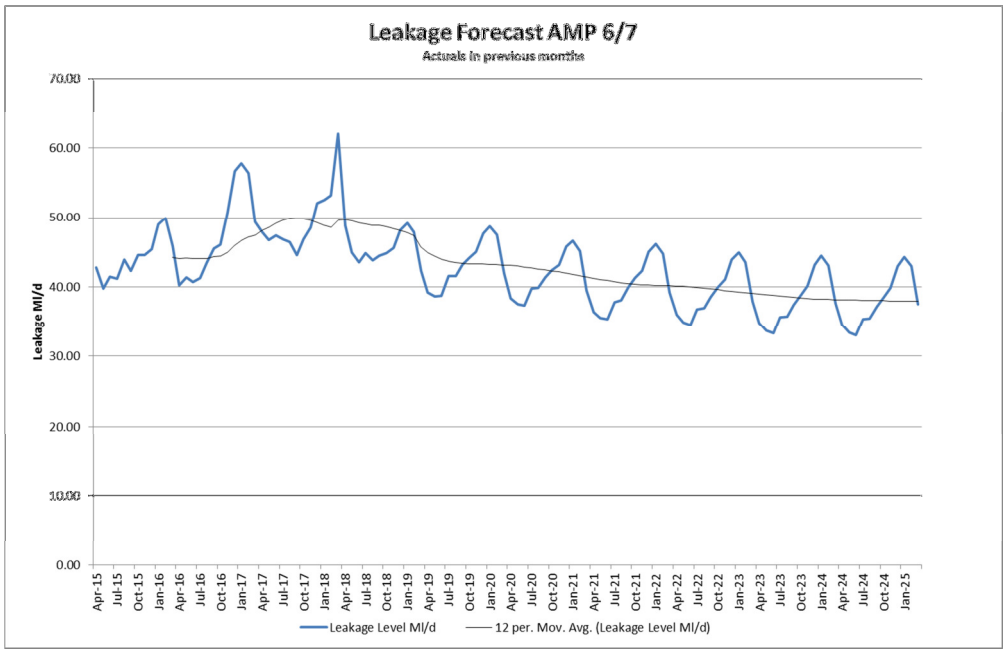
Our in-house leakage model has been utilised to produce a forecast of leakage over the AMP6/7 period. Table 7 sets out the AMP7 leakage forecast based on our in-house model.

Table 7: Forecast leakage numbers within Bristol Water model

AMP7	Annual Forecast Ml/d	Annual Target Ml/d
Year 1	41.4	42.0
Year 2	40.2	41.0
Year 3	39.1	39.5
Year 4	37.1	38.0
Year 5	35.9	36.5
Average	**38.7**	**39.4**

The AMP6/7 monthly trends are illustrated in Figure 3.

Figure 3: Forecast Leakage Trend over remainder of AMP6 and AMP7



The total leakage capex investment, including Water Service and Business Unit Allocation, is 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 infrastructure and non-infrastructure assets and is a mixture of maintenance and other capital expenditure.

Table 8: Water Service and Business Unit Allocation

Wholesale Control	**Water Network Plus**	**Total capex (Pre-Efficiency)**
Business Unit Allocation	***04 Treated Water Distribution***	
Leakage capex investment (%)	**100.0%**	**100%**
Leakage capex investment	**£5.910m**	**£5.910m**
Maintaining the long term capability of the assets - non-infra	£2.130m (36.1%)	**£2.130m (36.1%)**
Other capital expenditure - infra	£1.580m (26.7%)	**£1.580mc (26.7%)**
Other capital expenditure - non-infra	£2.200m (37.2%)	**£2.200m (37.2%)**
Leakage capex investment with 8% capex efficiency		**£5.437**

5.2 Contribution to Performance Commitments

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

Table 9: Leakage - contribution to performance commitment targets from selected interventions

Performance commitment	**Unit**	**2019/20 Baseline**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**Total performance improvement required in AMP7**	**Leakage contribution to performance improvement**
Leakage (annual)	Ml/d	43	42	41	39.5	38	36.5	6.5	84.05%

The selected leakage investment case interventions provide the majority of all of the required 6.5Ml/d improvement in leakage.

The leakage target will be assisted by the following investment cases which all make contributions to the leakage target by addressing the leakage effects of asset deterioration and enhanced monitoring:

- Trunk Mains
- Distribution Mains
- Bulk Meters and Pressure Control Valves
- Network Ancillaries
- Network Monitoring

In addition:

- Service Reservoirs and Towers investment case: includes the inspection and repair of Service Reservoirs to ensure they are water-tight and thereby reducing leakage;
- Bulk Meters and Pressure Control Valves investment case: includes the replacement of MCERT[6] meters and bulk meters some of which provide key data in determining where leakage is occurring;
- Customer Meters investment case: includes the installation of new customer meters to primarily improve meter penetration and per capita consumption. Installation of customer meters will also improve monitoring of the network and help in the identification of leakage; and
- Network Monitoring investment case: includes the installation of pressure monitors, flow loggers and acoustic loggers all of which will identify the presence and location of leaks

5.3 Non Selected Interventions

All leakage interventions were selected, as they are required to meet out Leakage performance commitment target.

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.

At the time of writing work is continuing to calculate the company leakage level in accordance with the Shadow Reporting Methodology that will be used in AMP7. The differential between the current method of calculation and the new method will not be confirmed until the end of AMP6. Therefore the leakage numbers and target in this investment case are all based on our current (AMP6) leakage reporting process. At the end of AMP6 the differential will be applied and the 15% reduction will be calculated based on the corresponding shadow reporting figures.

5.5 AMP 8

In AMP8 we will need to continue to deliver a positive supply demand balance, with a resilient network to be able to deliver water in a 1 in 200 year drought. The leakage target achieved in AMP7 will be a staging point for further reductions will be determined based on customer, stakeholder, environmental, financial and political influences.

5.6 Base Maintenance

This investment case covers all activities related to leakage and no assessment of base maintenance investment is required.

[6] MCERT is the Environment Agency's monitoring certification scheme.

5.7 Historical and AMP7 Investment Comparison

An investment of £20.690m is required in active leakage control in order to sustain leakage at 43Ml/d, and an investment of £5.660m is required in order to drive leakage down by 6.5Ml/d to transition down to below the target of 36.5Ml/d. Therefore totex investment in active leakage control and pressure management of £26.350m is needed in combination to both sustain 43Ml/d and to transition down to 36.5Ml/d.

This compares to an AMP6 total investment of £26.3m to maintain and drive leakage down by 2.1Ml/d: from the 2014/15 value of 45.1Ml/d to the AMP6 target of 43Ml/d.

A greater investment in AMP7 compared to AMP6 is expected, because the lower leakage performance achieved will cost more to sustain. Although the AMP7 investment is slightly higher, the challenge is significantly higher with this lower starting point, and the greater reduction in leakage levels in AMP7 will demonstrate a significant performance improvement.

The totex investment on all leakage activities in AMP6 is forecast to be £26.3m. We have re-categorised AMP6 forecast expenditure data used in line with the investment areas used in our AMP7 of our investment cases for the purposes of this comparison. A summary comparison between AMP6 and AMP7 totex forecast costs is shown in Table 10 below.

Table 10: Totex investment forecast in AMP6 and AMP7

	Leakage totex (£m)	
Area	**AMP6**	**AMP7**
Find and repair leaks	21.2	20.025
Pressure Management	1.1	2.200
Meters, loggers, systems, management etc.	4.1	4.125
Total investment	**26.3**	**26.350**

Investment in AMP7 is similar to that in AMP6, but with additional emphasis on active find and fix and pressure management.

This investment case contributes solely to the Leakage Performance Commitment and historic annual performance for Leakage is shown in Table 11 below.

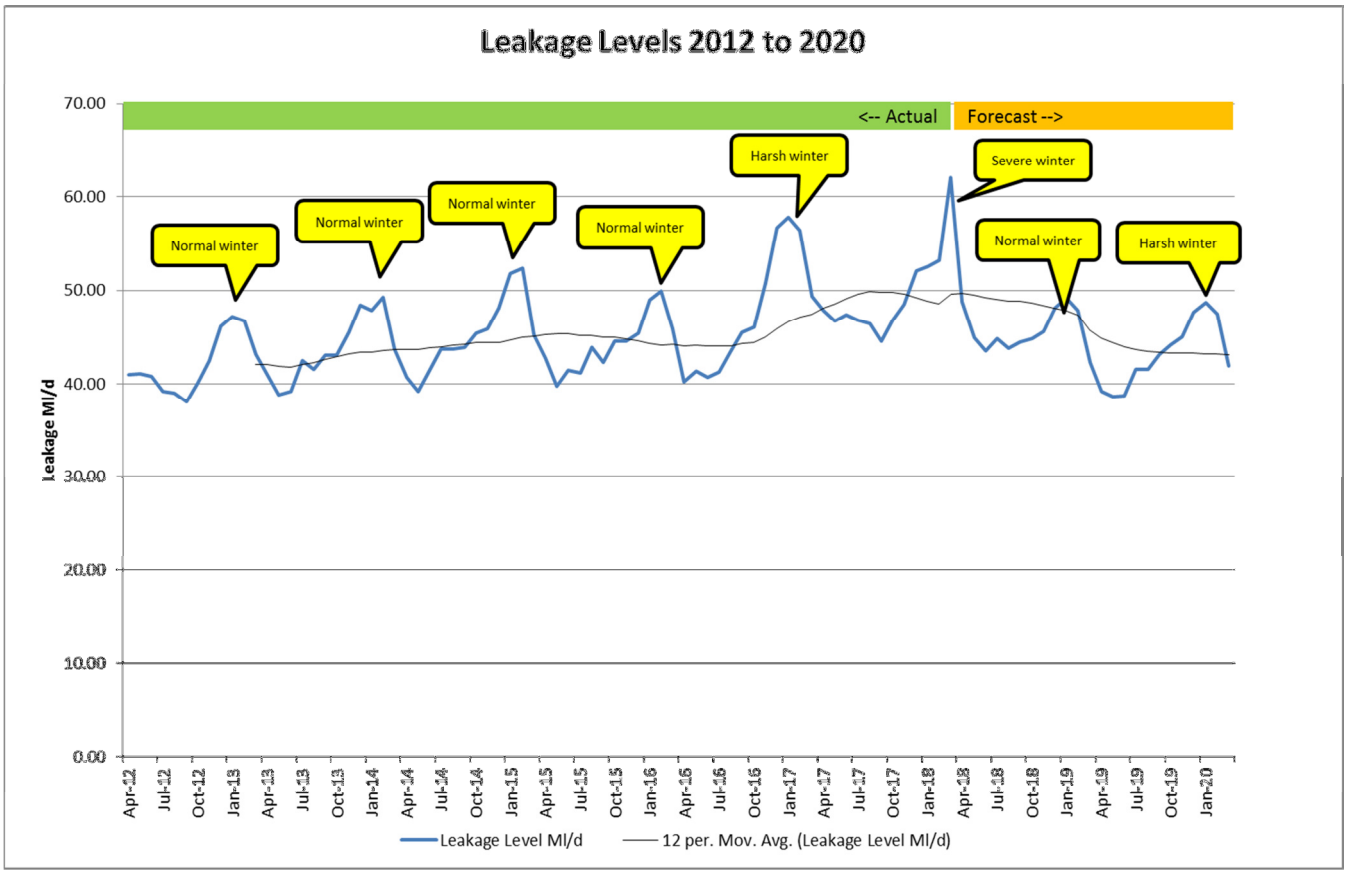
Table 11: AMP6 annual leakage performance

Performance Commitment		2015/16	2016/17	2017/18	2018/19 (Forecast)	2019/20 (Forecast)
Leakage (Current Leakage) (Ml/d) (annual)						
Bristol Water	Target	48.0	47.0	45.0	44.0	43.0
	Company Performance	44.2	47.4	49.6	44.0	43.0

The forecast for the remaining years of AMP6 is to drive leakage down to our target value of 43Ml/d by 2020. Years 2 and 3 of AMP6 have been particularly difficult with significant weather events following a prolonged period of benign weather with leakage levels well below target.

This is demonstrated on the Figure 4 below which shows stable leakage levels over the period until 2016 when a “harsh” winter occurred causing an increase in leakage. This was followed by a “severe” winter in 2017. The forecasts for the remainder of AMP6 are based on a “normal” winter in 2018 and a “harsh” winter to finish the AMP6 period. We define the severity of the winter weather based on the rate of rise seen across the network over the November to March period. This is compared to the average experienced over the previous 10 years for this 5 month period and is classed as “normal” when at 50th percentile or lower, “harsh” when between the 50th and 75th percentile and “severe” when above the 75th percentile.

Figure 4: Leakage levels from 2012 with forecast to end of AMP6



6 Conclusions

Our customer engagement programme has identified what our customers want us to deliver and has defined this as a set of performance commitments. The interventions proposed as part of this investment case are expected to meet the leakage performance commitment target.

We plan to invest a totex of £26.350m in all leakage related activity to reduce leakage by 15% to the end of AMP7 target value of 36.5Ml/d.

Our leakage investment will deliver an AMP7 target leakage reduction of 6.5Ml/d to reduce leakage by 15% from the end of AMP6 target of 43Ml/d down to 36.5Ml/d which will provide a water resource resilience for a 1 in 200 year drought, over-achieve the Water Resources Management Plan requirement, give an ambitious response to the Ofwat leakage challenge and, most importantly, deliver what the majority of our customers want. This target will deliver affordable bills and leave sufficient water available for trading.

The reduced leakage target will be achieved through increased active leakage control and increased pressure management and monitoring across our network.

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

7 Appendices

- Appendix A: Line of Sight Diagram
- Appendix B: Datasets Used in the Leakage Investment Case
- 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

Leakage Line of Sight

Investment Case
NTPBP-INV-LEA-0535

Customer Priorities

Saving Water

Leakage

Performance Commitments

Optimiser Input Form Reference

NTPBP-CAL-LEA--0354-10

Local Community Resilience

Slower Plan
Suggested Plan
Faster Plan
Targets based on Lookback: 5

Leakage

41
36.5
36

Customer High Priority

ODI

Common Reward and Penalty

Other Monetised Benefits

Interventions

10.001.02
Active Leakage Control

10.001.03
Pressure Management

10.001.05
Leak Stop .
Customer side leak repair (supply pipes)

OFWAT Initial Assessment Tests

Test Area	OFWAT Initial Assessment Tests
Engaging Customers	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
Securing long term resilience	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
Targeted controls , markets and innovation	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
Securing Confidence and Assurance	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

Board Requirements

Customer Engagement	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
Resilience	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
Business Planning	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

Performance Commitment Key

- Common Performance Commitment
- Common New Performance Commitment
- Bespoke Performance Commitment
- Bespoke New Performance Comittment

Document Number: NTPBPP-MET-LEA-0640

7.2 Appendix B: Datasets Used in the Leakage Investment Case

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
BRW0504-050 03 AMP7 SELL Assessment	BW assessment of its sustainable economic level of leakage (SELL), report compiled by RPS	-	✓	✓	✓
NTPBP-EXT-SEL-0620 BRW0512-005.02 SELL Sensitivity Apr 2018	Sensitivity analysis	-	-	✓	-
The following list of data sets were supplied by Bristol Water to RPS and were used in the production of their report (see above "BRW-050 03 AMP7 SELL Assessment					
Bristol Water leaks report 2006-2016.xlsx (6MB)	Leaks 2006-2016	-	✓	✓	✓
Burst_frequency_action_codes _updated_Dec 2010 (2).xls (32KB)		-	✓	✓	✓
Book4.xlsx (100KB)	AZNP and HDF	-	✓	✓	✓
Properties Night Use and Mains Mar 16.xlsx (62KB) Total_ENU_Mar_16.xlsx (838KB) Total UKWIR 50%_Mar_16.xlsx (3MB)	Mar 2016 DMA base data	-	✓	✓	✓
daily MNF batch 1.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 2.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 3.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 4.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 5.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 6.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 7.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 8.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 9.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 10.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 11.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 12.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 13.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 15.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 16.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 17.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 18.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 19.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 20.xls	Daily MNF for NRR	-	✓	✓	✓
daily MNF batch 14.xls (3MB)	Daily MNF for NRR	-	✓	✓	✓
WWMD to DMA link for Kier prioritisation look up.xlsx (92KB)		-	✓	✓	✓
Mains_Report_3.xlsx (11MB)	GIS Extract of mains	-	✓	✓	✓
weekly MNF 2012-13.xls (8MB)	Weekly MNF 2012/13	-	✓	✓	✓
final weekly MNF 2012-13.xlsx (3MB)	Weekly MNF 2012/13	-	✓	✓	✓
final weekly MNF 2012-13.xlsx (2MB)	Weekly MNF 2012/13	-	✓	✓	✓
final weekly MNF 2013-14.xlsx (2MB)	Weekly MNF 2013/14	-	✓	✓	✓
final weekly MNF 2014-15.xlsx (2MB)	Weekly MNF 2014/15	-	✓	✓	✓
final weekly MNF 2015-16.xlsx (2MB)	Weekly MNF 2015/16	-	✓	✓	✓
n/a	Pre and Post MLE leakage 2011/12 to 2015/16	-	✓	✓	✓
Book2.xlsx (123KB)	PMA data	-	✓	✓	✓

Dataset File Name	Data Summary	Process In Which Data Has Been Used			
		Risk Identification, Verification and Needs Assessment	Optioneering	Intervention Costing	Benefits Quantification
Book3.xlsx (23KB)	PMA to DMA Links	-	✓	✓	✓
SRM Orders Energy 2013-14.xlsx (113KB) SRM Orders Energy 2014-15.xlsx (177KB) SRM Orders Energy 2015-16.xlsx (205KB) SRM Orders Energy 2016-17.xlsx (207KB) Dca2013-14.xlsx (218KB) Dca2014-15.xlsx (218KB) Dca2015-16.xlsx (221KB) Dca2016-17.xlsx (267KB)	Yearly SRM Orders (Energy)	-	✓	✓	✓
BW Monthly Power by Site 2016-17.xlsx (613KB)	BW Monthly Power by Site	-	✓	✓	✓
Production Unit Cost 2015-2016.xlsx (16MB)	Marginal Cost of Water 2015/16	-	✓	✓	✓
Production Unit Cost of Water by Site 2016-2017.xlsx (16MB)	Marginal Cost of Water 2016/17 (part year)	-	✓	✓	✓
dailyabn2015-16.xls (5MB)	Abstraction volumes 2015/16	-	✓	✓	✓
Report 007_Company_Deployable_Output_Evaluation_Issue_1 - Final.pdf (565KB)	Company_Deployable_Output_Evaluation	-	✓	✓	✓
Copy of 11 01 17 ARP export report 2016.xlsx (50KB)	Mains replacement costs	-	✓	✓	✓
BW_Sources_with_coords.xlsx (16KB)	Abstraction Sources with Coordinates	-	✓	✓	✓
BW Leakage activity since 2012.xlsx	Leakage detection activity	-	✓	✓	✓
Leak Repair Costs Since 2012 Mar-17 Cimbined.xlsx	Leak Repair Unit Costs	-	✓	✓	✓
Book2.xlsx (125KB)	Updated PMA Data	-	✓	✓	✓
20170502 WRMP data submission to RPS re SELL.xlsx (16KB)	WRMP data submission to RPS	-	✓	✓	✓
20170512 Property Count and WAFU info to RPS re ELL calc.xlsx (17KB)	Property Count Projections and WAFU	-	✓	✓	✓
Properties Night Use and Mains Mar 17.xlsx (396KB) Total UKWIR 50%_Mar_17.xlsx (3MB) Total_ENU_Mar_17.xlsx (1MB)	Base data for 2016/17 NRR	-	✓	✓	✓
Book1.xlsx (3MB)	2016/17 Leak Repairs for 2016/17 NRR	-	✓	✓	✓
april 16 may 16.xls (3MB) Aug 16 Sept 16.xls (3MB) June 16 Jul 16 (3MB)	Daily MNF for 2016/17 NRR	-	✓	✓	✓
Dec 16 Jan 17.xls (3MB) Feb 17 Mar 17.xls (3MB) Oct 17 Nov 17.xls (3MB)	Daily MNF for 2016/17 NRR	-	✓	✓	✓
BW Leakage activity since 2012 - inc durations GAH May-17.xlsx (6MB) Methodology Leakage Activity Durations since 2012.docx (387KB)	Leak Detection Activities - hours	-	✓	✓	✓
final weekly MNF 2011-12.xlsx (3MB)	Weekly MNF 2011/12	-	✓	✓	✓
Vehicle cost Leakage inspectors.xlsx (29KB)	Detection Fuel costs	-	✓	✓	✓

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
SRR40	Non Site Specific	IF the zonal replacement complete with communication replacement in the zone is not continued during AMP7 THEN BW will fail to meet its AMP7 leakage target.	3	2	4	3	4	3	4	12
SRR285	Non Site Specific	IF next generation consumption monitor are not adopted THEN it may not be possible to meet the leakage targets.	3	2	4	3	4	3	4	12
SRR39	Non Site Specific	IF the latest tools and equipment for detecting and monitoring leakage are not employed THEN BW will fail to meet its AMP7 leakage target.	3	2	4	3	4	3	4	12

7.4 Appendix C2: Non-Selected Risks

Not applicable - all risks for Leakage were selected.

7.5 Appendix D: Options Considered

This appendix shows the 4 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?
SRR40 SRR285 SRR39	IF the zonal replacement complete with communication replacement in the zone is not continued during AMP7 THEN BW will fail to meet its AMP7 leakage target. IF next generation consumption monitor are not adopted THEN it may not be possible to meet the leakage targets. IF the latest tools and equipment for detecting and monitoring leakage are not employed THEN BW will fail to meet its AMP7 leakage target.	N/A	N/A	Active Leakage Control to Reduce Leakage by 15%	Additional Active leakage control to find leaks	Y - Selected by RPS Study	Y
				Pressure Management	Additional pressure management	Y - Selected by RPS Study	Y
				All Other Areas (CAPEX on loggers, meters, etc)	Investment in replacement loggers and meters	Y - Selected by RPS Study	Y
				Asset Renewal	Replacement or relining of pipelines, valves etc to reduce leakage	N- Rejected by RPS Study	N

7.6 Appendix E: Interventions Developed

This appendix shows the 3 interventions developed from the 4 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)	Leakage (Ml/day)
SRR40 SRR285 SRR39	IF the zonal replacement complete with communication replacement in the zone is not continued during AMP7 THEN BW will fail to meet its AMP7 leakage target. IF next generation consumption monitor are not adopted THEN it may not be possible to meet the leakage targets. IF the latest tools and equipment for detecting and monitoring leakage are not employed THEN BW will fail to meet its AMP7 leakage target.	N/A	N/A	Active Leakage Control to Reduce Leakage by 15%	Additional Active leakage control to find leaks	Y - Selected by RPS Study	10.001.02	Active Leakage Control to Reduce Leakage by 15%	1.58	0	6.45 (combined)
				Pressure Management	Additoinal pressure management	Y - Selected by RPS Study	10.001.03	Pressure Management	2.20	0	
				All Other Areas (capex on loggers, meters, etc.)	Investment in replacement loggers and meters	Y - Selected by RPS Study	10.001.04	All Other Areas (capex on loggers, meters, etc.)	2.13	0	

7.7 Appendix F: Non-Selected Interventions

Not applicable – all interventions were selected for Leakage.