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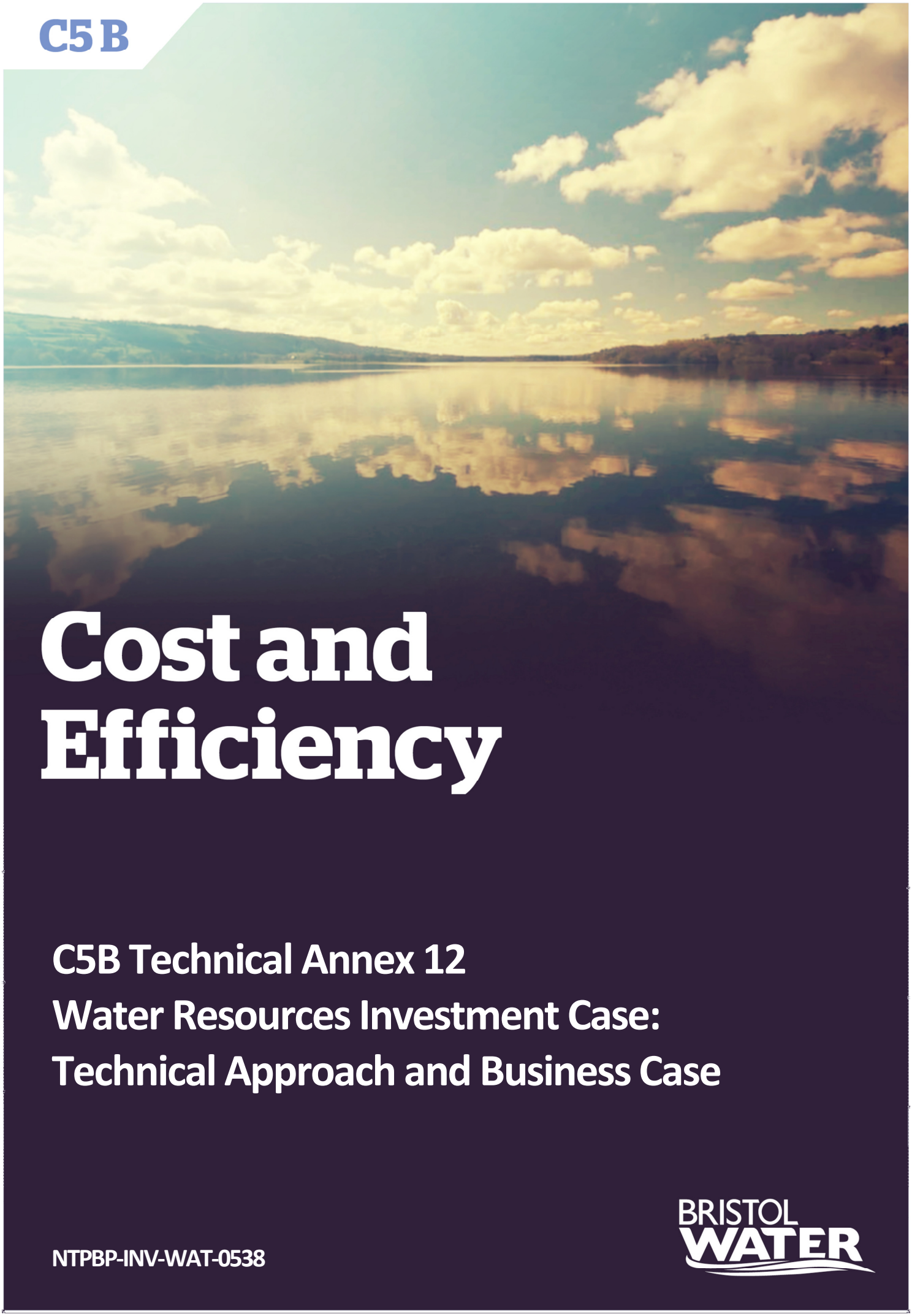

Cost and Efficiency

C5B Technical Annex 12
Water Resources Investment Case: Technical Approach and Business Case

NTPBP-INV-WAT-0538

BRISTOL WATER

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1 Foreword

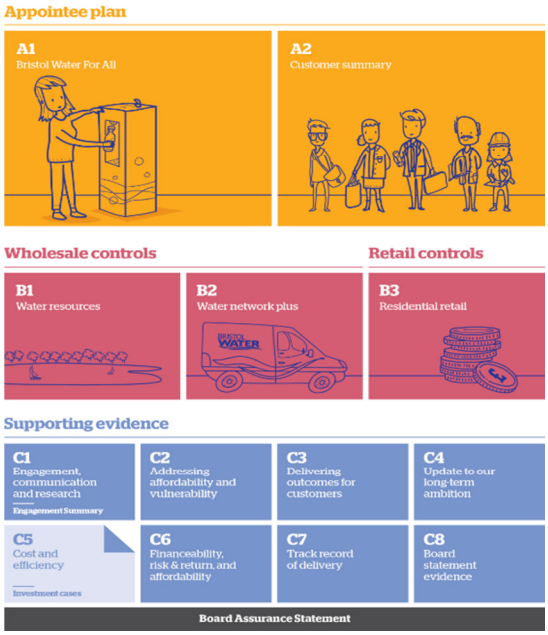
This Investment Case covers three distinct areas of asset investment related to Water Resources;

- The Water Resources Management Plan; - how we intend to manage water resources to meet customer demand now and into the future, whilst protecting the environment;
- Public access and recreation – provision of public access and amenities at our raw water reservoirs; and
- Inspection and maintenance of large raised reservoirs – how we will safe guard these critical assets into the future.

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

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

In order to provide customers with a reliable and environmentally sustainable water supply now and into the future, we will focus on maintaining the level of risk posed by our water resources and large raised reservoirs, and improve the customer access and enjoyment of our reservoir assets. We will achieve this by using our totex investment approach which includes investment of £8.026m. We will deliver five interventions that will contribute to providing our customers with a reliable and environmentally sustainable water supply. We will challenge ourselves to deliver more efficiently and apply innovation to the process we adopt to treat water. When considering our efficient and innovative approach we plan to deliver our water treatment works capital programme for £7.384m.

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 they want us to provide more and/or improved recreational facilities, with improved disabled access arrangements.

This investment case covers three key areas of investment that are closely linked with the management of our water resource assets. These areas are; investment to strengthen and improve our strategic water resource planning approach; investment in the recreational services we provide for our customers and the wider population at our reservoir sites; and investment to maintain the resilience and safety of our largest reservoir structures.

We plan to invest £8.026m in water resources from 2020 to 2025 (£1.123m on implementing our Water Resource Management Plan; £2.461m on lakeside recreation and access; and £4.442m on statutory inspection and maintenance of our reservoirs).

Our Water Resources Management Plan approach identifies a projected growth in population in our supply area, from 1.2 million people at present to 1.5 million by 2045. While this could lead to a significant increase in demand for water, our extensive customer engagement programme has revealed a clear customer preference for actions to save water before we develop new water resources. We need to help our customers become more water efficient and we need to ensure that our future planning approach uses the best information possible.

This investment case provides detail of the work we will carry out to update and improve our future Water Resources Management Plan process. Our customer research also shows that customers believe we should do more than just provide water. In a detailed survey, 66% of customers surveyed had visited our lakeside amenity sites or recreational facilities, and of the 34% that had not visited our lakes, almost all (98%) would consider visiting them in future if we are able to link more closely to the things they consider most important. We are fortunate in operating large reservoirs and lakes close to a major urban population, and in order to extend the appeal and access for these sites to a diverse society, we propose investment in these facilities to improve the service we provide.

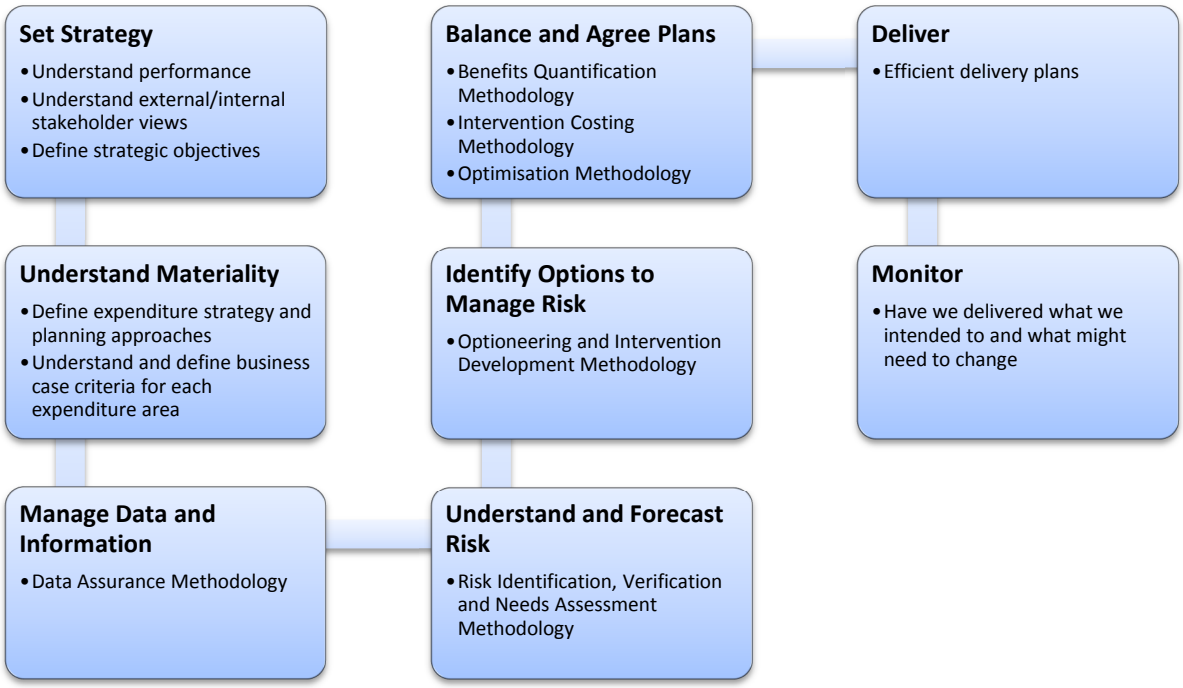
Finally, we operate large reservoir structures which, if not properly maintained, could represent a significant risk to public safety and to the resilience of customers' water supply. This investment case provides detail of the statutory programme of work we will carry out to ensure that these structures remain fit and well maintained and safe to use.

By carrying out the investment proposed, we will deliver the following benefits:

- We will provide the best-value long term planning approach for water supply and we will ensure that we fully understand and manage the water supply risks faced by our customers in the face of a changing climate;
- We will provide public access and recreation to a wider and more representative range of the population we serve, providing benefits to health and helping tackle growing social issues such as obesity and mental wellbeing; and
- We will ensure that our large storage reservoirs remain safe and fit to use in the long term, managing and controlling any risks to the structures in a way that maintains best value for our customers.

In order to ensure that we meet our customers' priorities and mitigate the risks associated with water resources we have adopted an asset management totex focused approach as set out in Figure 1.

Figure 1: Approach to meeting customer Priorities and Mitigating Risks



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

We plan to invest £8.026m between 2020 and 2025 in order to meet specific regulatory requirements and mitigate identified risks. No direct contribution to performance commitment targets has been attributed through this investment case.

We have set ourselves a challenging target of improving our efficiency by 8% during AMP7. This will be achieved by delivery of our business transformation programme results in in a post-efficiency investment of £7.384m.

88.2% of our investment for water resources is associated with water resources business unit and 11.8% associated with treated water distribution. All investment is categorised as maintaining the long term capability of the assets – non infrastructure.

3 Background To Our Investment Case

3.1 Context

Our supply area covers an area of some 2,400km^2, extending along the eastern flank of the Bristol Channel between Tetbury in the north and Glastonbury in the south. We currently supply approximately 1.2m people from our Mendip Hills reservoirs and from groundwater within our supply zone, with nearly half of our supply coming from a large abstraction from the Gloucester & Sharpness canal. This transfers water from outside our supply zone to supply our largest northern treatment works and accounts for approximately 46% of our licensed resource. In periods of dry weather, use of this source is maximised in order to conserve the water stored in our reservoirs.

The Mendip Reservoirs and their associated surface water abstractions account for approximately 42% of our available licensed resource. The remaining water is sourced within our water resource zone and is derived from groundwater and accounts for approximately 12% of our available licensed resource.

Our system for managing water is highly interconnected and for the purposes of water resources planning, we operate one integrated Water Resource Zone as agreed with the Environment Agency. Our Water Resources Management Plan sets out our approach for the management of our water resources for the benefit of our customers, the wider community and the environment for the period 2020 to 2045. Our plan proposes the most affordable programme of action to ensure that we can provide a reliable and resilient water supply to our customers, even in the face of severe drought.

Our asset base includes fourteen large raised reservoirs (defined as having a capacity greater than 25,000m^3 above natural ground level), that fall under the Reservoirs Act. As many of these reservoirs are over one hundred years old they are classified as high risk, we have a statutory duty to undertake condition assessment and maintenance to ensure that these key assets are available to us for safe and sustainable raw water storage into the future.

We own and manage around 900 hectares of land on and around our reservoirs. The lakeside estate is also a treasured asset within the community for social wellbeing and wildlife habitats. We were the first company to allow fishing on water supply reservoirs and one of the first companies to allow sailing at its water resource sites. This innovative approach continues, with new initiatives to bring paddle boarding, cycling facilities and other recreational benefits to the population we serve. The wellbeing benefit that our communities gain from our lakeside estate is at the heart of what makes Bristol Water special and we understand that our reservoirs mean much more to our customers than just water storage.

The Water Resources investment case strongly identifies with the messages that we received from our customers during our customer engagement programme, and our unique position within the community.

This investment case does not share performance commitment targets with any other investment case.

There are a range of synergies and interdependencies between this investment case and the Environment investment case. These are discussed below.

Abstraction Investigations

Abstraction investigations will overlap with the borehole analysis proposed in this investment case. There will be efficiencies around ensuring that environmental monitoring is implemented alongside pump tests for yield analysis. Those sites where both abstraction investigations and yield tests are required are:

- Banwell Springs;
- Chelvey Well;
- Honeyhurst and Wellhead;
- Oldford Boreholes; and
- Winscombe Borehole.

Proposals to improve data adequacy as part of the Water Resources Management Plan intervention will support delivery of environmental investigations under the WINEP, particularly those around abstraction sustainability.

Monitoring in relation to our Drought Plan proposed as part of the Water Resources Management Plan intervention will be aligned with requirements associated with WINEP adaptive management projects downstream of Chew and Blagdon Reservoirs..

Eel Passes

There will be synergy of working with the Environment investment case to ensure that our statutory obligations under WINEP to retrofit eel passes on sites where we are undertaking other remedial works are fulfilled. Relevant Bristol Water teams will work collaboratively in order to fulfil our reservoir related environmental obligations, including continued adaptive management of the flows downstream of reservoirs to meet the Water Framework Directive requirements.

Strategic Biodiversity Action Plan

The delivery of the actions from the Strategic Biodiversity Action Plan has a clear synergy with the Public Access and Recreation interventions to deliver a great customer experience of our lakes.

The implementation of good estate stewardship as set out in the WINEP is a dependency for the Lakeside Recreations Works intervention. Catchment management within this investment case will support our ambitions to improve public access assets, recreation assets and enhance visitor experience by improving raw water quality in the reservoirs.

3.2 Strategy

Developing the investment needs for our water resource and large raised reservoir assets 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 Water Resources Management Plan and Strategic Asset Management Plan, provides the strategic framework that supports this vision and enables investment in our water resources and large raised reservoir assets to clearly focus on delivering against outcomes and performance commitments.

Our long term strategy, as set out in the Outcomes Delivery Framework (section C3 of our business plan) has a focus on resilience and a growing need to ensure our assets are, and remain, well

maintained and effective in meeting our performance requirements. There are three strategic drivers identified that together ensure we meet our current and future needs for customers and stakeholders. These are:

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

Within this strategy there are specific Outcomes (Safe and Reliable Supply and Local Community and Environmental Resilience) that influence our investment in our water resources and large raised reservoirs, enabling us to continue to deliver a safe, high quality, and reliable drinking water supply to our customers and an improved local environment that they can enjoy.

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 short-term needs and the longer-term aims for Bristol Water, and drive the capability development plan and asset planning activities. Delivery of the investment for our water resources assets and large raised reservoirs 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 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 Bristol Water by stakeholders.

Our strategy for our water resource assets has two mains strands. Firstly we will maintain existing assets so that they are in good working order and are safe for people to use, and comply with our statutory obligations, both in the short term, between 2020-2025 and in the longer term through to 2045. The maintenance of our assets is at the heart of providing a Safe and Reliable Water Supply to our customers. Secondly, we will actively promote and develop our reservoirs as community assets, including improving access to these sites.

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.

Whilst the investment proposed does not contribute directly to performance enhancement via performance commitments, it does contribute more broadly towards achieving our outcome of providing a Safe and Reliable Supply

Specific details on our planned Investment for water resources can be found in section 5.

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

The health of our assets is a key element in delivering resilient water services to our customers. Our investment in our water resource assets and large raised reservoirs 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 water resources investment case supports the health and sustainability of our water resources assets and large raised reservoirs, and underpins the provision of a safe and reliable supply to our customers. Issues with our water resources assets and large raised reservoirs may under certain circumstances reduce or restrict our ability to feed water into our supply area or effectively store water before treatment, impacting our customers.

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

3.5 Compliance Obligations

Statutory and compliance obligations have influenced the development of interventions in this investment case and the proposed investment for AMP7. Relevant legislation is detailed below.

Our Water Resources Management Plan presents the analysis required by our regulators and Government to support our long-term plans for water resource management. It includes a full assessment of significant long-term issues such as population growth and climate change, and ensures we have plans in place to enable us to continue providing a reliable supply of water to our customers, while supporting a healthy environment and maintaining the level of service our customers expect at an

affordable cost. Where we identify a need for action because there is a potential shortfall in available water (known as a supply-demand deficit), we assess a range of options to manage this deficit.

The Water Industries Act (1991) and its amendments in 2003, require all water companies to produce a Water Resources Management Plan and to update it every five years. Each Water Resources Management Plan builds on the one before, updating the plan based on the latest information, technology, regulatory guidance and the views of our customers and stakeholders. Our Water Resources Management Plan 19 development approach has identified key areas for improvement in Water Resources Management Plan 24 and these obligations are expressed within Water Resources Management Plan 19 as improvements for future plans. These improvements have been agreed with Defra and if the Water Resources Management Plan 19 contribution were not to be fully implemented, this could pose the risk that Defra may not approve our Water Resources Management Plan 24 and associated financial business plan.

We have statutory obligations under multiple pieces of legislation and Codes of Practice to ensure that we make our land and water available for recreational and other use, and that the public have access to our areas of natural beauty. These pieces of legislation include:

- The Water Industry Act 1991;
- Code of Practice on Conservation, Access and Recreation (2000): Guidance for the Environment Agency and Water and Sewerage Undertakers;
- Equality Act 2010; and
- Countryside and Rights of Way Act 2000.

We have a statutory obligation under the Wildlife and Countryside Act 1981, Conservation of Habitats and Species Regulations (Habitats Regulations) 2017and Natural Environment and Rural Communities Act 2006, to protect and enhance the favourable status of Sites of Special Scientific Interest and Special Protection Area designated sites in our stewardship.

We have a statutory obligation under the Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act 1979 to preserve and protect important buildings, sites and objects of archaeological, engineering or historic interest, which includes Blagdon Pumping Station and Blagdon Lodge.

We also have a statutory obligation under the Reservoirs Act 1975 to safeguard against failure of our fourteen large raised reservoirs[2]. The maintenance of our assets is at the heart of providing a safe and reliable water supply to our customers; nowhere is this more so than in safeguarding our large raised reservoirs. These not only provide key storage facilities but also possess significant potential for catastrophic impact on local communities, property and the environment in the event of asset failure.

Within this investment case there are specific risks that we are seeking to mitigate in order to ensure our continued compliance with the regulations described above. These are explained in section 5.

[2] Defined as having a capacity greater than 25,000m^3 sitting above natural ground level.

3.6 AMP6 Investment And Performance

Our AMP6 investment in water resources 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.

A summary of our AMP6 investment in water resources is provided in Table 1 below. 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 1: AMP6 capital investment

Year	Water resources capex (£m)
2015/16 actual	0.198
2016/17 actual	0.282
2017/18 actual	0.665
2018/19 forecast	1.104
2019/20 forecast	0.763
AMP6 forecast	**3.012**

Our AMP6 investment delivers targeted improvement to our fisheries and recreational lakeside services, and enabled emergency draindown investigations and statutory asset inspections and subsequent remedial and maintenance works.

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 wholelife of the asset, regardless of whether it is operational expenditure (opex) or capital expenditure (capex).

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

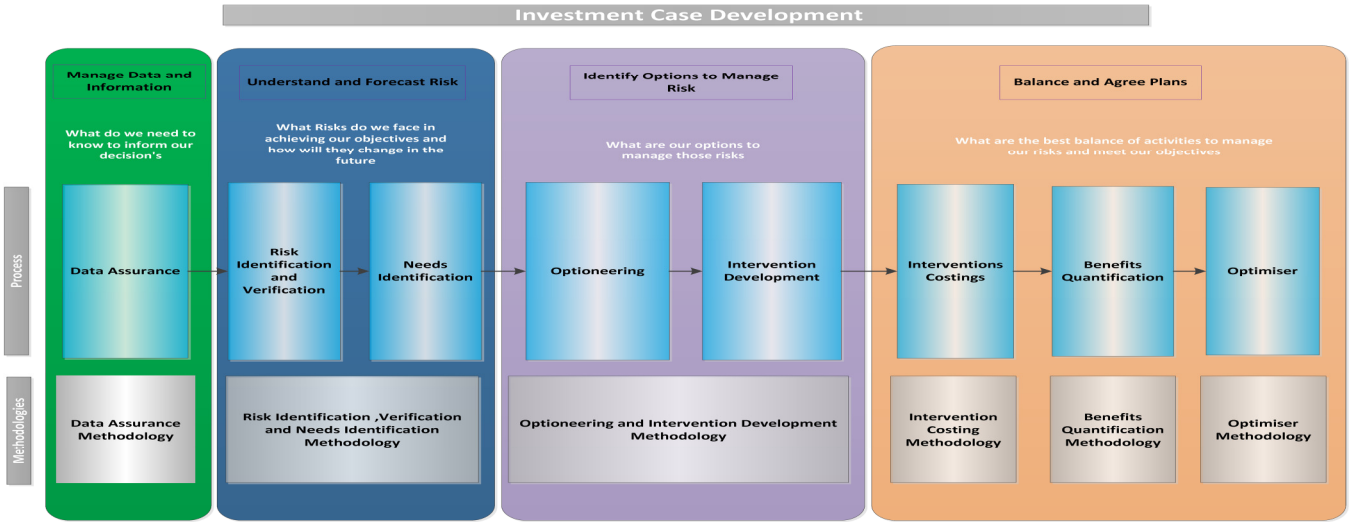
We have created and implemented a process that is supported by a set of six methodologies. When developing the methodologies, we wanted to ensure that they:

- 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 Development Process - Level 1 Diagram



4.1.1 Data & Data Assurance

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

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

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

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

We have selected a sample of nine investment cases, and have applied detailed data assurance based on their value and complexity. The total value of these nine investment cases represents 66% (circa £140m) of the total capital investment plan, and represents two hundred and eighty six individual data types. We have evaluated all two hundred and eighty six 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;
- 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;
- 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.

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 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 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 of build our cost database.

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

Therefore we have assessed the expected capital cost of each intervention.

Expected Capital Cost (capex after)

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

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

4.1.5 Benefits Quantification Methodology

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

Benefits can be assessed as either being:

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

Both direct and indirect benefits are considered and quantified.

Direct Benefits

We have a totex approach which considers both capex and opex.

Expected Capital Cost (capex before)

If we deliver the capital 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 Strategic 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 opex 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 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 opex 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 measured 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 wholelife costs. The investment optimisation process calculates the whole life cost as the net present value 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; or
- 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 Water Resources

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

4.2.1 Risk Identification, Verification & Needs Assessment Methodology

There were twenty seven risks identified in the Strategic Risk Register associated with this investment case. Every risk went through a process of assessment, scoring and review, following the Methodology of Risk Identification, Verification and Needs Identification.

Eight risks were selected and developed into need statements. The risk descriptions, scoring and associated needs statements are captured in the Strategic Risk Register. Details of the selected risks are provided in Table 2 below.

Table 2: Risk Identification and link to Performance Commitment

SRR ID	Risks identified & selected for intervention development	Performance Commitment
SRR649	**IF** Bristol Water does not meet its statutory obligations as set out in the Water Resource Management Plan, **THEN** Bristol Water will risk prosecution, increase drought risk, reduce reliability of supply and reduce affordability among other risks.	WINEP Compliance; Abstraction Incentive Mechanism (AIM); Biodiversity Index;; Legislative Compliance
SRR639	**IF** Barrow No.3 Reservoir does not comply with the requirements set out in statutory guidelines **THEN** Bristol Water is placing customers at risk and is itself at risk of prosecution.	Legislative Compliance
SRR640	**IF** Blagdon reservoir does not comply with the requirements set out in statutory guidelines **THEN** Bristol Water is placing customers at risk and is itself at risk of prosecution.	Legislative Compliance
SRR642	**IF** Chew Valley Reservoir does not comply with the requirements set out in statutory guidelines **THEN** Bristol Water is placing customers at risk and is itself at risk of prosecution.	Legislative Compliance
SRR646	**IF** Cheddar Reservoir does not comply with the requirements set out in statutory guidelines **THEN** Bristol Water is placing customers at risk and is itself at risk of prosecution.	Legislative Compliance
SRR751	**IF** S10 & S12 statutory inspections are not carried out **THEN** risk of prosecution for failing to meet 1975 Reservoirs Act.	Legislative Compliance
SRR786	**IF** mandatory maintenance items (such as "Matters in the Interest of Safety") arising from statutory inspections are not carried out **THEN** risk of prosecution for failing to meet 1975 Reservoirs Act.	Legislative Compliance
SRR672	If Bristol Water does not invest in maintaining and improving statutory access to the lakeside estate then Bristol Water is at risk of damaging its reputation with its customers, communities, stakeholders and investors. Moreover, there is a risk of fines and further reputational damage if disability access is not improved.	CMex: Local Community Satisfaction

Nineteen risks were not selected and these risks return to being monitored and reviewed under our business as usual risk management process. Details of the non-selected risks are provided in Appendix C.2.

An example of a non-selected risk is given below in Table 3:

Table 3: Example of an Unselected 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
SRR695	20	Purton Severn Intake Works PS	IF intake aerator fransformer fails THEN loss of power and water quality issues until temporary generator connected (Purton Pumping Station Severn Intake Works)	2	1	3	1	3	1	3	6

In the example above, there is a risk of failure of the intake transformer at Purton Treatment Works intake. The aerators are installed in the Purton 1 and 2 storage reservoirs to mitigate water quality issues and they run for six months of the year. In the event of a transformer failure whilst the aerators are in use, deployment of a standby generator would be required. This risk was considered as an operational risk which can be resolved under business as usual and was scored accordingly. For this reason, it was not taken forward into the investment planning process for AMP7.

The 'Line of Sight' for the whole process, beginning with the selected risks, the source of the risk, a record of source documents used to verify the risks, and the needs statements, is captured in the Water Resources Interventions Register[3].

4.2.2 Optioneering & Intervention Development Methodology

As described in section 4.2.1, eight risks were selected and developed into needs statements. Further investigation of these needs included data assimilation, analysis and consultation with key stakeholders. Multiple options were developed and recorded for each of the eight needs statements. These options were peer reviewed and all options identified as not viable were discarded. Viable options were converted into interventions. Each intervention had its costs and benefits assessed.

For example, against the selected risk SRR751 regarding the failure to undertake Section 10 and 12 statutory inspections of reservoirs, three options were identified and all of these were developed into intervention, as shown in Table 4.

[3] Bristol Water, Water Resources IC Intervention Register, NTPBP-CAL-WAT-0149

Table 4 Example of Options Selection

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options			Proposed Interventions	
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?	Ref. No.	Intervention Title
SRR751	**IF** S10 & S12 statutory inspections are not carried out **THEN** Bristol Water is placing customers at risk and could be prosecuted for failing to meet 1975 Reservoirs Act.	SRRN183	An investment is required to implement statutory reservoir inspections to achieve legislative compliance, protect our customers and ensure the safe operation of our reservoirs	Large Raised Reservoirs Proactive and Statutory Inspection	Programme of statutory inspections covering all large raised reservoirs (S10 and S12 inspections)	Viable option	20.002.02	Large Raised Reservoirs Proactive and Statutory Inspection
				Service reservoir inspections	Inspections at Pucklechurch and Victoria service reservoirs	This option splits SR and RWR inspections - both of which are viable options	20.002.04	Large Raised Service Reservoirs Statutory Inspection
				Raw water reservoir inspections	Inspections at all 12. no. raw water reservoirs	This option splits SR and RWR inspections - both of which are viable options	20.002.05	Large Raised Raw Water Reservoirs Statutory Inspection

A total of seven interventions were identified in this way. There were no multiple interventions against a single selected risk that required identification as mutually exclusive during intervention selection.

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.

4.2.3 Intervention Costing

As described in section 4.2.2, we have identified a total of seven interventions to be taken forward for scope development and cost estimation. Intervention costs were either calculated in house or calculated in collaboration with ChandlerKBS or external consultants Ricardo. The approach taken is described below.

Costs associated with reservoir draw down were developed by ChandlerKBS. A high level scope document was developed including an activity schedule, ChandlerKBS utilised a water industry unit cost database to complete cost estimation in accordance with their own assured methodology. The costed activity schedules were returned to us and peer reviewed against historical cost data held by Bristol Water, leading to further refinement in collaboration with ChandlerKBS.

The cost of inspection and maintenance our large raised reservoirs was prepared in-house, based on historical AMP6 project data.

The cost of for the Water Resource Management Plan intervention was prepared by Ricardo. The cost was based on a scope we supplied. The consultant costed the intervention based on their understanding of the work involved and the associated time and expertise requirements. The costed interventions were returned to us for peer review, leading to further refinement in collaboration with the consultant. These costed interventions are presented in Appendix E.

The public access and recreation interventions were costed in-house. Major asset costs were based on independent surveyor estimates following asset condition surveys. Extrapolation of historical cost and internal costings was applied for minor asset costings.

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

Cost Example: Large Raised Reservoirs Proactive & Statutory Maintenance

Investment is required to implement statutory reservoir inspections to achieve legislative compliance, protect our customers and ensure the safe operation of our reservoirs.

We have established a cost of undertaking the works of £2.519m, which includes labour and materials as well as contractual costs. The latter includes items such as (but not limited to) contractor accommodation, contractor management, contractor overhead and profit, and design. We have then applied Bristol Water's overhead of £0.409m for internal activities associated with the intervention, such as project management, land & compensation, legal, environmental costs, commissioning/handover, contract management, operations & system support, consultants and administration.

All of the direct costs above gave us an intervention cost of £2.928m to implement the intervention in a planned way (the capex after).

If however, we had to undertake this work in a reactive manner then we would expect to pay a premium for delivery. For example, labour rates at premium working agreement levels, materials at short notice, transport of materials at short notice, and specialist support and design out of hours at a premium rate. Our assessment is that we would increase the delivery cost by £0.878m, leading to a total cost of £3.806m (the capex before).

We have established that if we undertook the above intervention in either a planned or reactive way, there would be no increase or decrease in opex generated (opex after).

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

4.2.4 Benefits Quantification

The seven water resources 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. However, the Water Resources Management Investigations (20.001.01) and Appointed Lakeside Recreation Works – Regulatory Elements Only (20.003.02) will contribute monetary benefits categorised as 'Other Monetised Benefits' as described below.

The "other" indirect benefits which have been calculated and recorded in the benefits calculations include reduction of our bulk transfer agreement with Wessex Water as a an outcome of the Water Resources Management Investigations (20.001.01), and the avoidance of fines if we were to fail to comply with the Disability Discrimination Act 1995 statutory requirements regarding access to our reservoir amenities (20.003.02 - Appointed Lakeside Recreations Works - Regulatory Requirements Only and 20.003.03 - Appointed Lakeside Recreation Works - Non Regulatory Elements).

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

5 Outcomes

5.1 Selected Interventions

The seven interventions developed within the Water Resources investment case were assessed through the investment optimisation process. Of these seven interventions, six were selected.

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

Table 5: Selected interventions and costs

ID	Intervention Title	Capex (£)	Change in Opex per annum (£)
20.001.01	Water Resources Management Investigations	£1,123,000	£150,000
20.002.02	Large Raised Reservoirs Proactive and Statutory Maintenance (of Service Reservoirs, and incorporating intervention 20.002.99 for Raw Water Reservoirs)	£2,928,040	£0
20.002.04	Large Raised Service Reservoirs Statutory Inspections	£216,270	£0
20.002.05	Large Raised Raw Water Reservoirs Statutory Inspections	£1,297,620	£0
20.003.02	Appointed Lakeside Recreations Works - Regulatory Requirements Only	£1,479,482	£0
20.003.03	Appointed Lakeside Recreation Works - Non Regulatory Elements	£981,318	£0
Water Resources capital investment (pre-efficiency)		**£8,025,730**	**£150,000**
Water Resources capital investment with 8% capex efficiency		**£7,383,672**	

Of the six interventions selected, four were selected because they are mandatory to meet our statutory obligations (see section 3.5). The remaining two interventions were selected because they are cost-beneficial, helping to offset future bill increases for our customers

Despite not contributing to our performance commitment targets, the selected interventions contribute to our customer outcome of a Safe and Reliable Supply.

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

Water Resources Management Investigations (20.001.01)

Consultation with (and guidance from) our regulators (primarily the Environment Agency), in relation to our Water Resources Management Plan 2019, has illuminated best practice. This has led to the development of this intervention. The Water Resources Management Plan will be delivered primarily by way of consultancy support, overseen by our managers to ensure efficient delivery. Our approach will follow best practice and all appropriate guidance.

The Water Resources Management Plan intervention includes the following:

- A review and update of our flow records (used to define deployable output and the marginal yield of any water resource schemes). This will also support environmental investigations including those on the Water Industry National Environment Plan (see the Environment investment case).
- Re-assessment of our reservoir control curves.
- Improvement of data required for Demand Forecasting. This will include occupancy surveys and work on developing datasets specific to Bristol Water, used to define the demand forecast (for example micro component and macro component assumptions). This is an area where there is opportunity for improvement in terms of the data availability. At the moment we have identified ourselves as being at 'low risk' in terms of the problem characterisation process undertaken for Water Resources Management Plan 19. However, there is only a narrow margin if we are to avoid falling into the higher risk category.
- Environmental monitoring for our drought plan.
- Borehole yield analysis for all borehole sites, including condition surveys of the borehole head works, CCTV surveys and investment optimisation of borehole pump levels at all fifteen of our borehole sites.

This intervention will contribute to ensuring our Safe and Reliable Supply customer outcome by ensuring the on-going life of our assets and better use our water resources.

Large Raised Reservoirs Proactive and Statutory Maintenance and Statutory Inspections (20.002.02, 20.002.04 and 20.002.05)

The inspection and maintenance of our large raised reservoirs will be delivered primarily by way of consultancy support, overseen by our managers to ensure efficient delivery. Our approach will follow best practice and all appropriate guidance.

Large Raised Reservoirs Proactive and Statutory Maintenance (20.002.02)

We have a statutory duty to undertake annual monitoring and supervision of our large raised reservoirs. This intervention will allow us to carry out both statutory and proactive maintenance arising from the SI0 and S12 inspections. Reservoir maintenance plans have been produced and sanctioned by the incumbent Reservoir Engineers (included as statutory items under section 10)3)b) of the periodic inspection reports as the reservoirs are inspected). We have to maintain an action plan of all work required, with prioritisation which addresses statutory compliance actions and due dates. This encompasses all of our fourteen reservoirs, and has been used to determine the level of investment required in AMP7.

Base maintenance opex is required to manage our reservoir stock on a day to day basis and enable the routine surveillance to be completed effectively. This allocation includes annual routine grounds maintenance (including cleaning masonry structures, managing vegetation (both grass and intrusive/ detrimental hardwood plants)) and ensures the structures can be inspected for damage and any anomalies identified, monitored and assessed. This opex base maintenance is not included in this investment case.

Maximising our large raised reservoirs ensures the on-going asset operability, as well as safeguarding local communities against their failure. Intervention 20.002.02 covers Large Raised Reservoirs Proactive and Statutory Maintenance of Service Reservoirs, and incorporates a sub-intervention (20.002.99) for Proactive and Statutory Maintenance of Large Raised Raw Water Reservoirs)

Large Raised Reservoirs Statutory Inspections (20.002.04 and 20.002.05)

These interventions will address the need for an Approved Engineer to carry out statutory inspections on the eight reservoirs identified in Table 6. These inspections are due every 10 years and the Inspecting Engineer is required to produce a Periodic Inspection Report (S10) for each inspection. The S10 reports identify any 'matters in the interest of safety' and 'other matters', which we must address in accordance with a programme of work agreed with the Inspecting Engineer. They also identify any 'statutory maintenance' which will require completion before the next periodic inspection.

Table 6: Section 10 Periodic Inspections Due In AMP7.

Reservoir ID	Date of last S10	Inspecting Engineer	Latest Date for next S10	Inspecting Engineer proposed	AMP
Cheddar	12/05/2011	ALW	**12/05/2021**	ALW	7
Barrow Comp	19/07/2011	JPM	**19/07/2021**	AJB	7
Barrow No.3	23/08/2016	AJB	**23/08/2021**	AJB	7
Blagdon	14/08/2012	ICC	**14/08/2022**	ICC	7
Purton 1&2	04/08/2014	ICC	**30/10/2023**	ICC	7
Victoria	11/12/2013	ALW	**11/12/2023**	ALW	7
Pucklechurch	15/04/2014	ICC	**15/04/2024**	ICC	7

The interventions also provide an allocation for the Supervising Engineer to perform annual inspections and to produce Section 12 Statements (S12), which may include additional recommendations. S12 inspections are required on an annual basis for the following reservoirs:

- Barrow Comp
- Barrow No.1
- Barrow No.2
- Barrow No.3
- Blagdon
- Cheddar
- Chew Magna
- Chew Valley Lake
- Litton Lower
- Litton Upper
- Purton 1&2

Appointed Lakeside Recreations Works - Regulatory Requirements Only and Non Regulatory Elements (20.003.02 and 20.003.03)

Public access and recreation is inherently community-oriented and this is matched in our technical approach to these interventions. Our approach will be to involve the community in all aspects - from co-creation of concepts, to delivery and in-service management within community partnerships.

The following work is proposed:

- Refurbish our flagship lakeside leisure facilities at Chew Valley, Blagdon and Cheddar, enabling up to half a million visitors a year to enjoy the South Bristol/Mendip lakes and countryside;
- Refurbish buildings and grounds infrastructure; including those occupied by leisure related tenants, such as restaurants and water sports clubs where landlord obligations apply;
- Support the development of a new recreational trail at Chew Valley Lake;
- Improve our disabled access arrangements;
- Refurbish our national level sport fishing venues within our Bristol Water Fisheries activity;
- Introduce lifecycle monitoring and management of access related assets around our nine waterways in the South Bristol/ Mendip region; including independent surveys of major features; and
- Investigate and implement improved techniques for measuring visitor numbers and visitor satisfaction.

To ensure that our activities meet our customer outcomes, we have set realistic, measurable targets for our AMP7 programme. We will track our success against the following measures:

- customer and community feedback, including from our leisure tenants, lake user community, online survey panel and site visitor surveys for satisfaction ratings;
- The footfall of visitors;
- By benchmarking to other water companies and other owners of land of public interest, for example the National Trust;
- Sites of Special Scientific Interest status ratings, for example percentage of sites in 'favourable status' and our Biodiversity Index; and
- Financial indicators, to ensure that we are delivering value for customers throughout our estate.

Appointed Lakeside Recreations Works - Regulatory Requirements Only (20.003.02)

We have a statutory duty to provide public access to our lakesides. Existing facilities are in need of repair and upgrade to maintain current access. However, we acknowledge that disability access at all sites is poor. There is a need to address this to prevent discrimination and potential fines as a result of discrimination. This intervention addresses the variable standard of disabled access and facilities at all of our lakeside recreational sites.

Appointed Lakeside Recreation Works - Non Regulatory Elements (20.003.03)

This intervention is in addition to 20.003.02 (Appointed Lakeside Recreation Works – Regulatory Requirements only) and will provide the enhanced public access and improvement programmes, together with improvement programmes identified due to their high importance to customers and/or high opportunity for leveraging community partnership working.

customers overwhelming supported enhancing public access and recreation where there is minimal impact on wildlife. Walking was identified as the most popular activity, but there is increasing customer demand for family cycling and paddle sports.

These schemes will include;

- Chew Valley Cycle Trail – investment to support a potential Defra funded regional scheme;
- Chew Valley Picnic Area 2 development – investment to provide a small scale beverage outlet (leasehold operated); and
- Blagdon visitor and educational centre regeneration – investment to support the regeneration and re-launch of Blagdon visitor and educational centre.

This intervention visibly demonstrates our commitment to meeting customers' priorities and delivering real benefit for the local community and the environment.

This investment case is aligned to the Water Network Plus Wholesale Control category of our business plan. Costs are allocated to the Water Resources and Treated Water Distribution Business Units. Investment is all related to the maintenance of non-infrastructure assets.

Water Service and Business Unit Allocation is summarised in Table 7.

Table 7: Water Resources Investment – Water Service and Business Unit Allocation

Wholesale Control	**Water Resources**	**Water Network Plus**	**Total**
Business Unit Allocation	***01 Water Resources***	***04 Treated Water Distribution***	
Water Resources capital investment (%)	**88.2%**	**11.8%**	**100%**
Water Resources capital investment	**£7.079m**	**£0.946m**	**£8.026m**
Maintaining the long term capability of the assets - infra	£3.495m (43.6%)	£0m (0%)	**£3.495m (43.6%)**
Maintaining the long term capability of the assets - non-infra	£3.584m (44.7%)	£0.946m (11.8%)	**£4.530m (56.4%)**
Water Resources capital investment with 8% capex efficiency			**£7.384m**

5.2 Innovation

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 costs 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 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 innovative techniques that mean we can contribute to our 8% efficiency challenge and keep our customers' bills low into the future.

Innovation specific to this investment case is discussed below:

Demand Forecasting offers opportunities for innovation. Specifically, it will provide opportunities to develop new partnerships with stakeholders across our supply area, in order to create new and innovative ways to help customers become more resource efficient – such as our new initiative, Resource West, which brings together key partner organisations in water, energy and waste management; "to share knowledge, take action and cut waste".

Multi-sector partnerships

We have recently set up two significant new partnerships on the links between water, energy and other key resource issues such as food supply and waste management.

Our **Resource West** initiative brings together key players in water including the regional water companies, local government such as Bristol City Council and the West of England Combined Authority, organisations involved in waste management such as Bristol Waste, and organisations involved in energy management such as Bristol Energy and the Bristol Energy Network, to identify projects and knowledge that enables partners to achieve greater resource savings than could be possible with the organisations operating in isolation.

The newly launched **SUNEX** project (Sustainable Urban Nexus) brings together organisations across the world from Bristol to Doha, examining the common themes of food water and energy and how the nexus of these themes can be explored through shared modelling, investigation and research to identify the most effective ways to improve resource efficiency. One of the key areas under exploration in this project, which operates under the EU Sustainable Urban Globalisation Initiative is the water consumption impact of urban food growing and gardening.

As part of Bristol's successful bid to become EU Green Capital in 2015, Bristol Water is strongly engaged in local communities and we will take this opportunity to focus through the SUNEX project on one of the more volatile and growing areas of water use: garden watering. We believe this represents a significant opportunity to help customers use less water and cut their per capita consumption.

Public Access and Recreation

Public access and recreation is an inherently a community oriented function and therefore it benefits from community approaches such as partnerships and community co-creation.

Two examples are:

Chew Valley Lake Recreational Trail - The CVLRT is a community partnership between Bristol Water, Bath & North East Somerset West of England Rural Network and Sustrans. The intention is to form a Trust or Community Interest Company to manage and maintain the trail once it is developed in AMP7. This facilitates investment from community businesses and local people that benefit from the trail, as well as encouraging a volunteer ethos.

The Conservation Volunteers - Community volunteering organisations such as 'The Conservation Volunteers' may access grants to and volunteers to reduce the overall cost of public access improvements. We have been working with TCV throughout AMP6 on projects such as the replacement of boardwalks and bird hides; we plan to grow the scope of our joint working in AMP7.

5.3 Contribution to Performance Targets

The investment case for water resources is concerned with meeting specific regulatory requirements and mitigating identified risks. Although no direct contribution to performance commitment targets has been attributed through this investment case, the interventions selected address the health and sustainability of our water resource assets and large raised reservoirs and underpin our customer outcome of a Safe and Reliable Supply.

5.4 Non Selected Interventions

Of the seven interventions developed within this investment case, one was not selected – 20.002.01 Reservoir Rapid Draindown Compliance. During the business reviews that we completed following investment optimisation and prior to finalising the AMP7 investment plan, the business took the decision to exclude this intervention from the investment plan. New guidance identifying reservoir draw down requirements was issued in August 2017 and will come into effect at reservoir inspections pending in AMP7. Any shortfall identified during the inspection will require re-mediation before the next inspection, or potentially at an earlier date if identified as a 'Matter of Safety'. The risk associated with this intervention will be carried during AMP7. We will continue to monitor the residual risk throughout AMP7, and if the process requires the risk to be mitigated in AMP, we will respond with appropriate action. If this does not materialise, the intervention will be implemented in AMP8.

Details of the non-selected intervention are given in Table 8 below, with further details provided in Appendix C.

Table 8: The Non-Selected Intervention and Residual Risk

SSR ID	Risk Statement	Need Statement	Non-Selected Intervention & Residual Risk
SRR639	IF Barrow No.3 Reservoir does not comply with the requirements set out in statutory guidelines THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	Investment is required for implementation of reservoir draw down at Barrow No.3, Blagdon, Cheddar and Chew Valley Reservoirs to meet new reservoir drain down guidance - reservoir safety and emergency planning (issued Nov 2017).	20.002.01 Reservoir Rapid Drain down Compliance modifications at Barrow 3, Blagdon, Chew Valley Lake and Cheddar sites.
SRR640	IF Blagdon reservoir does not comply with the requirements set out in statutory guidelines THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.		
SRR642	IF Chew Valley Reservoir does not comply with the requirements set out in statutory guidelines THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.		
SRR646	IF Cheddar Reservoir does not comply with the requirements set out in statutory guidelines THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.		

Reservoir Draw down Studies

We are in the process of completing the AMP6 drawdown studies for all the large raised reservoirs. We prioritised Chew Valley Lake, Blagdon, Cheddar and Barrow Reservoir 3 as those reservoirs previously identified as requiring drawdown enhancements. From the initial drawdown study results attained, the four reservoirs require works to increase the reliable drawdown capacity to ensure compliance with industry best practice guidance (Guide to drawdown capacity for reservoir safety and emergency planning, August 2017).

Barrow Reservoir 3

Next Periodic inspection due before 23/08/2021 – the drawdown enhancement works are highly likely to be included as a Matter in the Interest of Safety in the Periodic Inspection Report and will therefore become a statutory obligation with a definitive completion deadline.

Cheddar Reservoir

Next Periodic inspection due before 12/05/2021 – the drawdown enhancement works are highly likely to be included as a Matter in the Interest of Safety in the Periodic Inspection Report and will therefore become a statutory obligation with a definitive completion deadline.

Blagdon Reservoir

Next Periodic inspection due before 14/08/2022 – the drawdown enhancement works are highly likely to be included as a Matter in the Interest of Safety in the Periodic Inspection Report and will therefore become a statutory obligation with a definitive completion deadline.

The deadlines imposed by the Reservoir Panel Engineer in their periodic inspection report would likely be dependent upon the complexity of the works involved. However, it is anticipated that the deadlines would be before the end of AMP7. There may be other investigational works (funded from the infrastructure base maintenance allocation) instructed as a Matter in the Interest of Safety to provide better understanding of our asset and its vulnerability to differing failure modes. Once the vulnerability of the reservoir has been assessed, a risk based approach can be used to refine the drawdown study assessment, potentially reducing the target drawdown level to be achieved.

Chew Valley Lake Drawdown interventions

From the results of the Chew Valley Lake study it is evident that there is a significant shortfall in the existing drawdown rate when compared to the industry best practice guidance (currently circa 15% of guidance capacity). To enhance the drawdown rate to comply with industry best practice guidance will require significant spend and intrusive works, potentially circa £5m (cost based on similar works completed on other reservoirs). In this instance, it is proposed that a longer term strategy is instigated encompassing a staged approach to increasing the drawdown capacity, completing the 'easy win' works in AMP7 (which are always going to be required) and undertaking intrusive site investigation works, enabling a more detailed risk based approach to be completed, rationalising the need for the 'hard win'.

There are currently two statutory Matters in the Interest of Safety that we are required to undertake at Chew Valley Lake. These include intrusive works that will be utilised to provide valuable data to assist with better understanding of our asset and its vulnerability to differing failure modes. Once the vulnerability of the reservoir has been assessed, a risk based approach can be used to refine the drawdown study assessment, potentially reducing the target drawdown level to be achieved.

The next periodic inspection for Chew Valley Lake is due before 10/03/2026. If we have not completed any drawdown enhancement works or investigations/preparatory works by this time, the drawdown enhancement works (worst case to meet the 85% shortfall currently faced) are highly likely to be included as a Matter in the Interest of Safety, and will therefore become a statutory obligation with a definitive completion deadline which will require significant unplanned spend.

5.5 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[4]. Assumptions specific to this investment case are discussed below.

If a new model is implemented to re-assess reservoir control curves, the cost of the intervention will double as there will be a requirement to run two models in parallel for changeover and calibration period.

If our reservoir control curves and flow records are reviewed and updated, this could theoretically reduce our deployable output.

Typical land management capital costs, such as woodland and hedgerow management, are collated within the Environment investment case rather than in this investment case.

The Chew Valley Lake Recreational Trail development is 100% funded by Defra's Rural Growth Programme as part of on-going community partnership between us, Bath & North East Somerset West of England Rural Network and Sustrans. The investment proposed in this investment case is to support the Chew Valley Lake Recreational Trail community partnership only, and includes things like ancillary elements that may fall outside of the direct funding agreement, but which add strong value to the overall trail experience.

It is assumed that planning permission for new developments or changes is granted as necessary within timescale constraints.

Proposals for powered vehicle gates to support disabled access presuppose innovative technology based solutions and close proximity to mains power. The intervention cost includes minor civils works only.

Refurbishment works at Blagdon Pumping Station are limited to essential works to preserve the Grade II listed building. The costs do not include major refurbishment of the visitor centre.

5.6 AMP 8

Many of the risks will continue on into AMP8 as they relate to compliance with legislation. New legislation implemented after the submission of this business plan and/or during AMP7 may present additional areas of compliance for consideration in AMP8.

At the current time there is no reason to expect that the scale and profile of investment required in AMP8 would be substantially different to that required for AMP7.

The Reservoir Rapid Draindown Compliance intervention (20.002.01) that was not selected for inclusion in the MAP7 business plan will be reappraised for investment in AMP8.

[4] Bristol Water, 2018, PR19 Investment Cases Summary Document ,NTPBP-INV-PR1-0635

5.7 Base Maintenance

This investment case covers all activities related to water resources therefore no assessment of base maintenance investment is required.

There is base maintenance investment which is not included within this investment case, covering the day to day operational activities associated with managing our reservoir stock and routine grounds maintenance that enables the routine surveillance to be completed effectively. Reservoir maintenance plans have been produced and sanctioned by the incumbent Reservoir Engineers (included as statutory items under section 10)3) b) of the periodic inspection reports as the reservoirs are inspected). Annual routine grounds maintenance to clean masonry structures, manage vegetation (both grass and intrusive/ detrimental deep-rooted plants) ensures that the structures can be inspected for damage, and any anomalies can be identified, monitored and assessed. By monitoring the structural integrity in this way, major works required to repair damaged areas of the structures can be avoided.

5.8 Historic & AMP7 Investment Comparison

A summary of historical investment in water resources is provided in Table 9, along with our AMP7 investment in water resources interventions. We have re-categorised data used in line with the scope of our investment cases. For historic data we have used the wholesale cost assessment (table 1 and 2 of the 16/17 return). Forecast data has been derived from PR19 data tables (WS1 and WS2).

Table 9: Historical & AMP7 capital investment

AMP	Capital investment values	Investment (£m)
AMP5	AMP5 actual	10.597
AMP6	2015/16 actual	0.198
	2016/17 actual	0.282
	2017/18 actual	0.665
	2018/19 forecast	1.104
	2019/20 forecast	0.763
	AMP6 forecast	3.012
AMP7	AMP7 pre-efficiency	8.026
	AMP7 8% capex efficiency applied	7.384

Our AMP7 levels of Water Resources investment have decreased since AMP5, but are an increase on AMP6 levels. In AMP5 we invested in a number of reservoir investigation and embankment stabilisation schemes. In AMP6 our investment included emergency draindown investigations, improvements to fisheries and recreational lakeside services, and statutory asset inspections and subsequent remedial and maintenance works. Our AMP7 investment will continue to invest in these areas, to deliver targeted improvements to our water resource assets, and to meet statutory obligations for our large raised reservoirs.

6 Conclusions

We need to ensure our water resources assets and large raised reservoirs are appropriately maintained and continue to deliver our customers' outcome of a Safe and Reliable Supply and meet our compliance obligations.

Our Lakeside venues are key in showcasing our place in local communities and our commitment to meeting our responsibilities regarding improved public access, whilst at the same time protecting and enhancing the environment for future generations.

An initial list of twenty seven risks was narrowed down to a total of seven potential interventions. These interventions have been developed and assessed through our asset management totex focused and put forward for investment optimisation. Of these a total of six interventions were selected on the basis that they are cost beneficial interventions that meet our customer priorities and meet our compliance obligations.

We plan to invest a pre-efficiency total of £8.026m on one Water Resources Management Plan interventions, three large raised reservoir maintenance and inspection interventions and two appointed lakeside recreation interventions. These interventions will increase our operating costs by approximately £150k per annum. 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, resulting in a post-efficiency investment of £7.384m.

No direct quantifiable contribution to performance commitment targets has been attributed through this investment case. However, the interventions in this investment case enable or indirectly support our performance commitments, which ensure we deliver what our customers expect. Our investment for AMP7 has kept our regulatory obligations and customer expectations at the centre of our focus.

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

7 Appendices

- Appendix A: Line of Sight
- Appendix B: Datasets
- Appendix C.1: Selected Risks
- Appendix C.2: Non-Selected Risks
- Appendix D: Options Considered
- Appendix E: Interventions
- Appendix F: Non-Selected Interventions

7.1 Appendix A: Line of Sight

Water Resources- Line of Sight

Investment Case
NTPBP-INV-WAT-0538

Customer Priorities

Performance Commitments

Optimiser Input Form Reference

NTPBP-CAL-WAT-0357

Other Monetised Benefits

Interventions

20.001.01

20.002.01

20.003.02

20.003.03

20.002.04

20.002.05

20.002.99

OFWAT Initial Assessment Tests

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	Securing long term resilience
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	
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	Business Planning
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 Commitment

Document Number NTPBP-INV-WAT-0726

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
NTPBP-CAL-STR 0708 Structures 33502_1_B_1_25_04_218	this data base summarises BW internal cost build up for those interventions referring to reservoir inspection and maintenance and the provides the CAPEX	-	-	✓	-
Lakeside AMP7 cost base - Issue 1 0 November 2017. s.l.	Internal document, November 2017 this data base summarises cost build up for interventions referring to reservoir inspection and maintenance and provides the CAPEX data	-	-	✓	-
Drain down studies strategy for implementation	Summary of risk related to reservoir draw down.	✓	-	-	-
3 pager narrative - lakeside AMP7 capital v1 1st December 2017	Investment in Lakeside recreation	-	✓	-	✓
Large Raised Reservoir Annual Maintenance Allocation Strategy	Strategy document for reservoir maintenance	-	✓	-	-
Public Access and Recreation Costs and Benefits 09 08 2017 meeting notes and actions	Meeting notes from Buddy meeting	-	✓	-	-
Public Access and Recreation Costs and Benefits 18 07 2017 meeting notes and actions	Meeting notes from Buddy meeting	-	✓	-	-
Public Access and Recreation Meeting - 12 10 17	Meeting notes from Buddy meeting	-	✓	-	-
RE Water Resources Interventions Costing - Ricardo	Meeting notes from Buddy meeting	-	✓	-	-
Reservoir Structures =- Buddy Meeting 26 03 18	Meeting notes from Buddy meeting	-	✓	-	-
Water Resources Meeting - 12 09 17	Meeting notes from Buddy meeting	-	✓	-	-
Water Resources Meeting - 12 10 17	Meeting notes from Buddy meeting	-	✓	-	-

Dataset File Name	Data Summary	Process In Which Data Has Been Used			
		Risk Identification, Verification and Needs Assessment	Optioneering	Intervention Costing	Benefits Quantification
Water Resources Meeting - 15 08 17	Meeting notes from Buddy meeting	-	✓	-	-
Water Resources Meeting - 27 06 17	Meeting notes from Buddy meeting	-	✓	-	-
Water Resources Structures Meeting - 29 09 17	Meeting notes from Buddy meeting	-	✓	-	-
180108 BW Drawdown Study DRAFT for issue	Study report	✓	✓	-	-
Barrow3RAREport-R0.doc	Risk identification and quantification	✓	-	-	✓
ChewValleyLakeQRAREport-R2.doc	Risk identification and quantification	✓	-	-	✓
NCheddarQRAREport-R1.doc	Risk identification and quantification	✓	-	-	✓
BlagdonQRAREport-R1.doc	Risk identification and quantification	✓	-	-	✓
NTPBP-INT-SIT-0096 Site Design Output.xlsx	Works output values	-	-	-	✓
Costing for Water Resources AMP7	WRPM cost information	-	-	✓	-
Water Resource Management Plan Option Details	WRPM option information	-	✓	-	-

7.3 Appendix C.1: Selected 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
SRR639	Barrow Reservoir 3	If non-compliance with guidance regarding emergency draindown THEN POTENTIAL PROSECUTION	3	1	4	1	5	1	5	15
SRR640	Blagdon Reservoir	If non-compliance with guidance, then emergency draindown is required for high risk large raised reservoirs.	3	1	4	1	5	1	5	15
SRR642	Chew Valley Reservoir	If non-compliance with guidance regarding emergency draindown THEN POTENTIAL PROSECUTION	3	1	4	1	5	1	5	15
SRR646	Cheddar Reservoir	If non-compliance with guidance regarding emergency draindown THEN POTENTIAL PROSECUTION.	3	1	4	1	5	1	5	15
SRR649	All supply area	WRMPs are produced as part of a statutory process. Under Section 37 of the Water Industry Act 1991 (WIA), water companies are required to provide domestic and non-domestic customers with a reliable supply of water for domestic and business purposes. The Water Act 2003 amended the WIA 1991 by introducing a statutory requirement for water companies to produce WRMPs at least every five years, setting out how we ensure that we are able to meet the demand for water that we expect will arise in the future (WIA 1991 Section 37A, as amended). This legislation also requires us to consult with customers and stakeholders on our draft WRMP (WIA 1991 Section 37B, as amended).	3	3	4	4	5	5	5	15
SRR672	Lakesides	Failure to invest appropriately in our estate and our public land will lead to increased risk exposure for the company.	3	2	3	2	4	5	5	15
SRR751	All Large Raised Reservoir Sites	If S10 and S12 statutory inspections are not carried out THEN risk of prosecution for failure to comply with 1975 Reservoirs Act.	5	2	3	1	5	4	5	25
SRR786	All Large Raised Reservoir Sites	If mandatory maintenance items (such as "Matters in the Interest of Safety") arising from statutory inspections are not carried out THEN risk of prosecution for failing to meet 1975 Reservoirs Act.	3	1	3	1	5	1	5	15

7.4 Appendix C.2: Non-Selected 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
SRR21	Chew Magna Reservoir	IF no flood protection to on-site and off-site infrastructure at Chew Magna Reservoir THEN site at high risk of on-site and off-site flooding WHEN spillway used	2	2	2	1	2	1	2	4
SRR42	Egford Main	IF Egford Main site floods from off site sources THEN ground water source could be contaminated.	1	1	3	1	3	1	3	3
SRR43	Egford Sub	IF Egford Sub floods from off site sources THEN ground water source could be contaminated.							0	0
SRR44	Harptree Combe	IF the Line of works sites not inspected THEN there is a risk of numerous asset failures leading to loss of functionality of line of works							0	0
SRR45	Banwell Spring	If the local sewer backs up and floods at Banwell Spring THEN there is a potential for contamination of the ground water source	3	1	3	1	2	1	3	9
SRR46	Purton TW	IF the structure around the inlet valves at Purton fail THEN lose the site	3	1	4	3	2	5	5	15
SRR47	Harptree Combe	IF the line of Works sites : 1. Harptree combe tubes 2. Leigh tubes 3. Winscombe tubes are not not painted THEN there is a risk of rusting resulting in structural failure	2	1	4	2	2	1	4	8
SRR48	Axbridge TW	IF the tower screens are lost at Axbridge TW THEN the Cheddar Pumps would be lost. (Axbridge-Area 3)	3	1	3	1	2	1	3	9
SRR49	Chew Magna Reservoir	IF the overflow spillway at Chew Magna Reservoir structurally fails THEN there is a structual risk of losing the reservoir with consequent extreme flooding downstream.	2	4	4	5	5	2	5	10
SRR50	Chelvey TW	IF any contaminated water within the triple engine building at Chelvey Source gets into the 7ft well internal to the building THEN there are potential water quality issues (Hydrocarbons)	2	1	3	1	3	1	3	6
SRR51	Chelvey TW	IF the Simpson Well head floor fails during inspection THEN health and safety issue-fall from height	3	4	3	2	3	1	4	12
SRR52	Egford Sub	IF raw water main and instrumentation continues to discharge to surface waters at Egford Sub THEN potential fines	4	1	2	1	3	0	3	12
SRR260	Charterhouse TW	If high turbidity from springs, then site is down (Charterhouse-Area 3)	4	1	2	1	2	1	2	8

SRR ID	Location/Zone	Revised Risk Description	Likelihood	Human Health / Environment	Ease to Resolve	Publicity & Reputation	Regulatory Impacts	customers Impacted	Max Impact	Risk Score
SRR261	Alderley TW	IF domestic oil spill in the catchment THEN Hydrocarbon risk, costly investigations and DWI notification, possible DWI enforcements (Alderley TW)	2	2	2	1	3	1	3	6
SRR636	Barrow Compensation	If non-compliance with guidance regarding emergency draindown then high risk large raised reservoirs is required.	1	1	4	1	5	1	5	5
SRR637	Barrow Reservoir 1	IF Barrow 1 Reservoir is non-compliance with regard to latest guidance regarding emergency draindown THEN there is a risk of potential prosecution	1	1	4	1	5	1	5	5
SRR638	Barrow Reservoir 2	IF Barrow 2 Reservoir is non-compliance with regard to latest guidance regarding emergency draindown THEN there is a risk of potential prosecution	1	1	4	1	5	1	5	5
SRR641	Chew Magna Reservoir	If non-compliance with guidance, then emergency draindown is required for high risk large raised reservoirs.	1	1	4	1	5	1	5	5
SRR643	Litton Lower Reservoir	If non-compliance with guidance, then emergency draindown is required for high risk large raised reservoirs.	1	1	4	1	5	1	5	5
SRR644	Litton Upper Reservoir	If non-compliance with guidance, then emergency draindown is required for high risk large raised reservoirs.	1	1	4	1	5	1	5	5
SRR645	Purton TW	If non-compliance with guidance regarding emergency draindown THEN POTENTIAL PROSECUTION.	1	1	4	1	5	1	5	5
SRR647	Purton TW	If non-compliance with guidance, then emergency draindown is required for high risk large raised reservoirs.	1	1	4	1	5	1	5	5
SRR695	Purton Severn Intake Works PS	IF Intake aerator Transformer fails THEN loss of power and WQ issues until temporary generator connected (Purton Severn Intake Works PS)	2	1	3	1	3	1	3	6

7.5 Appendix D: Options Considered

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?	Intervention to be developed into an intervention?
SRR649	IF Bristol Water does not meet its statutory obligations as set out in the Water Resource Management Plan, THEN Bristol Water will risk prosecution, increase drought risk, reduce reliability of supply and reduce affordability among other risks.	SRRN649	Meet the requirements as set out in Bristol Waters Water Resources Management Plan, a statutory obligation.	Water Resource Management	Programme of works and studies as per water resource management plan	Viable option.	Yes
SRR639	IF Barrow No.3 Reservoir does not comply with the requirements set out in latest statutory guideines (Reservoir Draindown Guidance - Reservoir Safety and Emergency Planning, Issued Nov 2017) THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	SRRN27	Implimentation of reservoir draw down at Barrow No.3, Blagdon, Cheddar and Chew Valley Reservoirs	Reservoir Rapid Draindown Compliance	Carry out works to implement compliance with new reservoir draindown guidance - reservoir safety and emergency planning (issued Nov 2017). This will involve installing rapid draw down facilities on the following high risk reservoirs: Barrow No.3, Blagdon, Cheddar and Chew Valley.	This is a viable engineering option. It is highly likely deadlines will be imposed for completion within AMP7 (Chew Valley Lakes could be early AMP8). Bristol Water's Dam inspection engineer, Matthew Atyeo who is on the board of dam inspection engineers, advises that this option should be carried out in AMP7, therefore this option is identified for inclusion in the business plan.	
SRR640	IF Blagdon Reservoir does not comply with the requirements set out in latest statutory guidleines (Reservoir Draindown Guidance - Reservoir Safety and Emergency Planning, Issued Nov 2017) THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	SRRN28,		Do Nothing	Continue current reservoir management strategy in AMP 7, leaving all modifications to achieve statutuory compliane until AMP 8/9 or beyond.	Although this is a viable engineering option, it is highly likely that the Inspecting Engineer will require drain down modifications to be implemented at the next S10 inspection. The S10 Imspections of the 4 named reservoirs are due in AMP7. It is anticpated that timescales for statutory compliance are anticipatedin AMP 7. Leaving implementation of work until AMP 8 leaves BW open to failure to comply with statutory reservoir guidelines. This option has been discarded as a result.	
SRR642	IF Chew Valley Reservoir does not comply with the requirements set out in statutory guidleines (Reservoir Draindown Guidance - Reservoir Safety and Emergency Planning, Issued Nov 2017) THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	SRRN29,					
SRR646	IF Cheddar Reservoir does not comply with the requirements set out in statutory guidleines (Reservoir Draindown Guidance - Reservoir Safety and Emergency Planning, Issued Nov 2017) THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	SRRN30					
SRR751	IF S10 & S12 statutory inspections are not carried out THEN Bristol Water is placing customers at risk and could be prosecuted for failing to meet 1975 Reservoirs Act.	SRRN183	An investment is required to implement statutory reservoir inspections to achieve legislative compliance, protect our customers and ensure the safe operation of our reservoirs	Large Raised Reservoirs Proactive and Statutory Inspection	Programme of statutory inspections covering all large raised reservoirs (S10 and S12 inspections)	Viable option	
				Service reservoir inspections	Inspections at Pucklechurch and Victoria service reservoirs	This option splits SR and RWR inspections - both of which are viable options	
				Raw water reservoir inspections	Inspections at all 12. no. raw water reservoirs	This option splits SR and RWR inspections - both of which are viable options	
SRR786	IF mandatory maintenance items (such as "Matters in the Interest of Safety") arising from statutory inspections are not carried out THEN there is risk of prosecution for failing to meet 1975 Reservoirs Act.	SRRN215	An investment is required for reservoir safety, minor remedial and maintenance works is required to cover items identified in the last Periodic Inspection Report (S10) as “Matter in the Interest of Safety”, “Other Matters”, “statutory maintenance”, other recommendations (some of the instructions we have a statutory duty to complete) and any recommendations from the annual statements (S12), or to complete proactive maintenance of the large raised reservoir stocks to ensure that even though the average age is increasing the asset condition and hence residual life is not reducing.	Large Raised Reservoirs Proactive and Statutory Maintenance	Proactive maintenance arising from madatory reservoir inspections (S10 & S12)		
SRR786				Do Nothing			

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?	Intervention to be developed into an intervention?
SRR672	IF access (statutory) to our Lakeside estable is not maintained and improved THEN Bristol Water is at risk of damaging its reputation with its customers, communities, stakeholders and investors. Moreover, there is a risk of fines and further reputational damage if disability access is not improved.	SRRN91	Bristol Water has a statutory duty to provide public access to their lakesides. Current facilities are in need of repair and upgrade to maintain current access. However, disability access at all sites is poor. There is a need to address this to prevent discrimination and potential fines as a result of discrimination.	Appointed Lakeside Recreations Works	Between 2020 and 2025 lakeside recreations will continue with their lifecycle replacement programme with a number of maintenance and improvement programmes. This includes: • Investment in lifecycle replacement of assets and equipment such as tools, signs, roads and landlord's repairs, • Investment in improving equality of access across our lakeside estate; including aspects such as gates, footbridges and public conveniences, • Investment in refreshing the lakeside leisure and community facilities.	Viable - This investment will significantly improve the customer's experience of Bristol Water and their understanding of thier work in protecting communities, public health and the natural environment.	
				DDR required access	Improved disabled access at all out lakeside amentiies	YES, above intervention spilit into the regulatory and non regulatory elements	
				Facilities upgrade	Investment in refreshing the lakeside leisure and community facilities.	YES, above intervention spilit into the regulatory and non regulatory elements	

7.6 Appendix E: Interventions Developed

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
SRR649	**IF** Bristol Water does not meet its statutory obligations as set out in the Water Resource Management Plan, **THEN** Bristol Water will risk prosecution, increase drought risk, reduce reliability of supply and reduce affordability among other risks.	SRRN649	Meet the requirements as set out in Bristol Waters Water Resources Management Plan, a statutory obligation.	Reservoir Rapid Draindown Compliance	Carry out works to implement compliance with new reservoir draindown guidance - reservoir safety and emergency planning (issued Nov 2017). This will involve installing rapid draw down facilities on the following high risk reservoirs: Barrow No.3, Blagdon, Cheddar and Chew Valley.	Yes	20.001.01	Water Resource Management	1.123	0	380.05
SRR639	IF Barrow No.3 Reservoir does not comply with the requirements set out in latest statutory guideines (Reservoir Draindown Guidance - Reservoir Safety and Emergency Planning, Issued Nov 2017) THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.	SRRN27	Implimentation of reservoir draw down at Barrow No.3, Blagdon, Cheddar and Chew Valley Reservoirs	Reservoir Rapid Draindown Compliance	Carry out works to implement compliance with new reservoir draindown guidance - reservoir safety and emergency planning (issued Nov 2017). This will involve installing rapid draw down facilities on the following high risk reservoirs: Barrow No.3, Blagdon, Cheddar and Chew Valley.	This is a viable engineering option. However, it is highly likely deadlines will be imposed for completion within AMP7 (Chew Valley Lakes could be early AMP8). Bristol Water's Dam inspection engineer, Matthew Atyeo who is on the board of dam inspection engineers, advises that this option should be carried out in AMP7, therefore this option is identified for inclusion in the business plan.	20.002.01	Reservoir Rapid Draindown Compliance modifications at Barrow 3, Blagdon , Chew Valley Lake and Cheddar sites.	3.038765	0	83.953
SRR751	**IF** S10 & S12 statutory inspections are not carried out **THEN** Bristol Water is placing customers at risk and could be prosecuted for failing to meet 1975 Reservoirs Act.	SRRN183	An investment is required to implement statutory reservoir inspections to achieve legislative compliance, protect our customers and ensure the safe operation of our reservoirs	Large Raised Reservoirs Proactive and Statutory Inspection	Programme of statutory inspections covering all large raised reservoirs (S10 and S12 inspections)	Viable option	20.002.02	Large Raised Reservoirs Proactive and Statutory Maintenance (of Service Reservoirs, and incorporating 20.002.99 for Raw Water Reservoirs)	2.92804	0	
				Service reservoir inspections	Inspections at Pucklechurch and Victoria service reservoirs	This option splits SR and RWR inspections - both of which are viable options	20.002.04	Large Raised Service Reservoirs Statutory Inspection	0.21627	0	
				Raw water reservoir inspections	Inspections at all 12. no. raw water reservoirs	This option splits SR and RWR inspections - both of which are viable options	20.002.05	Large Raised Raw Water Reservoirs Statutory Inspection	1.297619	0	
SRR786	**IF** mandatory maintenance items (such as "Matters in the Interest of Safety") arising from statutory inspections are not carried out **THEN** there is risk of prosecution for failing to meet 1975 Reservoirs Act.	SRRN215	An investment is required for reservoir safety, minor remedial and maintenance works is required to cover items identified in the last Periodic Inspection Report (S10) as “Matter in the Interest of Safety”, “Other Matters”, “statutory maintenance”, other recommendations (some of the instructions we have a statutory duty to complete) and any recommendations from the annual statements (S12), or to complete proactive maintenance of the large raised reservoir stocks to ensure that even though the average age is increasing the asset condition and hence residual life is not reducing.	Large Raised Reservoirs Proactive and Statutory Maintenance	Proactive maintenance arising from madatory reservoir inspections (S10 & S12)		20.002.03	Large Raised Reservoirs Proactive and Statutory Maintenance	1.513889	0	

Strategic Risk Register (SRR) Reference	SRR Revised Risk Description	Risk Need		Identification & Viability of Options			Proposed Interventions		Costs	Benefits	
		SRR Need ID	Need Description (from SRR)	Proposed Option Name	Proposed Option Description	Option Viability?	Ref. No.	Intervention Title	Capex After (£M)	Change in Opex (£k)	Other monetised benefits
SRR672	**IF** access (statutory) to our Lakeside estable is not maintained and improved **THEN** Bristol Water is at risk of damaging its reputation with its customers, communities, stakeholders and investors. Moreover, there is a risk of fines and further reputational damage if disability access is not improved.	SRRN91	Bristol Water has a statutory duty to provide public access to their lakesides. Current facilities are in need of repair and upgrade to maintain current access. However, disability access at all sites is poor. There is a need to address this to prevent discrimination and potential fines as a result of discrimination.	Appointed Lakeside Recreations Works	Between 2020 and 2025 lakeside recreations will continue with their lifecycle replacement programme with a number of maintenance and improvement programmes. This includes: • Investment in lifecycle replacement of assets and equipment such as tools, signs, roads and landlord's repairs, • Investment in improving equality of access across our lakeside estate; including aspects such as gates, footbridges and public conveniences, • Investment in refreshing the lakeside leisure and community facilities.	Viable - This investment will significantly improve the customer's experience of Bristol Water and their understanding of thier work in protecting communities, public health and the natural environment.	20.003.01	Appointed Lakeside Recreations Works	2.4608	0	
				DDR required access	Improved disabled access at all out lakeside amentiies	YES, above intervention spilit into the regulatory and non regulatory elements	20.003.02	Appointed Lakeside Recreations Works - Regulatory Requirements Only	1.479482	0	
				Facilities upgrade	Investment in refreshing the lakeside leisure and community facilities.	YES, above intervention spilit into the regulatory and non regulatory elements	20.003.03	Appointed Lakeside Recreation Works - Non Regulatory Elements	0.981318.3		

7.7 Appendix F: Non-Selected Interventions

ID	Intervention Title	Expected Capex after (£k)	Change in Opex (£k)	Residual Risk
20.001.01	Water Resource Management	1123	0	If Bristol Water does not meet its statutory obligations as set out in the Water Resource Management Plan, Bristol Water will risk prosecution, increase drought risk, reduce reliability of supply and reduce affordability among other risks.
20.002.01	Reservoir Rapid Draindown Compliance modifications at Barrow 3, Blagdon , Chew Valley Lake and Cheddar sites.	3038.76494	0	IF Barrow No.3 Reservoir does not comply with the requirements set out in statutory guidleines THEN Bristol Water is placing customers at risk and is itself at risk of prosecution.
20.003.01	Appointed Lakeside Recreations Works	2460.79988	0	If Bristol Water does not invest in maintaining and improving statutory access to the lakeside estate then Bristol Water is at risk of damaging its reputation with its customers, communities, stakeholders and investors. Moreover, there is a risk of fines and further reputational damage if disability access is not improved.
20.002.04	Large Raised Service Reservoirs Statutory Inspection	216.2698714	0	If S10 & S12 statutory inspections are not carried out THEN risk of prosecution for failing to meet 1975 Reservoirs Act.
20.002.05	Large Raised Raw Water Reservoirs Statutory Inspection	1297.619229	0	