C5 B

Cost and Efficiency

C5B Technical Annex 13
Raw Water Distribution Investment Case: Technical Approach and Business Case

NTPBP-INV-RAW-0539

BRISTOL WATER

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1 Foreword

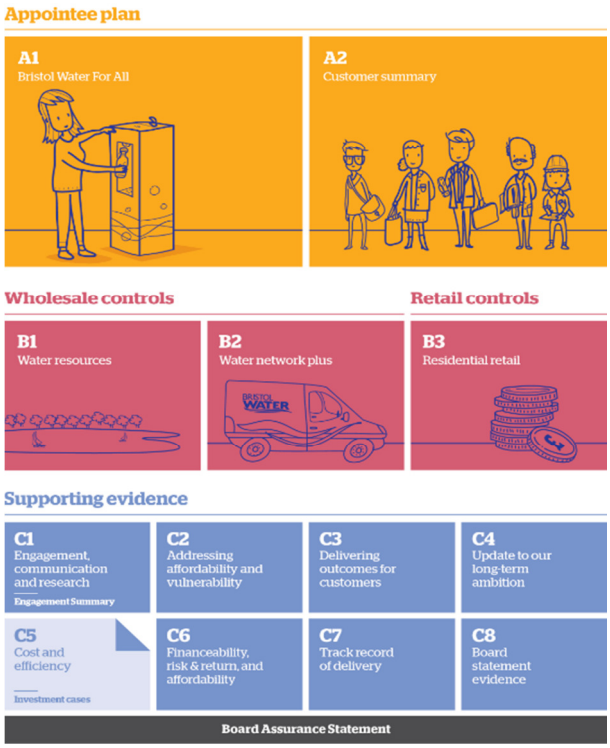
Our raw water distribution network carries raw and pre-treated (non-potable) water from the source to one of our treatment works. The sources include ground water sources (e.g. borehole, well or spring), rivers, and raw water storage reservoirs.

Our raw water distribution network currently comprises approximately 160km of raw water mains installed within our licensed area.

The purpose of this document is to set out Bristol Water's customer led, outcome focused plan which will mitigate risks posed by and associated with raw water distribution network.

The investment case, one of 21, will summarise the facts, risks and investment requirements for raw water distribution for the next review period for 2020 to 2025. This investment case will also summarise performance for raw water distribution for the current review period from 2015 to 2020 and our methodology for determining and delivering the future raw water distribution 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 Resources and Water Network Plus Wholesale Control aspects 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

To ensure we can provide a reliable and environmentally sustainable water supply, our long-term supply and demand balance depends upon our being able to effectively utilise and manage all our water resources. This requires full availability of our raw water distribution network, so we can transfer raw water from our sources to our treatment works as necessary. We will support this by using our totex investment approach which includes investment of £0.253m. When considering our efficient and innovative approach, we plan to deliver our raw water distribution capital programme for £0.233m

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 the health of our raw water distribution assets, and maximising the use of our existing resources, are important means of meeting this priority.

This investment case will address specific issues by utilising a totex approach to determine necessary investment to compressively evaluate current restrictions that we have identified on the transfer capacity of two of our raw water mains. Blagdon Pumping Station has the capacity to pump 45 Ml/d, but is currently limited due to concerns about over-pressurising certain sections of the Blagdon to Says Lane main, as historically the main has been subject to a significant number of bursts. Additionally, the pressure relief valves on the Axbridge Pumping Station surge vessel on the Barrow Treatment Works supply have been activated on a number of occasions and as a result Axbridge Pumping Station has also been limited to operating at reduced capacities.

The interventions presented in this report have been developed to address these issues. Further investigations and studies are proposed to determine the specific underlying cause(s) in each case, and identify the most cost efficient solution to returning these two water mains to full capacity.

The proposed interventions will enable us to identify cost efficient solutions to the reduced transfer capability currently being experienced. Restoration of capacity is essential in order for us to provide a robust and resilient raw water supply network and enable us to have the flexibility to transfer water around our area. This becomes particularly critical during dry weather periods when are raw water resources are at their most stretched.

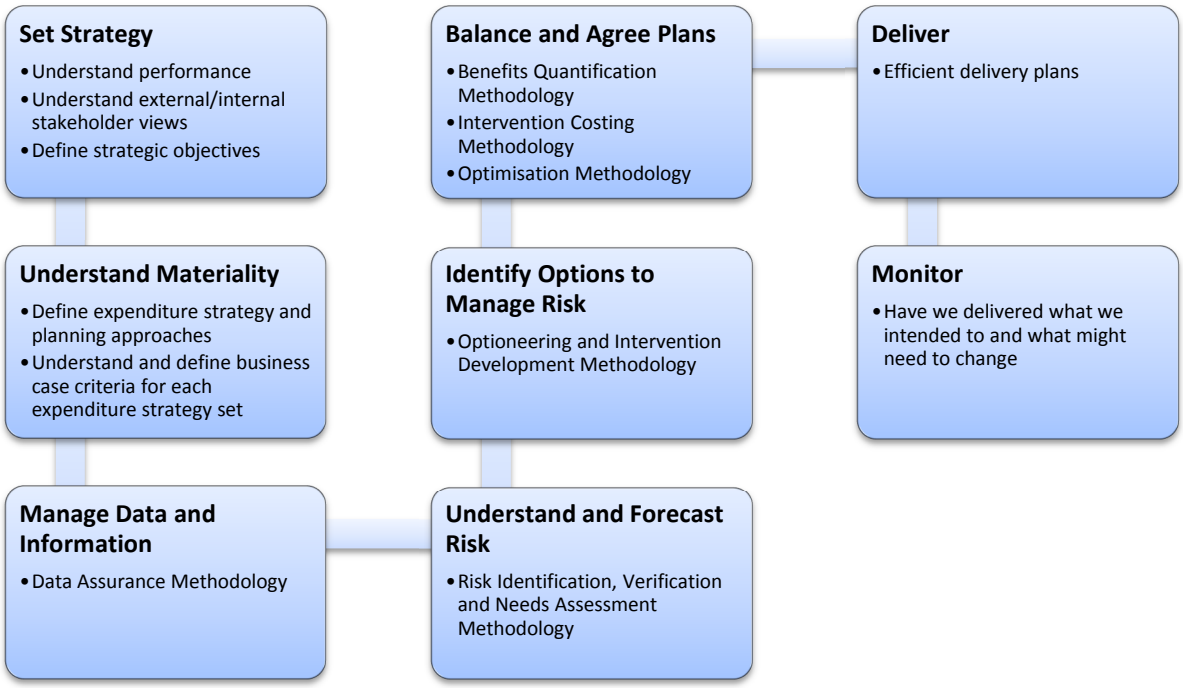
Our future strategy described in our WRMP 2019, includes improved monitoring of our raw water flows and 4.7 Ml/d reduction in leakage from our raw water network by 2034-35.

- Investigation work to source and remedy the current restrictions on the Blagdon to Says Lane main. This will inform a remedial programme of work for future implementation.
- Explore and develop a solution to the over pressurisation of the Axbridge to Says Lane 33” main. This will inform a remedial programme of work for future implementation.

Should we fail to invest in raw water distribution, the key risk is that we will not meet our customers' preference for saving water before developing new supplies. Additionally, there is a risk that if the pipelines cannot run at the higher transfer rate, then we will incur extra cost in managing our water resources and carry more risk because we cannot transfer sufficient water from our southern sources. This added burden placed on water resource management may result in our customers experiencing demand restrictions in the event of dry year (drought) conditions.

To ensure that we meet customers' priorities and mitigate the risks associated with raw water distribution, we have adopted an asset management totex focused approach, as set out in Figure 1.

Figure 1: Approach to meeting customer Prioities and Mitigating Risks



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

We plan to invest £0.253m between 2020 and 2025 in order to undertake preliminary investigations to identify cost efficient solutions to the current transfer restrictions, in order to provide customers with resilient water supply and meeting their preference of saving water before developing new supplies. We will also focus on improving water efficiency by ensuring that our raw water distribution system is fit and well maintained. We have set ourselves a challenging target of reducing our costs by 8% during AMP7. This will be achieved by delivery of our business transformation programme and result in a post-efficiency investment of £0.233m.

No direct quantifiable contribution to performance commitment targets has been attributed through this investment case. However, our raw water distribution investment case supports the health and sustainability of our raw water network, and underpins the provision of a safe and reliable supply for our customers. Costs are allocated to the Raw Water Distribution Business Unit. Investment is related to maintaining the long term capability of our infrastructure assets.

3 Background To Our Investment Case

3.1 Context

The Raw Water Distribution investment case includes raw water pipework, shafts and tubes, raw water meters and ancillaries and culverts and structures. It includes the 'Line of Works'; this is a collection network which links a series of springs and wells and delivers water to Barrow Treatment Works.

We have approximately 160km of raw water distribution mains, over 60% of which are constructed from ferrous material (either cast, ductile or spun iron) and make up the majority of our longer pipe runs. Our major raw water distribution mains are identified in the Table 1.

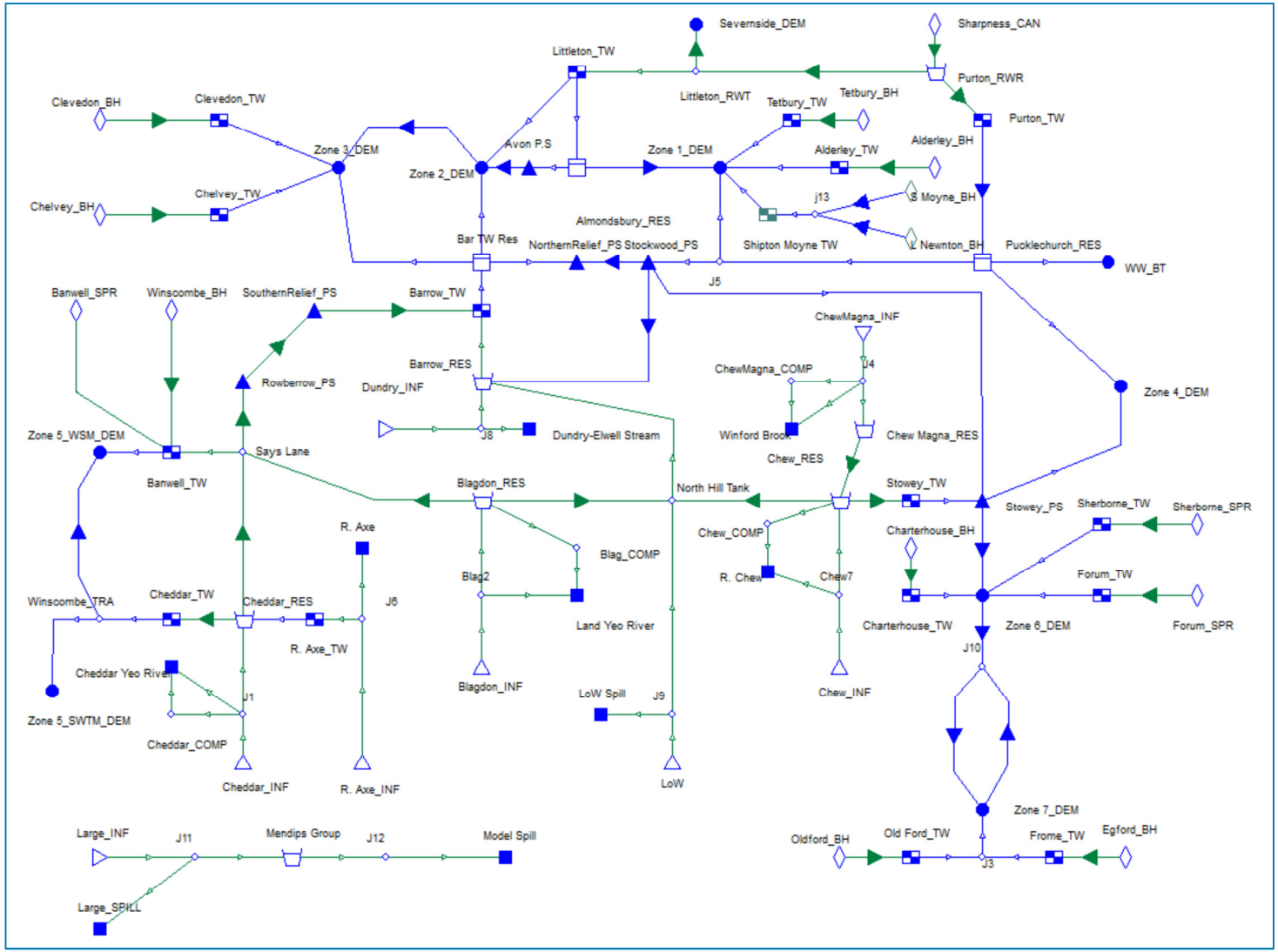
Table 1: Bristol Water major raw water distribution mains

Raw Water Mains	Length (km)
Purton Pumping Station to Littleton Treatment Works	17.0
Axbridge to Says Lane	8.9
Blagdon to Says Lane	5.1
Says Lane to Barrow	16.9
Rowberrow to Banwell	4.5
Rickford Springs to Blagdon	2.8
Landford Springs to Blagdon	6.0
Blagdon to North Hill Tank	8.1
Chew Stoke to North Hill Tank	2.0
Chew Stoke to Stowey	2.7
Line of Works	17.6
Yelling Mill to Windsor Hill to Forum	2.4
Total	**94.0**

The investment case excludes the dams, impounding reservoirs, intakes, boreholes springs and wells associated with our water resources. It also excludes raw water pumping stations and pre-treatment processes, and the associated instrumentation, telemetry, vehicles and buildings.

A schematic layout for raw water distribution in the south of our supply area is presented in Figure 2.

Figure 2: Bristol Water Miser model schematic (showing raw water network in green)



3.2 Strategy

Developing the investment needs for our 160km of raw water distribution mains is underpinned by our long term corporate strategy which has the vision ***"Trust beyond water - we provide excellent experiences"***. Our outcomes Delivery Framework together with our Strategic Asset Management Plan provide the strategic framework that supports this vision and enables investment in our Raw Water Distribution assets 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 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 that is influencing our investment in our raw water distribution network, which is a safe and reliable supply.

Our Asset Management Strategy has objectives developed in alignment with the long term strategy and delivery of corporate objectives and outcomes. These objectives cover both our short-term needs and longer-term aims, and drive the capability development plan and asset planning activities. Delivery of the investment for our raw water distribution network 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 strategy for our raw water distribution assets focuses on ensuring they are in good working order. The maintenance of our assets is at the heart of providing a safe and reliable water supply to our customers. We need to ensure that planned investment is sufficient for the continuation of business as usual activities and routine and reactive maintenance, and the continued provision of high quality water to our customers.

Our strategy is set out in "Bristol Water Clearly" and being trusted by our customer is a principal objective for us. We state that one of the ways we are going to achieve this "Trust beyond Water" is to "Continually improve the resilience of water supplies – this requires us to deliver across a wide range of areas, including leakage and water efficiency" and that this will require us to "maintain the long-term health of our assets as a minimum and improving long-term health as we deliver the service improvements that customers value".

The specific investigations included in this investment case will support the long term resilience of our raw water network by identifying cost effective solutions to deliver the on-going and future health of these assets. This investment case articulates the bottom-up asset interventions that are required in AMP7 to achieve the outcomes that customers, regulators and other stakeholders have told us they expect.

3.3 Customer Priorities

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

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

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

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 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 Raw Water Distribution and one of our outcomes – Safe and Reliable Supply.

We undertook more detailed discussions at phase 2 of our engagement process; gathering evidence (see section **C1 – customer engagement, communication and research** appendix to our business plan) which gave us a wealth of information about how our customers' view Bristol Water, our services, and long term plans. We also explored short and long-term trade-offs in decision making and asked customers to tell us how we should approach long term issues of resilience and how we could best respond to service interruptions. When discussing the Safe and Reliable Supply outcome with our customers, we found that they are understanding of one-off events and often focus more on how we can improve our response to them. We asked them about investment in water quality and reliability and we asked what areas they felt most comfortable investing in. In our March 2018 customer panel, our

customers prioritised reliability above local environment, resilience and customer experience[2]. Detailed analysis of customers' views on this area can be found in **section C3 – Delivering Outcomes for Customers.**

We consulted in three potential scenarios in relation to our Safe and Reliable Supply outcome:

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

*With 90% customers in these centres remaining at risk

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 Raw Water Distribution, specific details on our planned investment and associated performance can be found in section 3.4.

[2] A4g: customer online panel March 2018

3.4 Asset Health Performance Commitments, 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 our raw water distribution network will help ensure our assets are being maintained appropriately for the benefit of current and future generations.

No direct quantifiable contribution to performance commitment targets has been attributed through this investment case. However, our raw water distribution investment case supports the health and sustainability of our raw water network, and underpins the provision of a safe and reliable supply to our customers. Known issues in our raw water distribution network may under certain circumstances reduce or restrict our ability to transfer raw water resources around our supply area. While our major treatment works in the southern supply area can be supplied from alternative resources, any restrictions may have an impact on the operational resilience of the network during periods of extreme drought.

3.5 Compliance Obligations

While there are no direct statutory or compliance obligations that are influencing the development of interventions in this investment case, the Water Industries Act 1991 clearly identifies our statutory obligation to provide domestic and non-domestic customers with a reliable supply of water for domestic and business purposes. The Water Act 2003 amended the Water Industries Act 1991, by introducing a statutory requirement for water companies to produce Water Resources Management Plan at least every five years setting out how we ensure that we are able to meet current and future supply demand from our customers whilst safeguarding the sustainability of our water resources..

The broader obligation of this legislation to maintain the condition and functionality our water supply system, this is addressed by interventions proposed in this investment case and through many other interventions proposed within our Business Plan.

3.6 AMP6 Investment

Our AMP6 investment in raw water distribution supports our ability to maintain the health of our assets and to mitigate identified risks. No direct contribution to AMP6 performance commitment targets has been attributed.

AMP6 capex investment related our raw water distribution network is summarised in Table 2 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 2: AMP6 capital investment

Year	Raw Water Distribution Capex (£m)
2015/16 actual	-
2016/17 actual	0.053
2017/18 actual	0.228
2018/19 forecast	0.944
2019/20 forecast	0.749
AMP6 forecast	**1.974**

Our AMP6 investment delivers targeted improvement to key raw water mains as well as asset remedial and maintenance works to improve the health of our raw water distribution assets.

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

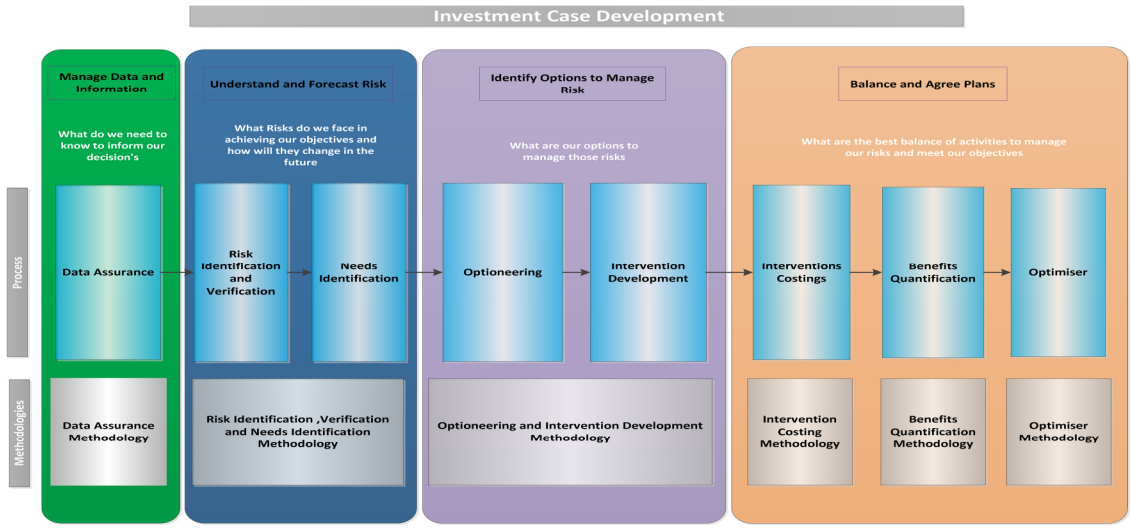
We have created and implemented a process that is supported by a set of six methodologies. When developing the methodologies, we wanted to ensure that they:

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

Figure 3: 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 nine investment cases. We will continue to focus on improving the quality of our data and the associated assurance processes.

4.1.2 Risk Identification, Verification & Needs Assessment Methodology

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

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

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

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

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

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

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

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

We developed need statements for all selected risks.

4.1.3 Optioneering & 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 peer reviewed and all options identified as not viable were discarded.

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

4.1.4 Intervention Costing Methodology

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

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

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

Therefore we have to assess the expected capital expenditure (capex) of each intervention.

Expected Capital Cost (capex after)

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

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

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

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

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

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

A series of business reviews and sense checks of the investment optimiser results have been undertaken prior to finalising the AMP7 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 Raw Water Distribution

Each of the following sections describes the specific details associated with the application of the investment case development process for raw water pumping stations.

4.2.1 Investment Case Risk Identification, Verification & Needs Assessment

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

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

Two risks were not selected and these risks return to being monitored and reviewed under our business as usual risk management process. Details of non-selected risks are provided in Appendix C.2. An example of a non-selected risk is given below in Table 3.

Table 3: Example of non-selected risk

SRR ID	IC No	Location/Zone	Revised Risk Description	Likelihood	Human Health / Environment	Ease to Resolve	Publicity & Reputation	Regulatory Impacts	Customers Impacted	Max Impact	Risk Score
SRR53	21	Axbridge Treatment Works	If the main between the River Axe and works fails, then output from Axbridge site will be lost	2	1	1	1	2	1	2	4

In this case, peer review and assessment of the risk determined that the pipeline was not likely to fail until AMP8 or 9 and therefore was allocated a likelihood score of 2. The Axbridge treatment works output is pumped into Cheddar reservoir and used to supplement yield from the Cheddar ponds source. A raw water mains failure could be fixed within 24 hours and therefore there would be very little impact on Cheddar reservoir levels over this period. The impacts of such a failure were therefore assessed to be small.

4.2.2 Optioneering & Intervention Development

Three risks were selected and developed into needs statements. Multiple options were developed and recorded for each of the three needs statements. These options were peer reviewed and all options identified as not viable were discarded.

For example, against the selected risk regarding the transfer capacities of the Blagdon Pumping Station to Barrow Treatment Works, we considered the options of doing nothing and of investigative studies to establish causes and potential solutions, as set out in Table 4.

The do nothing option involves continued operation at reduced capacities, but was discarded because of the extra cost incurred in managing our water resources and as it carries more risk because we cannot transfer sufficient water from their southern sources.

The investigative study options will directly address the need to restore water transmission capacities and carries proportionally lower cost and was therefore selected identified as a viable option and taken forward for intervention development.

Table 4: Example of Options Selection for SRR671

Strategic Risk Register	Need Description	Proposed Option Name	Proposed Option Description	Option Viability?	Ref No	Intervention Title	Intervention Description
SRR671 IF the current (AMP6) investigation reveals that the pipe cannot operate at sufficient pressure THEN the transfer rate from Blagdon to Barrow will remain limited to 35 Ml/d and the deployable output will be more peak constrained and we will be in a compromised position in managing water resources which will require a longer term programme using more expensive alternative sources to balance supply- demand. (Risk Score = 12)	If the pipeline cannot run at the higher transfer rate then Bristol Water will incur extra cost in managing their water resources and carry more risk because they cannot transfer sufficient water from their southern sources. Replacement of the Blagdon to Says Lane pipeline is one option but is very expensive and there may be other alternative or options (for example cleaning the pipeline or rehabilitating it). This requires further survey, physical investigations and studies to assess what options are available.	Data collection and studies.	Condition camera/ survey along the whole main to determine the condition of the main and the pressure rating of the main. Feasibility study to determine options to allow transfer of the full capacity of the pumping station (45 Ml/d) to Barrow.	This solution will provide information on the cause of the restriction and develop a cost effective solution for implementation. This is considered by us as a viable and informed approach to the need requirement.	21.001.02	Blagdon to Says Lane Data Collection and Studies	Condition camera/ survey along the whole main to determine the condition of the main and the pressure rating of the main. Feasibility study to determine options to allow transfer of the full capacity of the pumping station (45 Ml/d) to Barrow
		Do Nothing	Continue business as usual, monitor risk through AMP7	This option is not considered viable as it will mot mitigate the identified risk or fulfil the need. The inability to transfer at high capacity is impacting on the resilience of the raw water network, for this reason this option has been discarded and will not be taken forward for intervention development.	N/A	N/A	N/A

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. These included in some cases, multiple interventions against a single selected risk and these were identified as mutually exclusive during intervention selection For example the Sherborne Treatment Works Rectification (24.006.15) which is considered within Treatment Works Strategic Maintenance investment case, was set as mutually-exclusive against intervention Sherborne to Stowey pipeline rehabilitation (21.001.01), as they both address the risk SRR664.

A summary of all selected risks and their associated options is included in Appendix D. A summary of all non-selected risks is given in Appendix C.2.

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

4.2.3 Intervention Costing

We have identified a total of three interventions to be taken forward for scope development and cost estimation.

Costs for interventions Blagdon to Says Lane data collection and studies (21.001.02) and Axbridge to Barrow data collection and studies (21.001.03) were calculated in-house by Bristol Water using historical data for similar investigational work and then peer reviewed. The preferred ChandlerKBS cost estimation procedure was not used in this instance as investigations and study work is not an area that is included in their unit cost data base. Contractor overheads and Bristol water overheads have then been added on at intervention level based on information supplied by ChandlerKBS.

For the Sherborne to Stowey pipeline rehabilitation intervention (21.001.01), a high level scope document was developed including an activity schedule. ChandlerKBS utilised a water industry unit cost data base to complete estimation in accordance with their own assured methodology.

The costed activity schedules were returned to us for peer review, leading to further refinement in collaboration with ChandlerKBS.

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

Cost Example; Blagdon to Says Lane data collection and studies

Investment is needed to understand the nature of the current restriction to, and identify a viable solution for the 24” diameter cast iron main between Blagdon Pumping Station and Says Lane junction. A timely intervention now will ensure that we are able to develop a cost efficient solution for implementation in AMP7/8.

We have established a direct cost of undertaking the works of £0.101m; this includes labour and materials as well as contractual costs. We have then applied Bristol Water’s overhead of £0.016m for internal activities associated with the intervention, such as project management, contract management, operations and system support, consultants and administration.

All of the direct costs above gave us an intervention cost of £0.117m to implement the intervention in a planned way (the capex after).

If however, we did not undertake the study work proactively, then we will continue to the current practice of operating the main with the restriction in place, this will mean that our deployable output continues to be peak constrained and we will be unable to fully deliver the requirements of our Water Resources Management Plan 2019.

We have established that regardless of whether we undertook the above intervention proactively or not there would be no change in operational expenditure (opex after).

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

4.2.4 Benefits Quantification

The three Raw Water Distribution interventions were assessed for Direct and Indirect benefits. These are presented in Appendix E.

Under this investment the benefits of the interventions do not contribute directly to performance commitment target values. The outcome of the study work will contribute monetary benefits categorised as 'Other Benefits' as described below:

These are other indirect benefits which have been calculated and recorded in the benefits calculations and include for example, customer compensation payments, and environmental penalties. Where appropriate to the intervention, these benefits have been monetised and included on the optimiser input form as 'Other Benefits'.

In this case, interventions Blagdon to Says Lane data collection and studies (21.001.02) and Axbridge to Barrow data collection and studies (21.001.03) will identify the cause of restrictions in the Blagdon to Says Lane main and Axbridge to Barrow main and propose viable solutions to restore transmission capacity. This will re-instate our resource availability, the benefit has been monetised on the basis that the shortfall cannot be made up from our Mendip reservoirs and will have to made up from the north of our supply area at much higher cost, to the extent that if this situation is not remedied a new source may be required. The benefit is therefore based on the expected cost of developing a new source. Quantifiable benefits will only be fully realised upon completion of the study work and final remediation of the mains themselves.

5 Outcome

5.1 Selected Interventions

The three interventions developed within the Raw Water Distribution investment case were assessed through intervention optimisation. Of the three interventions proposed, two 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 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 process innovations that mean we can contribute to our 8% efficiency challenge and keep our customer's bills low into the future

The two selected interventions are set out in Table 5, along with details of the associated costs.

Table 5: Selected Interventions & Costs

ID	Intervention Title	Total Capex (£)	Change in Opex per annum (£)
21.001.02	Blagdon to Says Lane Data Collection and Studies.	£116,737	£0.00
21.001.03	Axbridge to Barrow Data Collection and Studies.	£135,998	£0.00
Raw water distribution capital investment (pre-efficiency)		**£252,735**	**£0.00**
Raw water distribution capital investment with 8% capex efficiency		**£232,516**	

The two selected interventions are selected because they are both **cost-beneficial**, helping to offset future bill increases for our customers.

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

Blagdon Pumping Station to Says Lane Data Collection and Studies

Blagdon Pumping Station was refurbished in AMP5 and has the capacity to pump 45 Ml/d to Barrow or Banwell Treatment Works. The flow rate has been restricted since construction to 35 Ml/d. as the main has been subject to a number of bursts in the past. The section of main between Blagdon Pumping Station and Says Lane junction is 24" diameter cast iron and was originally installed in 1920. Our data records indicate that we would not normally experience significant numbers of burst incidents on a water main of this age and type. Due to the size and location of the main the bursts are not straightforward to repair and result in a high annual maintenance cost.

The limitations on pressurising the pipe means that the transfer rate from Blagdon Pumping Station remains limited to 35 Ml/d and our deployable output will be peak constrained. This reduces our network resilience and means transferring water from our northern supply area at significant additional cost, to balance supply and demand. We will also carry more risk because of the restriction imposed on our southern sources.

Despite the current hydraulic restrictions on this main, we have some local capability for alternative supply provided normal demand is not exceeded.

If the current situation of limited transmission is allowed to continue then our deployable output is peak constrained and we cannot achieve the deployable outputs required by our Water Resources Management Plan 2019. The intervention need is therefore is to enable the main to accommodate the full pumping station transfer rate of up to 45 Ml/d and restore the required level of resilience to our raw water transmission system.

Replacement of the Blagdon to Says Lane pipeline is one option but carries a very high CAPEX, dependent on the cause of the current limitations, alternative options (for example cleaning the pipeline, relining or rehabilitation) may provide cost efficient solutions. Further investigation is required including CCTV survey along the length, this will requires additional access points, flow tests and valve refurbishment or replacement. The outcome will deliver information on the condition of the main and identification and full assessment of the viability of potential solutions.

Axbridge to Barrow Data Collection and Studies

The Axbridge to Says Lane 33" main was originally installed in 1929 and conveys water from Axbridge Pumping Station to Barrow via Says Lane. The pressure relief valves at Axbridge Pumping Station surge vessel is venting off air regularly indicating the surge vessel is frequently over-pressurised. To prevent damage to the vessel the Axbridge Pumping Station we currently restrict operation to a single large pump (32 Ml/d). Normal operation would otherwise operate 2 pumps providing transfer of approximately 48 Ml/d to Barrow Treatment Works. The current restriction on pumping results in a shortfall of some 16 Ml/d in the volume that can be transferred to Barrow Treatment Works.

If the current situation of limited transmission is allowed to continue then our deployable output is peak constrained and we cannot achieve the deployable outputs required by our Water Resources Management Plan 2019. This reduces our network resilience and means transferring water from our northern supply area at significant additional cost to balance supply and demand.

We will also carry more risk because we cannot transfer sufficient water from our southern sources.

The nature of the problem is not currently fully understood, and further investigation work is required into the cause, this is likely to include flow and pressure tests and potential valve replacement/refurbishment. The outcome of the study will report on the nature of the issue(s) causing restriction and full assessment of the viability of potential solutions.

The total raw water distribution investment including Water Service and Business Unit Allocation is summarised in Table 6. This Investment Case is aligned to the Water Resources and the Water Network Plus Wholesale Control categories of our business plan. Costs are allocated to the Water Resources and Raw Water Distribution business units. Investment is all related to maintaining the long-term capability of infrastructure assets.

Table 6: Water Service and Business Unit Allocation

Wholesale Control	**Water Resources**	**Water Network Plus**	**Total**
Business Unit Allocation	***01 Water Resources***	***02 Raw Water Distribution***	
Raw water distribution capital investment (%)	**46.2%**	**53.8%**	**100%**
Raw water distribution capital investment	**£0.117m**	**£0.136m**	**£0.253m**
Maintaining the long term capability of the assets - infra	£0.117m (46.2%)	£0.136m (53.8%)	**£0.253m (100%)**
Raw water distribution capital investment with 8% capex efficiency	**£0.108m**	**£0.125m**	**£0.233m**

5.2 Contribution to Performance Commitment Targets

The investment case for raw water distribution is concerned with identified risks and ensuring that our infrastructure assets are able to operate efficiently to meet the requirements that we have identified in our WRMP19.

The outcome of this investment will deliver solutions to two restrictions that we have identified which relate to our raw water transmission and which currently reduce the overall resilience of our raw water infrastructure network under peak demand conditions. Although the benefits of our proposed investigation are not directly quantifiable against the performance commitment targets in our business plan, the interventions selected address the health and sustainability of our raw water network and underpin a safe and reliable supply to our customers.

5.3 Non-Selected Interventions

Of the three interventions developed within this investment case, one was not selected because it was not cost beneficial. The risks associated with this intervention represent a residual risk that will be carried during AMP7. We will continue to monitor this residual risk throughout AMP7, and where this process requires this risk to be mitigated, we will respond with appropriate action. Details of the non-selected intervention are given in Appendix F. A summary is given in Table 7.

Table 7: Non-Selected Intervention and Residual Risk

SSR ID	Risk & Need Statement	Non-Selected Intervention & Residual Risk
SRR664	Risk; If Sherborne source remains out of service THEN the abstraction licence could be lost amounting to an average potential yield of approx. 5Ml/d. A new source of the same capacity could cost £12.5 M to develop. Need: Investment is required to keep this source in service to prevent the licence being lost and avoid the delays and high cost of developing a new source when an additional resource is required in future.	Non-Selected Intervention: 21.001.01Sherborne to Stowey pipeline rehabilitations Residual Risk: The residual risk is that if the abstraction licence at Sherbourne is surrendered then our Drought Plan has a 3.7 Ml/d deficit

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 the PR19 Investment Cases Summary Document[3]. There are no additional specific assumptions related to this investment case.

5.5 AMP8

We have a legal requirement to plan for water resource management to ensure resilient supply during exceptional droughts. The Water Resource Management Plan 2019 has been produced in line with a statutory 25-year Water Resource Management Plan planning process and includes the output from Sherborne.

If the Sherborne spring licence were revoked by the Environment Agency because it is not being utilised, then this would reduce the deployable output of our sources by 3.7 Ml/day based on anticipated yield during a period of extreme drought.

5.6 Base Maintenance

This investment case covers all activities related to raw water distribution, and therefore no assessment of base maintenance investment is required.

The investigational study work proposed in this investment case may generate future base maintenance requirements, these will be reviewed as part of the study work and an assessment of benefits and efficiencies made for inclusion in the study reporting.

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

5.7 Historic & AMP7 Investment Comparison

A summary of historical investment in Raw Water Distribution is provided in Table 8 along with the planned AMP7 investment value from Raw Water Distribution interventions.

Table 8: Historical & AMP7 Investment

AMP	Capital investment values	Investment (£m)
AMP5	AMP5	13.268
AMP6	2015/16 actual	-
	2016/17 actual	0.053
	2017/18 actual	0.228
	2018/19 forecast	0.944
	2019/20 forecast	0.749
	AMP6 forecast	**1.974**
AMP7	AMP7 pre-efficiency	**0.253**
	AMP7 8% capex efficiency applied	**0.233**

Our levels of Raw Water Distribution investment have decreased since AMP5 and AMP6. In AMP5 and AMP6 we invested in specific asset health and maintenance activities, including work to address identified risks on our Axbridge-Rowberrow Raw Water Main and Line of Works assets. In AMP7, we are proposing to invest in investigations and studies to improve our understanding of, and data related to, our raw water distribution assets.

6 Conclusions

We need to ensure our raw water distribution assets are appropriately maintained and continue to deliver our customers' priority for a safe and reliable supply.

An initial list of five risks was developed into three potential interventions. These interventions were developed and assessed through our asset management totex focused approach and put forward for investment optimisation. Of these a total of two interventions were selected on the basis that they are cost beneficial interventions that meet our customer priorities and associated asset health requirements.

We plan to invest a pre-efficiency total of £0.253m in two strategic raw water distribution interventions. We have set ourselves a challenging target of reducing out costs by 8% during AMP7. This will be achieved by delivery of our business transformation programme, resulting in a post-efficiency investment of £0.233m.

The interventions selected address known restrictions in our raw water distribution network that may restrict our ability to transfer raw water resources around our supply area. Our investment will allow us to compressively evaluate current restrictions on the transfer capacity of two of our raw water mains. Blagdon Pumping Station has the capacity to pump 45 Ml/d, but is currently limited due to concerns about over-pressurising certain sections of the Blagdon to Says Lane main, as historically the main has had a significant number of bursts. On the Axbridge Pumping Station to Barrow Treatment Works main, the pressure relief valves on the Axbridge Pumping Station surge vessel have been activated on a number of occasions, and as a result Axbridge Pumping Station has been limited to operating at reduced capacities.

If we fail to invest in our raw water distribution assets, the network's capacity will be restricted and we will not be able to provide a robust and resilient supply, and our flexibility to transfer water around our area will be reduced. This becomes particularly critical during dry weather periods when are raw water resources are at their most stretched. Known issues in our raw water distribution network may under certain circumstances reduce or restrict our ability to transfer raw water resources around our supply area. While our major treatment works in the southern supply area can be supplied from alternative resources, any restrictions may have an impact on the operational resilience of the network during periods of extreme drought.

No direct quantifiable contribution to performance commitment targets has been attributed through this investment case. However, our raw water distribution investment case supports the health and sustainability of our raw water network, and underpins the provision of a safe and reliable supply to our customers.

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

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

Raw Water Distribution- Line of Sight

Investment Case
NTPBP-INV-RAW-0539

Customer Priorities

Performance Commitments

Optimiser Input Form Reference

NTPBP-CAL-WAT-0358

Other Monetised Benefits

Interventions

21.001.01

21.001.02

21.001.03

OFWAT Initial Assessment Tests

Test Area

What is the quality of the Company's customer engagement and participation and how is it incorporated into the companies business plan and ongoing operations

Engaging Customers

How well has the company used the best available evidence to objectively assess and prioritise the diverse range of risks and consequences of disruptions to its systems and services and engaged effectively with customers on its assessment of the risks and consequences

How well has the company objectively assessed the full range of mitigating options and selected the solutions that represent the best value for money over the long term and support from customers

Securing long term resilience

To what extent has the company clearly demonstrated that it has considered whether all relevant projects are technically suitable for direct procurement for customers. Where it has one or more such projects, to what extent has the Company provided a well reasoned and well evidenced value for money assessment

Targeted controls , markets and innovation

To what extent does the company have a good track record of producing high quality data, taking into account the company's data submission, assurance process and statement of high quality , and our 2018 assessment of the company under the Company Monitoring Framework

Securing Confidence and Assurance

Board Requirements

Assurance that the company's business plan has been informed by customer engagement and feedback from the company's CCG about the quality of its customer engagement and how this has been incorporated into the plan

Customer Engagement

Assurance that the company's business plan has been informed by a robust and systematic assessment of the resilience of the company's systems and services; customer views on managing resilience and a comprehensive and objective assessment of interventions to manage resilience in customers long term interests

Resilience

How has it challenged an satisfied itself that the overall strategy for data assurance and governance processes delivers a high quality data

How has it challenged and satisfied itself that the business plan will enable the company to meet its statutory and licence obligations , now and in the future and take account of the UK and Welsh governments strategic policy statements.

How has it challenged and satisfied itself that its plan will deliver operational financial and corporate resilience over the next control period and the long term through its governance and assurance processes, taking into account of its track record of performance

Business Planning

Performance Commitment Key

Common Performance Commitment

Common New Performance Commitment

Bespoke Performance Commitment

Bespoke New Performance Comittment

Document Number: NTPBP-INV-RAW--0725

7.2 Appendix B: Datasets

This appendix lists the datasets used in this investment case and where they have been utilised

Dataset File Name	Data Summary	Process In Which Data Has Been Used			
		Risk Identification, Verification and Needs Assessment	Optioneering	Intervention Costing	Benefits Quantification
RE Blagdon to Says Lane Risk	Email from Water Resources Manager re. risk posed to drought plan.	✓	-	-	-
Meeting - Raw Water Mains 3-1-18	Buddy meeting	✓	-	-	✓
Sherborne TW Solutions Report v0.3.pdf	Optioneering re. Sherborne WTW	-	✓	✓	✓
I20140001_1 Blagdon to Says Lane replacement design brief	Design brief for replacement of main	-	-	✓	✓
FW Costing for Air Valves IC	Cost estimation re. air valves	-	-	✓	-
RE 21 001 01 - 21 001 01 - Raw Water Distribution	Cost estimation re. pipeline	-	-	-	✓

7.3 Appendix C1: Selected Risks

This appendix shows the 3 selected risks of the 5 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
SRR664	Sherborne TW	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	3	2	4	2	2	3	4	12
SRR671	Blagdon to Says Lane	IF the current (AMP6) investigation reveals that the pipe cannot operate at sufficient pressure THEN the transfer rate from Blagdon will remain limited to 35 Ml/d and the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will reqire a long programme using more expensive alternative sources to balance supply- demand.	3	2	4	3	3	3	4	12
SRR701	Axbridge to Barrow	IF the current situation is allowed to continue with only a low transfer rate from Axbridge to Barrow THEN the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will require a long programme using more expensive alternative sources to balance supply- demand.	3	2	4	3	3	3	4	12

7.4 Appendix C2: Non-Selected Risks

This appendix shows the 2 non-selected risks of the 5 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
SRR2	North Hill	IF North Hill Farm bridge fails THEN the loss of Barrow Rising Main and Spring section of line of works is likely.	3	2	3	2	3	3	3	9
SRR53	Axbridge TW	IF the main between the River Axe and works fails, THEN site is out (Axbridge-Area 3)	2	1	1	1	2	1	2	4

7.5 Appendix D: Options Considered

This appendix shows the 11 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?
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	N/A	N/A	Abandon works	Abandon the works and surrender the licence.	Not beneficial due to the high replacement cost of obtaining new licences for future demand	N
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	N/A	N/A	Move licence to Chew	Abandon the works and attempt to move the abstraction licence to Chew Valley Lake.	Not viable as the Environment Agency were not willing to accommodate the transfer of the licence to Chew Valley Lake.	N
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	N/A	N/A	UV	Replacing the arrangement with cartridge filters and UV, and subsequently blending with water from Stowey.	Viable solution, though rejected due to the complex issues regarding water quality, sources blending and reduced output when dependant on other works.	N
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	N/A	N/A	Containerised unit	Replace the works with a containerised filtration unit.	Viable solution, to buy a containerised unit with low commissioning costs. Rejected due to high capex costs reduced CBA ratio.	N
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	SRRN44	The site has been out of service since 2012. The Environment Agency are due to conduct a review of water abstraction licences by 2020/2025 for all water companies, with the view to reduce abstraction and evaluate sustainable practices. Any sources not being utilised are expected to come under scrutiny with a potential reduction in allowable abstraction limits. The source is likely to be required in future as demand in the BW network grows. Development of new sources costs in the region of £2.5M per ML and can take many years to achieve. Therefore it is likely to be cheaper to implement a scheme to keep Sherborne abstraction in service and so keep the licence, than to allow the licence to be lost and develop a new source in future. Investment is required to keep this source in service to prevent the licence being lost and avoid the delays and high cost of developing a new source when an additional resource is required in future.	Rehabilitate abandoned 21" raw pipeline	Rehabilitation of an abandoned 21” pipeline to allow treatment at a Stowey.	Viable and most cost beneficial solution, to use the old 21” main that linked the site to Stowey, advance to next design stage.	Y
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	N/A	N/A	New 6" pipeline	Install a new 6” pipeline to transfer the water to Stowey	Viable, but rejected due to high capex for a new pipeline near existing mains, routes constrained by local geography.	N
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	SRRN44	The site has been out of service since 2012. The Environment Agency are due to conduct a review of water abstraction licences by 2020/2025 for all water companies, with the view to reduce abstraction and evaluate sustainable practices. Any sources not being utilised are expected to come under scrutiny with a potential reduction in allowable abstraction limits. The source is likely to be required in future as demand in the BW network grows. Development of new sources costs in the region of £2.5M per ML and can take many years to achieve. Therefore it is likely to be cheaper to implement a scheme to keep Sherborne abstraction in service and so keep the licence, than to allow the licence to be lost and develop a new source in future. Investment is required to keep this source in service to prevent the licence being lost and avoid the delays and high cost of developing a new source when an additional resource is required in future.	Renovate existing works.	Renovating the existing plant and implementing the required HSE improvements to operate the site.	Viable option to investigate further. Significant effort required to redesign and rectify existing works within the current constraints, lower CBA than pipeline method.	Y

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?
SRR671	IF the current (AMP6) investigation reveals that the pipe cannot operate at sufficient pressure THEN the transfer rate from Blagdon will remain limited to 35 Ml/d and the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will require a long programme using more expensive alternative sources to balance supply- demand.	SRRN96	The Blagdon to Says Lane pipeline has sections of Class B (6 bar) rated pipeline. To minimise the risk of burst in the pipeline, which historically has suffered numerous bursts, the transfer rate from Blagdon to either Barrow or Banwell is currently limited to 35 Ml/d. The pumping station has the capacity to transfer 45 Ml/d without the limitation. Investigation of the condition of the pipe is currently on-going to determine if it is safe to run at the higher pressure required for the higher transfer rate. If the pipeline cannot run at the higher transfer rate then Bristol Water will incur extra cost in managing their water resources and carry more risk because they cannot transfer sufficient water from their southern sources. Replacement of the Blagdon to Says Lane pipeline is one option but is very expensive and there may be other alternative or options (for example cleaning the pipeline or rehabilitating it). This requires further survey, physical investigations and studies to assess what options are available.	Data collection and studies.	Condition camera/ survey along the whole main to determine the condition of the main and the pressure rating of the main. Feasibility study to determine options to allow transfer of the full capacity of the pumping station (45 Ml/d) to Barrow.	This solution will provide information on the cause of the restriction and devlop a cost effective solution for implementation. This is considered by us as a viable and informed approach to the need requirement.	Y
				Do Nothing	Continue business as usual, monitor risk through AMP7	This option is not considered viable as it will mot mitigate the identified risk or fulfil the need. The inability to transfer at high capacity is impacting on the resilience of the raw water network, for this reason this option has been discarded and will not be taken forward for intervention development.	No
SRR701	IF the current situation is allowed to continue with only a low transfer rate from Axbridge to Barrow THEN the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will require a long programme using more expensive alternative sources to balance supply- demand.	SRRN97	The pressure relief valves at Axbridge PS surge vessel are letting off regularly indicating the surge vessel is over pressurised. To prevent damage to the vessel the Axbridge PS is currently restricted to operating with 1 large pump only. (With 2 large pumps operating approx 48 Ml/d can be transferred to Barrow. With just one pump operating this reduces to approx 32 Ml/d) This limits the volume that can be transferred from Axbridge to Barrow. Preliminary investigations into the cause of the apparent high pressure at Axbridge have identified that a non-return valve at Rowberrow may be causing a restriction in the main. If the pipeline cannot run at the higher transfer rate then Bristol Water will incur extra cost in managing their water resources and carry more risk because they cannot transfer sufficient water from their southern sources. The nature of the problem is not fully understood and therefore further investigations, monitoring and studies are required to fully understand the problem and to determine what options mays be available to mitigate it.	Data collection and studies.	Monitoring of the pressure in the main. Camera surveys of the main including hot-tapping insertion points. Camera of NRV at Rowberrow. Hydraulic and pump analysis and monitoring. Feasibility studies into options to restore full transfer rate.	This solution will provide information on the cause of the restriction and devlop a cost effective solution for implementation. This is considered by us as a viable and informed approach to the need requirement.	Y
				Do Nothing	Continue business as usual, monitor risk through AMP7	This option is not considered viable as it will mot mitigate the identified risk or fulfil the need. The inability to transfer at high capacity is impacting on the resilience of the raw water network, for this reason this option has been discarded and will not be taken forward for intervention development.	No

7.6 Appendix E: Interventions Developed

This appendix shows the 3 interventions developed from the 11 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)	Other monetised Benefits (£k)
SRR664	IF Sherbourne TW is keep out of service of service for a prelonged period due to the complex issues associated with running and maintaining the site THEN there is a risk of losing the licence for the resource/site.	SRRN44	The site has been out of service since 2012. The Environment Agency are due to conduct a review of water abstraction licences by 2020/2025 for all water companies, with the view to reduce abstraction and evaluate sustainable practices. Any sources not being utilised are expected to come under scrutiny with a potential reduction in allowable abstraction limits. The source is likely to be required in future as demand in the BW network grows. Development of new sources costs in the region of £2.5M per ML and can take many years to achieve. Therefore it is likely to be cheaper to implement a scheme to keep Sherborne abstraction in service and so keep the licence, than to allow the licence to be lost and develop a new source in future. Investment is required to keep this source in service to prevent the licence being lost and avoid the delays and high cost of developing a new source when an additional resource is required in future.	Rehabilitate abandoned 21" raw pipeline	Rehabilitation of an abandoned 21" pipeline to allow treatment at a Stowey.	Viable and most cost beneficial solution, to use the old 21" main that linked the site to Stowey, advance to next design stage.	21.001.01	Sherborne to Stowey pipeline rehabilitation	7.3	0	13.717
SRR671	IF the current (AMP6) investigation reveals that the pipe cannot operate at sufficient pressure THEN the transfer rate from Blagdon will remain limited to 35 Ml/d and the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will require a long programme using more expensive alternative sources to balance supply- demand.	SRRN96	The Blagdon to Says Lane pipeline has sections of Class B (6 bar) rated pipeline. To minimise the risk of burst in the pipeline, which historically has suffered numerous bursts, the transfer rate from Blagdon to either Barrow or Banwell is currently limited to 35 Ml/d. The pumping station has the capacity to transfer 45 Ml/d without the limitation. Investigation of the condition of the pipe is currently on-going to determine if it is safe to run at the higher pressure required for the higher transfer rate. If the pipeline cannot run at the higher transfer rate then Bristol Water will incur extra cost in managing their water resources and carry more risk because they cannot transfer sufficient water from their southern sources. Replacement of the Blagdon to Says Lane pipeline is one option but is very expensive and there may be other alternative or options (for example cleaning the pipeline or rehabilitating it). This requires further survey, physical investigations and studies to assess what options are available.	Data collection and studies.	Condition camera/ survey along the whole main to determine the condition of the main and the pressure rating of the main. Feasibility study to determine options to allow transfer of the full capacity of the pumping station (45 Ml/d) to Barrow.	This solution will provide information on the cause of the restriction and devlop a cost effective solution for implementation. This is considered by us as a viable and informed approach to the need requirement.	21.001.02	Blagdon to Says Lane Data Collection and Studies.	0.117	0	66.702
SRR701	IF the current situation is allowed to continue with only a low transfer rate from Axbridge to Barrow THEN the deployable output will be more peak constrained and BW will be in a compromised position in managing water resources which will require a long programme using more expensive alternative sources to balance supply- demand.	SRRN97	The pressure relief valves at Axbridge PS surge vessel are letting off regularly indicating the surge vessel is over pressurised. To prevent damage to the vessel the Axbridge PS is currently restricted to operating with 1 large pump only. (With 2 large pumps operating approx 48 Ml/d can be transferred to Barrow. With just one pump operating this reduces to approx 32 Ml/d) This limits the volume that can be transferred from Axbridge to Barrow. Preliminary investigations into the cause of the apparent high pressure at Axbridge have identified that a non-return valve at Rowberrow may be causing a restriction in the main. If the pipeline cannot run at the higher transfer rate then Bristol Water will incur extra cost in managing their water resources and carry more risk because they cannot transfer sufficient water from their southern sources. The nature of the problem is not fully understood and therefore further investigations, monitoring and studies are required to fully understand the problem and to determine what options mays be available to mitigate it.	Data collection and studies.	Monitoring of the pressure in the main. Camera surveys of the main including hot-tapping insertion points. Camera of NRV at Rowberrow. Hydraulic and pump analysis and monitoring. Feasibility studies into options to restore full transfer rate.	This solution will provide information on the cause of the restriction and devlop a cost effective solution for implementation. This is considered by us as a viable and informed approach to the need requirement.	21.001.03	Axbridge to Barrow Data Collection and Studies.	0.136	0	70.097

7.7 Appendix F: Non-Selected Interventions

This appendix shows the non-selected intervention. See appendix D for costs or performance commitments.

ID	Intervention Title	Expected Capex after (£M)	Change in Opex (£k)	Residual Risk
21.001.01	Sherborne to Stowey pipeline rehabilitation	7.3	0	The site has been out of service since 2012. The Environment Agency are due to conduct a review of water abstraction licences by 2020/2025 for all water companies, with the view to reduce abstraction and evaluate sustainable practices. Any sources not being utilised are expected to come under scrutiny with a potential reduction in allowable abstraction limits. The source is likely to be required in future as demand in the BW network grows. Development of new sources costs in the region of £2.5M per ML and can take many years to achieve. Therefore it is likely to be cheaper to implement a scheme to keep Sherborne abstraction in service and so keep the licence, than to allow the licence to be lost and develop a new source in future. Investment is required to keep this source in service to prevent the licence being lost and avoid the delays and high cost of developing a new source when an additional resource is required in future.