WSX38 – Annexes – Resilience, risk management and decision frameworks

Business plan
2025-2030

Wessex Water
YTL GROUP

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WSX38 – Annexes – Resilience, risk management and decision frameworks

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This supporting document is part of Wessex Water's business plan for 2025-2030.

Please see 'WSX00 – Navigation document' for where this document sits within our business plan submission.

More information can be found at wessexwater.co.uk.

A1 List of shocks and stresses

Table 1: List of shocks and stresses

Shocks		Stresses	
Financial crisis	The loss in the nominal value of financial assets. For example: asset bubbles where unsustainably overpriced assets such as commodities, housing, shares, etc. in a major economy or region.	**Bad debt**	Debt which cannot be recovered, often linked to the debtor being insolvent. Risk of bad debt is often linked to the strength of the wider economy.
Industrial and trade dispute	A dispute between employees and employers, which may lead to disruption in the continuation of service. E.g. Union organised strikes	**Cost increase**	Increasing costs of resources or increasing interest rates causing increased financial burdens on individuals and organisations.
Supply chain failure	Global resource scarcity or disruptions to supply chains which prevent critical products or services reaching their required designations	**Recession**	A temporary period of reduced economic activity during which industrial and trade are reduced for two consecutive quarters.
Power failure	Unexpected loss of energy supply caused by an external network issue, from extreme events, causing an issue for continuation of services	**Environmental change**	Changes in habitats, ecosystems and biodiversity from pollution, habitat destruction and climate change. This includes invasive alien species arriving and outperforming and replacing the native species.
Telecommunication failure	Outage of critical information infrastructure (e.g. internet, satellites, etc.) and networks, causing widespread disruption.	**Climate change**	Change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, in addition to natural climate variability.
Environmental pollution	Deterioration in the quality of air, soil and water from ambient concentrations of pollutants and other activities and processes. In the case of water, this includes emerging contaminants, such as human pharmaceuticals and hormones, micro/nanomaterials and recreational drugs.	**Customer behaviours/ expectations**	Changes in the way people live, causing a change in the resources used and expectations of services provision.

Shocks		Stresses	
Extreme Weather/ natural disasters	Major property, infrastructure, and/or environmental damage as well as loss of human life caused by extreme weather events.	**Land use change**	Changes in the use of land. This could be from changes in agriculture, land management or urban sprawl.
Flooding	Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme weather events which cause flooding	**Demographic change**	Global population growth is predicted, the location of these population is expected to change. This also includes ageing populations in developed and developing countries driven by declining fertility and decrease of middle- and old-age mortality.
Space weather	Space weather, such as solar flares, impacting radio, satellite and GPS communications as well as impacting electric power transmission.	**Skills shortage**	A shortage of known specialist skills required for the continued running of businesses, systems and services.
Political and macro industry change	Inability of regional or global institutions to resolve issues of economic, geopolitical or environmental importance, including economic changes causing changes in the sectors of the economy.	**Ageing infrastructure**	Failure to adequately invest in, upgrade and/or secure infrastructure networks (e.g. energy, transportation and communications), leading to pressure or a breakdown with system-wide implications.
Infectious disease	Bacteria, viruses, parasites or fungi that cause uncontrolled spread of infectious diseases (for instance as a result of resistance to antibiotics, antivirals and other treatments) leading to widespread fatalities and economic disruption.	**Emergent technologies**	Innovation that creates a new market and disrupts the company operations (e.g. digital technologies, fracking, smart metering).
Political instability and terrorism	Major social movements or protests (e.g. street riots, social unrest, etc.) that disrupt political or social stability, negatively impacting populations and economic activity.		
Vandalism/ theft	Major malicious (or wilful) defacement or destruction or illegal removal of private or public property.		
Asset failure	A sudden, unexpected loss in the service provided by an asset. This may have a knock-on effect on the service of other parts of the network.		

Shocks		Stresses	
Cyber attacks	Large-scale cyberattacks or malware causing large economic damages, geopolitical tensions or widespread loss of trust in the internet.		
Major industrial/ transport incidents	Major incident which impacts normal service provision, could be cause by a number of incidents including fire, nuclear, and transport disaster.		

A2 Good practice review

We undertook a high-level desk-based 'good practice' review across the water sector (and broader infrastructure sectors, where appropriate) alongside Ofwat's feedback post-PR19, to inform updates to the risk & resilience framework and broader Wessex Water activities.

In this appendix we outline the key findings of the good practice review, including:

- Definitions
- Guidance and standards

A2-1. Definitions

Table 2: List of definitions for good practice review

Term	Definition	Source
Resilience	Resilience is the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future	Wessex resilience action plan – from Ofwat's Resilience in the Round, 2017
Risk	Risk is the effect of uncertainty on objectives.	ISO 31000
Hazard	A hazard is any source of potential risk: damage, harm, or adverse effects on something or someone.	UK Government Health and Safety Executive
Shock	An acute, sudden and high impact event, usually time-limited, that disturbs the system. Example: an earthquake.	Lipton, 1999 https://www.publichealthnotes.com/what-is-shock-stresses-and-resilience/
Stresses	Chronic, long-term trends or pressures that undermine the stability of a system. Example: climate change	https://www.publichealthnotes.com/what-is-shock-stresses-and-resilience/

A2-2. Guidance and standards

A2-2.1. BS ISO 31000: Risk Management - Guidelines

BS ISO 31000 provides principles, a framework and a process for managing risk (see **Error! Reference source not found.**). It can be used by any organisation regardless of its size, activity or sector. ISO 31000 also establishes several risk management principles. In particular the ideas that risk management creates and protects value; is part of decision making and an integral part of all organisational processes.

ISO 31000 defines risk as 'the effect of uncertainty on objectives'. The process of risk management includes the assessment of both **consequences** (i.e. what can happen, how bad this would be), and **likelihood** (the probability of risk occurring), and combines these to find the overall level of risk. Risk management occurs at different scales and across different time periods, with some risks associated with enterprise / company risk (i.e. financial risk, personnel, reputation), and others aligning with legal health and safety obligations.

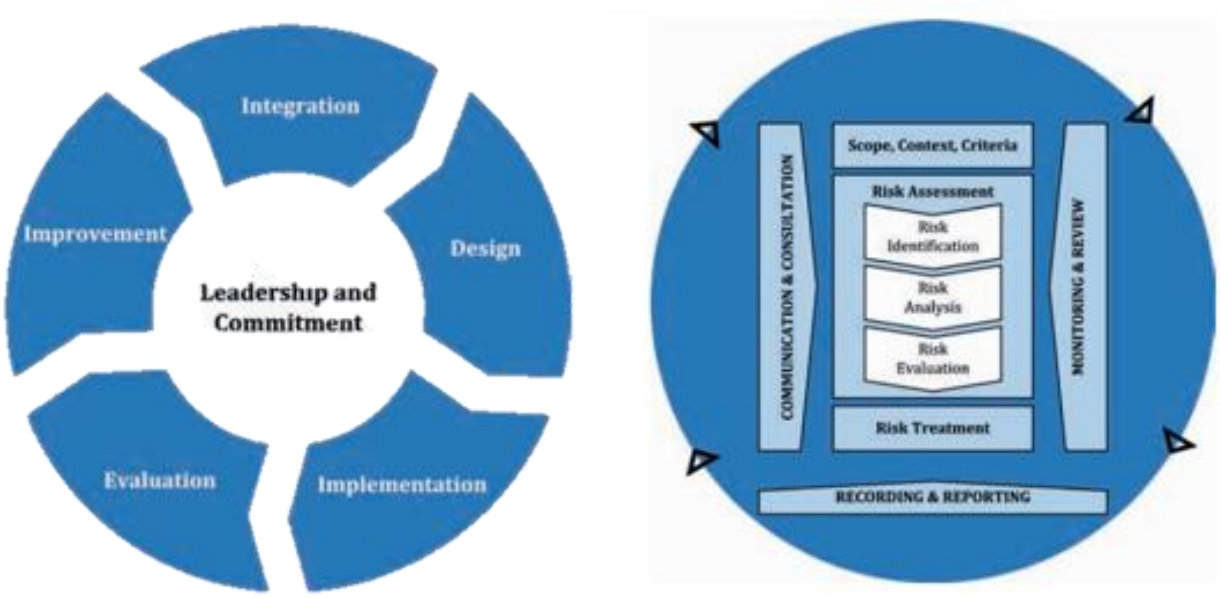


Figure1 1 - ISO31000 risk management process (left) and framework (right)

A2-2.2. BS 65000: Guidance on organisational resilience

This standard (now a Code of Practice) provides guidance and recommendations on what constitutes organisational resilience, the defining attributes and the practical measures that should be considered or can be taken.

The standard refreshes the definition for resilience: Resilience is a strategic capability for an organisation. It enables an organisation to (a) **prepare for** and respond to disruption; (b) **adapt** in a timely and appropriate manner; and (c) **thrive** in a changing environment.

The Code of Practice sets out eight 'Guiding principles', and sets out the 'Practices of Organizational resilience', under the headings of:

- Establishing the context for organizational resilience
- Developing organizational resilience
- Stress testing organizational resilience
- Embedding resilience
- Organizational learning
- Organizational structure change
- Governance for resilience
- Resilience reporting

The Code of Practice also outlines the four dimensions of resilience: Readiness, Responsiveness, Recovery and Renewal, highlighting the importance of learning and adapting (within the renewal step) in resilient companies.

A2-2.3. BS ISO 55000: Asset management & the Institute of Asset Management

ISO 55000 provides an overview of asset management, its principles and terminology, and the expected benefits from adopting asset management. The Institute of Asset Management (IAM) are the international professional body for asset management professionals' guidance.

Asset management is defined as the “coordinated activity of an organisation to realise value from assets”. In order to realise this value, costs, risks, opportunities and performance benefits need to be balanced.

Within the asset management system, risk assessment and management is identified as a specific component (i.e. risk & review) (see **Error! Reference source not found.**). The IAM’s ‘An Anatomy’ describes that an organisation’s risk management approach influences its asset management strategies and objectives, capital investment decisions and the choice of regimes for the operation and maintenance of its assets. Effective risk management is an essential part of the successful delivery of all life cycle activities.

It recognises that:

- An organisation’s approach to risk management will be determined by its risk appetite and tolerance.
- Risk assessment and management interacts with other asset management subjects.
- A risk management policy sets out an organisation’s approach to risk management and is integral to its internal control and governance arrangements.
- Understanding the criticality of assets is important to enable the ranking of risks and prioritising actions. All endeavour carries risk.
- Having identified and assessed the risks, the responses available to handle these, are often grouped into the so-called ‘4Ts’: Tolerate, Transfer, Treat, Terminate.
- Managing risk within tolerable levels is a key consideration in asset management decision-making.

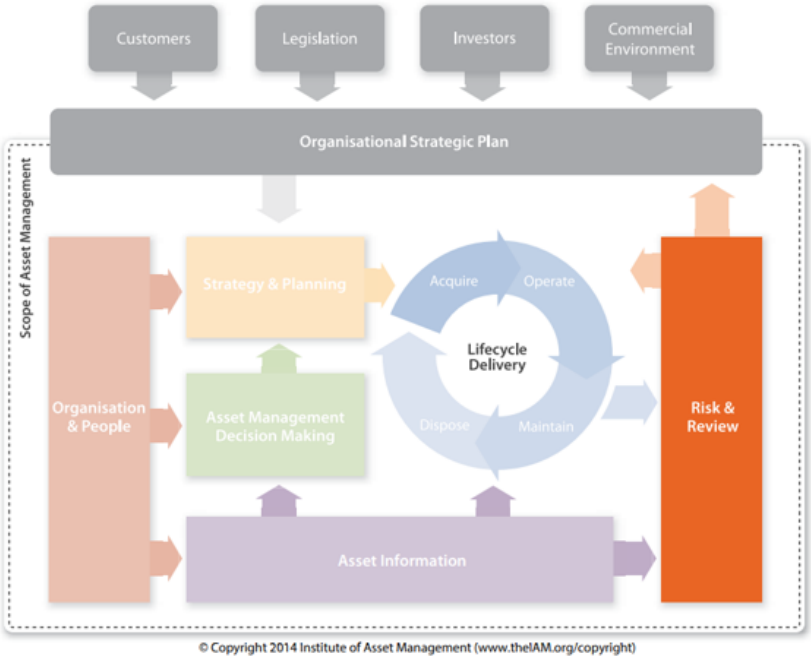


*Figure 2**Error! No text of specified style in document.**2 - Asset Management conceptual model (Source: Institute of Asset Management)*

A2-2.4. Ofwat - Resilience in PR24 Guidance (2023)

Resilience thinking has developed since Ofwat's *Resilience in the Round* (2017) publication. Rather than having a dedicated resilience section, the final guidance for PR24 mainstreams resilience through all other aspects of the methodology. The focus is on financial resilience, operational resilience, and long-term delivery strategies (see Figure 3 below).

The guidance notes Ofwat's statutory duties to: *"further the resilience objective to secure the long-term resilience of companies' systems and to secure that they take steps to enable them, in the long term, to meet the need for water supplies and wastewater services."*

The final PR24 methodology sits alongside Ofwat's long-term ambition to develop an integrated monitoring framework for operational resilience (presented in Ofwat's 'Operational resilience discussion paper' in April 2022). This is aligned with Ofwat's plan to focus on the long-term in their key challenges and ambitions for PR24.

Figure 33 - Ofwat key challenges and ambitions for PR24

A2-2.5. The UK Government - Resilience Framework (2022)

The UK Government Resilience Framework sets out how the UK Government will strengthen the systems and capabilities that support collective resilience. Published in December 2022, this framework sets a new strategy which centralises resilience as a major national endeavour, and is based on the following principals:

- A developed and shared understanding of the civil contingencies risks we face is fundamental;
- Prevention rather than cure wherever possible: a greater emphasis on preparation and prevention; and
- Resilience is a 'whole of society' endeavour

It proposes measures and investment to enable the UK's resilience system to prevent risks manifesting or crises happening where possible. But it recognises that while prevention is a key principle, it cannot replace careful and effective management of emergencies as they occur. Some risks are inherently unpredictable, or manifest in unpredictable ways – whether over a wide geographic area, or as a result of a wide range of triggers and/or other risks. For this reason, this framework also proposes actions to improve response and preparation for risks and ensure that partners throughout the system are able to play their part fully. There will be a shift away from simply dealing with the effects of emergencies towards a stronger focus on prevention and preparation for risks.

A3 Addressing shocks and stresses

Table 3: Actions to address shocks and stresses.

Shocks* and stresses	Now / BAU	Long-term	
		Wholesale water (LTDS/WRMP)	Wholesale wastewater (LTDS/DWMP)
Industrial and trade Dispute*	Risk management framework		
Infectious disease*	Risk management framework		
Political instability and terrorism*	Risk management framework		
Major industrial/ transport incidents*	Risk management framework		
Space weather*	Risk management framework		
Supply chain failure*	Risk management framework (mitigation through AMF)		
Power failure*	Risk management framework (mitigation through AMF)		
Telecommunication failure*	Risk management framework (mitigation through AMF)		
Vandalism/ theft*	Risk management framework (mitigation through AMF)		
Extreme Weather/ natural disasters*	Risk management framework (mitigation through AMF)		
Environmental pollution*	Risk management framework	Y (WRMP/LTDS)	
Flooding*	Risk management framework (mitigation through AMF)		Y (DWMP/LTDS)
Political and macro industry change*	Risk management framework	Y (WRMP/LTDS)	Y (DWMP/LTDS)
Asset failure*	Risk management framework/ Asset management framework	Strategic Asset Management Plans (SAMP)/DWMP	

<table>
<tr><th rowspan="2">Shocks* and stresses</th><th rowspan="2">Now / BAU</th><th colspan="2">Long-term</th></tr>
<tr><th>Wholesale water (LTDS/WRMP)</th><th>Wholesale wastewater (LTDS/DWMP)</th></tr>
<tr><td>Cyber-attacks*</td><td>Risk management framework (mitigation through AMF)</td><td>Y (LTDS)</td><td>Y (LTDS)</td></tr>
<tr><td>Climate change</td><td>Risk management framework</td><td>Y (WRMP/LTDS)</td><td>Y (DWMP/LTDS)</td></tr>
<tr><td>Customer behaviours/ expectations</td><td>Risk management framework</td><td>Y (WRMP/LTDS)</td><td>Y (DWMP/LTDS)</td></tr>
<tr><td>Land use change</td><td>Risk management framework</td><td>Y (LTDS)</td><td>Y (LTDS)</td></tr>
<tr><td>Demographic change</td><td>Risk management framework</td><td>Y (WRMP/LTDS)</td><td>Y (DWMP/LTDS)</td></tr>
<tr><td>Ageing infrastructure</td><td>Risk management framework/ Asset management framework</td><td colspan="2">Strategic Asset Management Plans (SAMP)</td></tr>
<tr><td>Emergent technologies</td><td>Risk management framework</td><td>Y (LTDS)</td><td>Y (LTDS)</td></tr>
<tr><td>Environmental change</td><td>Risk management framework</td><td></td><td></td></tr>
<tr><td>Skills shortage</td><td>Risk management framework/ Asset management Framework</td><td></td><td></td></tr>
<tr><td>Bad debt</td><td colspan="3" rowspan="4">Risk management framework and Long-term viability framework</td></tr>
<tr><td>Cost increase</td></tr>
<tr><td>Recession</td></tr>
<tr><td>Financial crisis*</td></tr>
</table>

A4 Frameworks underpinning our approach

This section outlines the principles, frameworks and tools that underpin our risk and resilience framework, influencing both our broad approach to resilience, and specific processes, for example our investment or asset management approaches.

A4-1. Our risk management framework

Our risk management framework (Figure 4) sets out the essential elements of our approach to risk management, explains the context for risk management, introduces the risk management systems we use and explains the risk management process and the escalation procedure.

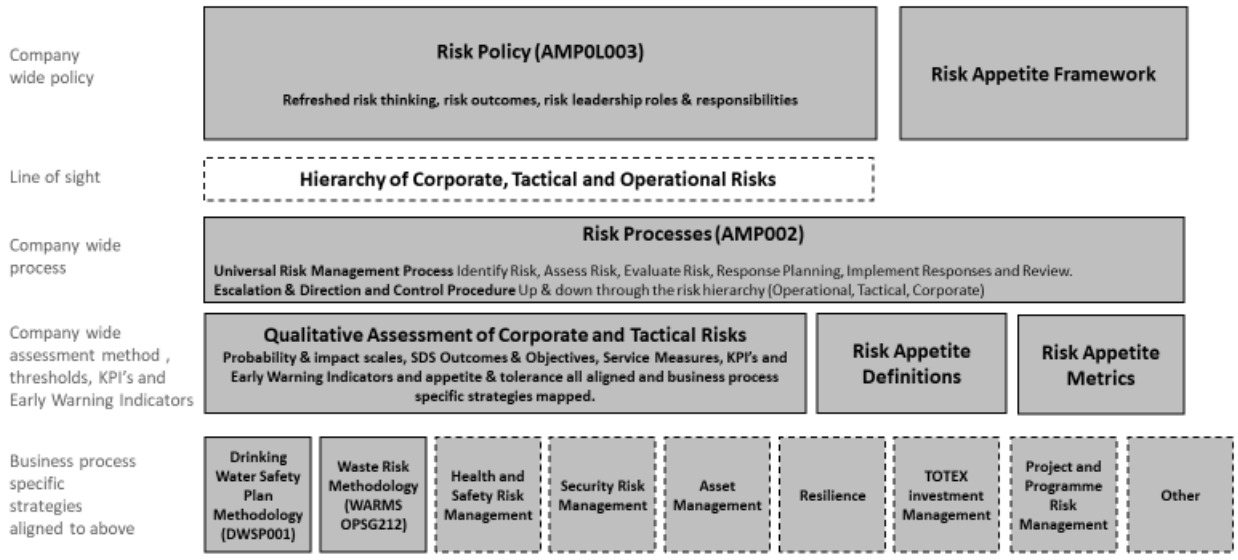


*Figure 4**Error! No text of specified style in document.**4 - An overview of the WWSL risk management framework*

A4-2. Our investment management framework & tools

Our approach to investment management and decision making, outlined in Figure 5 below, is aligned with the UK Water Industry Research (UKWIR) framework for expenditure decision making (FEDM) and is consistent with the Ofwat Price Review PR24 methodology. It is designed to enable a consistent approach across the business in terms of how we plan, manage and make-decisions on our investments and is framed around the following key steps: identifying needs, identifying solutions, optimising & selecting solutions, and delivering the plan & reviewing

outcomes. Utilising our framework allows us to make better decisions around our strategic, tactical, and operational-level expenditure and ensures a line of sight from risk identification to the development and optimisation of solutions.

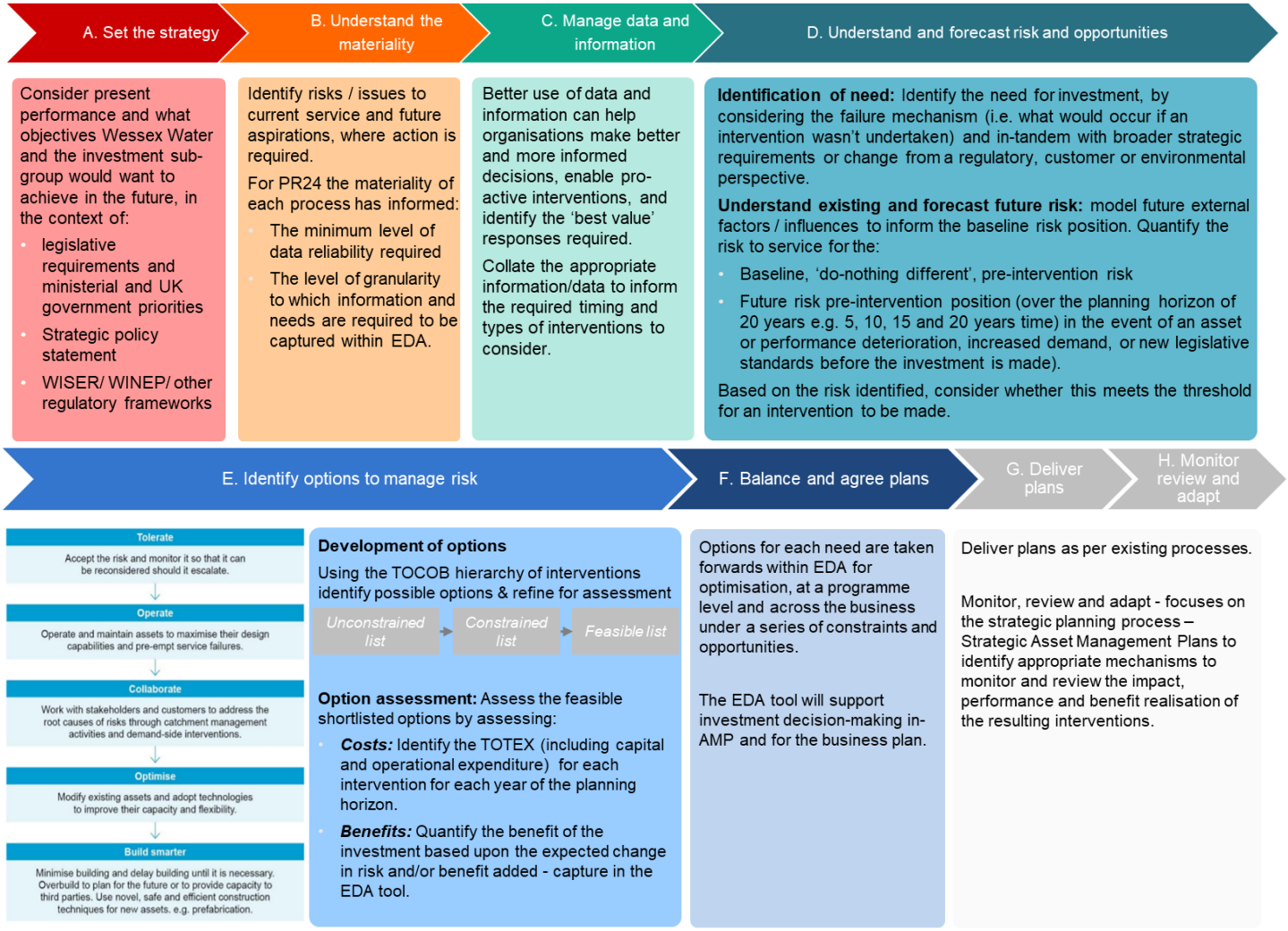


Figure 5 5- Detailed view of Wessex Water Investment Decision Making Process

Our investment decision-making framework is primarily driven by our Strategic Direction Statement (SDS) which sets our overarching priorities and outcomes and underpins our commitment to achieving best value for our customers and the environment. Alongside the SDS, we consider our legislative requirements and drivers, our asset health & capital maintenance needs, service improvement needs and stakeholder commitments to develop a holistic portfolio of expenditure. This includes our statutory plans – i.e. Water Resource Management Plan (WRMP), Drinking Water Management Plan (DWMP), and the Water Industry National Environment Plan (WINEP); each of the overarching processes integrate into our business plan investment decision-making process - whereby interim Best Value Portfolios are iteratively developed and subsequently optimised within the wider business plan, then updated to reflect broader organisation drivers and constraints.

This investment decision making process ties into our wider resilience framework, as illustrated in Figure 6 below.

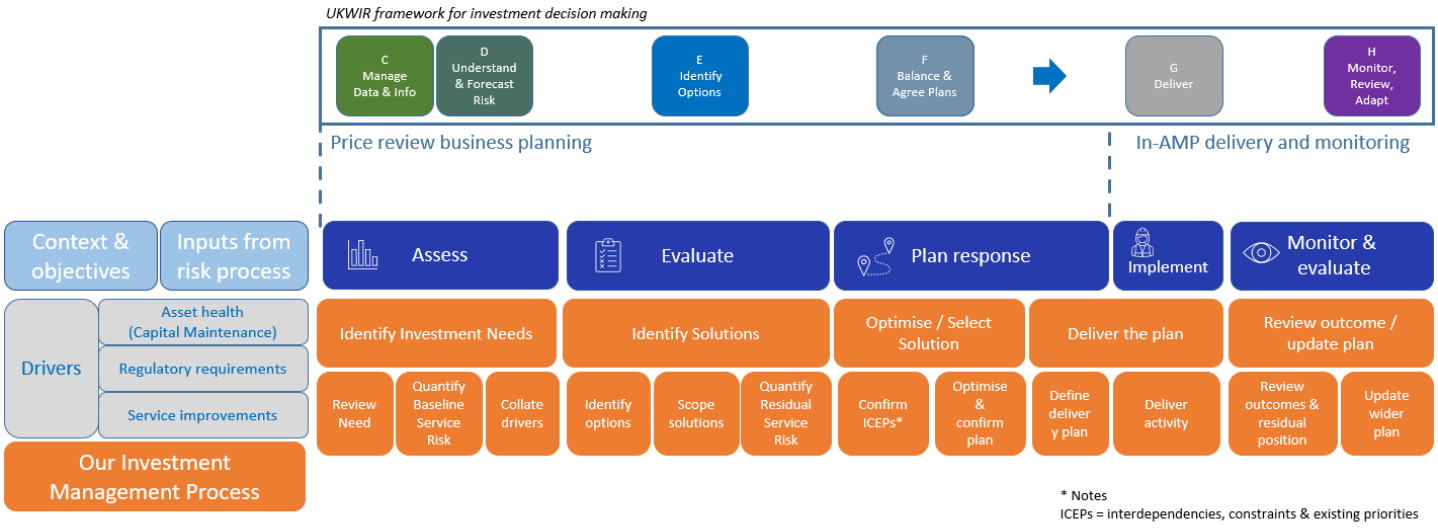


Figure 66 - Wessex Water Investment management process

Supporting tools and frameworks

Within our investment decision-making framework, we utilise a number of decision-support frameworks and tools to inform our decision-making. Their use across the business enables a consistent and auditable approach to investment planning and decision making. These include the SMF, EDA and benefits valuations, which are outlined in more detail in the following sections.

A4-3. Service Measure Framework

A SMF is a systematic service risk- and value-based assessment approach that enables objective comparisons of investment options across business areas, drawing on common valuation criteria to support investment decision making. This common language is used to form an agreed set of metrics (i.e. service measures) cover the majority of the services Wessex Water provide to meet our corporate objectives, including providing services to customers, to the environment and to stakeholders (including employees). The SMF is used to quantify risks to service and opportunities from investment, undertake expenditure planning and decision-making, taking into account asset operation and stakeholder views (including customers). It supports meaningful comparison and facilitation of prioritisation in expenditure selection.

As part of the SMF, our Value Framework utilises a capitals framework mapped across our four sustainability principles: Natural, Social, Human and Financial/Built, as described in Figure 7. Our framework is based on the International Integrated Reporting Framework (2021) and aligns with good practice in the industry as well as other UK water utilities' approaches to investment planning, e.g. Yorkshire Water, Anglian Water etc. This approach aims to identify, measure and report on both financial and non-financial impacts and dependencies (often referred to as 'sustainability accounting') in monetary terms to enable holistic investment decision making. As such, our multi-capitals approach supports us to make more informed, sustainable investment decisions that provide the best balance of public value to customers, society and the wider environment, framed around Wessex Water's strategic vision.

Behind each service measure sits a monetised unit value representing the value of service failure to Wessex Water and impacts on the broader environmental, social and human & intellectual capitals – as identified in Figure 8. The

SMF allows a user to articulate a pre-intervention and post-intervention risk position, with the change in risk deriving a monetary benefit of the intervention.

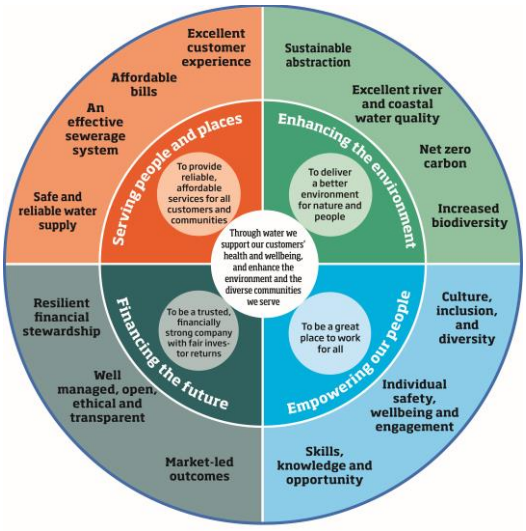


Figure 7 –7 Summary of four sustainability principles (taken from Wessex Water SDS)

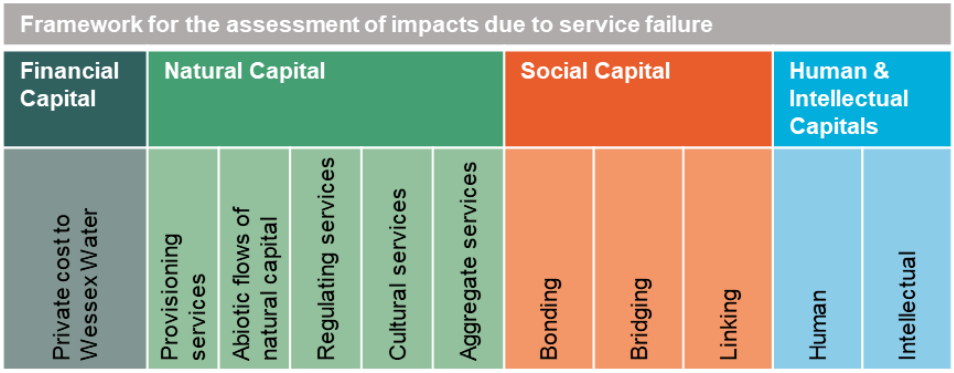


Figure 8 -8 Wessex Water Service Measure Framework

A4-3.1.1. Natural Capital

The Wessex Water SMF incorporates Natural Capital into the risk and value framework, allowing for the assessment of the impact of failure of service on natural capital services due to interventions.

Table 4 outlines the SMF framework against which impacts are assessed and monetary values are defined, which include the priority services recommended by the WRPG. The framework is aligned to the Capitals Coalition Natural Capital Protocol and industry best practice. Services have been screened out (i.e. grey) where they are less material to the water sector or there is limited valuation data available. Valuations have been derived from a range of literature sources as described below.

Table 4 –9 SMF framework for natural capital

Natural Capital		Valuation Data Sources
Provisioning services	Food	Where possible, valuations have been derived from a range of literature sources including: • Defra ENCA Data Services Tool-book • University of Exeter – Orval and Woodland Valuation Tool • CIRIA – Benefits of SuDS Tool (B£ST Tool) • UK Gov – BEIS, Department for Transport • Environment Agency - National Water Environment Benefits Survey • Woodland Trust - Economic Benefits of Woodland *Note: There are elements of the framework where there is limited information to inform a monetised valuation or have been excluded due to low materiality to Wessex Water (in grey). The SMF is used as a decision-support framework.*
	Timber	
	Water	
	Fish	
	Energy Crops	
	Pollination	
	Soil	
	Supporting Navigation	
Abiotic flows of natural capital	Renewable Energy	
	Oil and Gas	
	Minerals	
Regulating services	Air pollution	
	Carbon	
	Flood Regulation	
	Noise	
	Temperature	
	Waste Remediation	
Cultural services	Recreation	
	Physical health	
	Education	
	Volunteering	
	Mental health	
	Nature-based	
Aggregate services	Amenity	
	Biodiversity	
	Soil	
	Water quality	
	Landscape	
	Non-use values	

A4-3.1.2. Social, Human & Intellectual Capital

Table 5 below outlines the SMF framework against which impacts are assessed and monetary values are defined for Social, Human & Intellectual Capital. Services have been screened out (i.e. grey) where they are less material to the water sector or there is limited valuation data available. Valuations have been derived from a range of sources as described below.

Table 5 –10 SMF framework for social, human and intellectual capital

Social Capital			**Valuation Data Sources**
Bonding	Cognitive	Trust in others	Where possible, valuations have been derived from a range of sources including: • Wessex Water's Willingness to Pay research (2022) based on customer research and provides locally specific valuations. • HACT Value Calculator • The National TOMS 2019: Social Value Calculator • UK Gov – BEIS, Department for Transport *Note: There are elements of the framework where there is limited information to inform a monetised valuation or have been excluded due to low materiality to Wessex Water (in grey). The SMF is used as a decision-support framework.*
	Behavioural	Connecting with community	
	Structural	Social networks and support	
Bridging	Cognitive	-	
	Behavioural	-	
	Structural	-	
Linking	Cognitive	Trust	
		Sense of influence	
	Behavioural	Social groups	
	Structural	Access to information	
		Mobility and connectivity	
		Local economy	
Human and Intellectual Capital			
Human & Intellectual	Skills and knowledge		
	Equality, diversity, inclusivity		
	Health		
	Safety and security		
	Wellbeing		
	Financial security		
	Culture		
	Routine and practices		
	Intellectual property		
	Stakeholder relationship		

A4-3.1.3. Financial Capital (private costs)

The Wessex Water SMF incorporates Financial Capital into the risk and value framework, allowing for the assessment of the impact of failure of service on operational services due to interventions, associated with risk-based service measures and represented by private costs. 'Private costs' are those which the business incurs in responding to failures of services. The values for these were developed through analysis and by consultation with members of staff from across Wessex Water various functions to quantify typical activities, durations and personnel involved with the different types of service failure.

A4-4. Defining our expenditure portfolio

A4-4.1.1. Identify risks & define investment needs

We define needs for investment by considering the failure mechanism (i.e. what would occur if an intervention wasn't undertaken), in-tandem with broader strategic, regulatory, customer or environmental requirements. Primarily, our investment needs are identified through a combination of our risk assessment process, asset health modelling, and regulatory requirements.

Once risks have been identified, these are assessed and those that lie beyond our risk appetite are confirmed as needs. Those they lie below our thresholds are tolerated and managed. This approach enables us to be efficient with our investment.

For each of Wessex Water's investment streams a data reliability grade has been identified based on Ofwat's Confidence Grades – expanding on the reliability bands based on typical characteristics of data confidence. This has involved:

- Identification of a minimum data reliability requirement for each investment process, against which there is an ambition for each data source to achieve. The assessment of the minimum data reliability requirement is based on the materiality of the investment (classified based on the AMP6 level of investment); for example where the materiality of a process is higher, it requires a higher level of data confidence - High to Very High materiality requires a Grade A, Medium materiality requires a Grade B and Low to Very Low materiality requires a Grade C. Notably, where there are key regulatory or legislative requirements (such as reservoirs, WRMP, DWMP and WINEP) a higher data reliability (Grade A) is required.

- An assessment the reliability of the information utilised within a decision-making process – both for identifying needs and forecasting risk (i.e. through the service measures).

Based upon the above, for each of the Value Framework inputs into EDA, users are required to identify an Ofwat confidence grade which considers the reliability and accuracy of information being entered. The reliability of information can then be considered as part of our decision-making process and is consistently tracked throughout the decision-making process. This is illustrated in Figure 9.

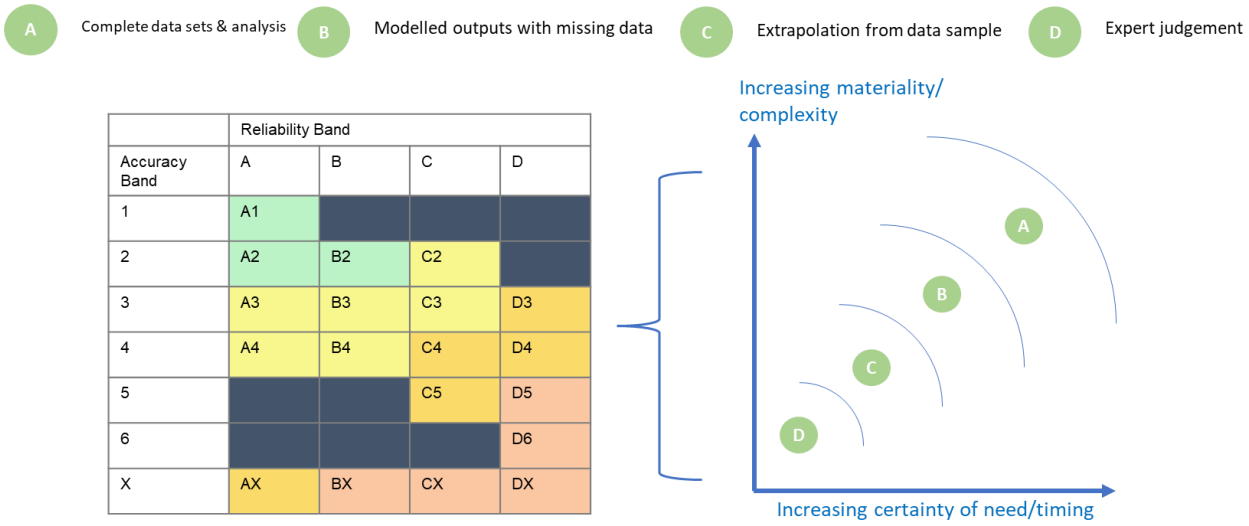
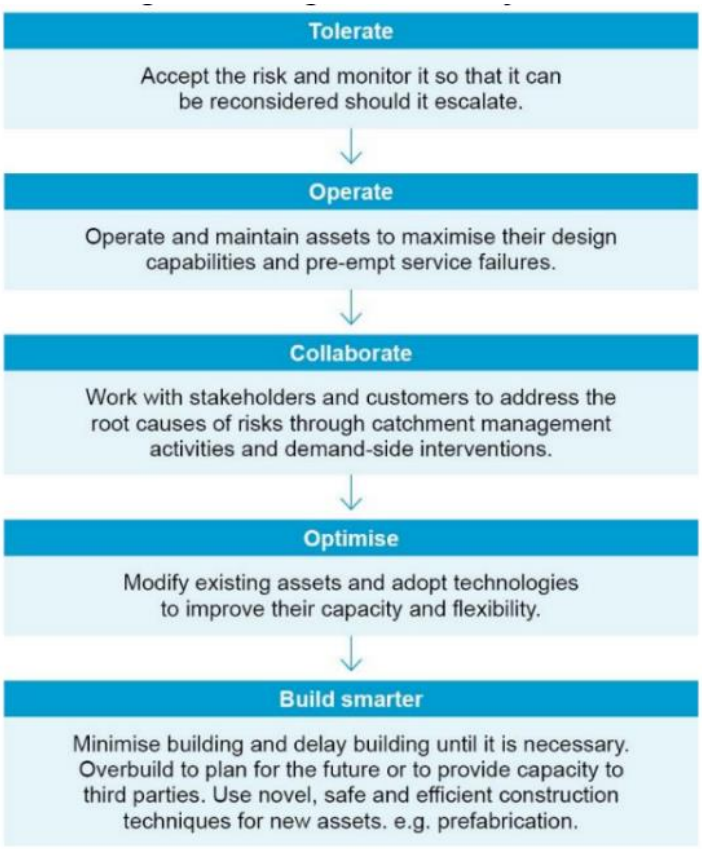


Figure 9 - Use of Data confidence grading in decision making

A4-4.1.2. Identifying solutions



Once a need is confirmed, it is captured in the EDA Tool and articulated using the relevant service measures (within the Value Framework) to represent the risks to Wessex Water, customers and the environment. Needs with legal obligations and regulatory commitments are identified as mandatory or 'must-do'. Our investment planners identify feasible options to address the root cause of the need. This involves identifying:

- Unconstrained options: Longlisting of all possible options.
- Constrained options: Coarse screening of options
- Feasible options: Fine screening of options to determine a preferred shortlist of interventions.

When identifying and screening options, we utilise a mitigation hierarchy to systematically encourage the development of mitigations which (1) tolerate the risk, (2) improve operations, (3) collaborate with stakeholders and customers to address the root causes (4) optimise existing assets using new technologies or (5) build smarter solutions (TOCOB). It defines building new manufactured capital solutions as the 'last resort' to be considered and helps us to direct our interventions closer to the root causes of issues and identify the more sustainable, effective expenditure decisions.

A4-4.1.3. Evaluating and selecting solutions (incl. our benefit impacts)

Once a shortlist of interventions is identified, they are captured within the EDA Tool and evaluated using the Value Framework. Using the Value Framework, for each feasible option we detail:

- Costs: Identifying the totex (including capital and operational expenditure) for each intervention for each year of the planning horizon. To inform our costing we utilise standardised cost databases & curves captured in EDA.
- Benefits: Understanding the benefit (or value) of the investment, based upon the change in risk over a 30-year planning horizon (i.e. the post-intervention value minus the pre-intervention value). For each option, we identify any further service measures affected by the intervention. In-depth or bespoke assessments are captured utilising our 'avoidable costs' service measure.

To inform the assessment of benefits (i.e. the Value Framework inputs), we have clearly defined data sources, methods and assign confidence levels (considering information source reliability and accuracy) for service risk. Notably, the data sources for each of Wessex Water's investment streams have been mapped and captured within our overarching Investment Process guidance. As part of the development of this guidance, we have identified desired minimum data reliability level and undertook an analysis to identify where data sources could be further improved in future. The assessment of benefits is subject to internal review and external assurance, as described further below.

EDA then determines a Benefit Cost Ratio (BCR) and Net Present Value (NPV) in accordance with UKWIR's 2010 CBA guidance (where the sector agreed the use of the Spackman approach) and Ofwat's Price Review 24 (PR24)

guidance. Our preferred plan is the plan with the best BCR, and our alternative plan is lowest whole life cost within performance target constraints.

Inputs to and outputs from EDA have been reviewed as part of external PR24 assurance. The external review focused on:

1. How the service measures for each area have been assessed and quantified; and
2. How the programme has been optimised (if applicable)
3. The outputs from EDA were covered by separate audits, including associated population of the data tables.

A4-4.1.4. Developing our plan

We use EDA to capture the detail for our investment plan for PR24, assess the impact of different service targets & constraints over the short, medium and long-term horizon and to optimise our portfolio of interventions to test for various future scenarios. This process is undertaken iteratively, creating optimisation scenarios and configurations to test out areas of investment separately, testing the impact of inclusion/exclusion of different service measures, optimisation goals (e.g. best benefit cost ratio, lowest whole life totex) to aid in our decision-making. We use the assessments of the individual investment areas to determine the appropriate levels of service each area adds and then collate the needs and solutions for all investment areas tougher to optimise the whole of the business plan. This allows us to compare options & timeframes for implementation to generate a preferred investment programme. The figure below illustrates selecting various needs within EDA into a snapshot where we can configure different optimisations and review the results.

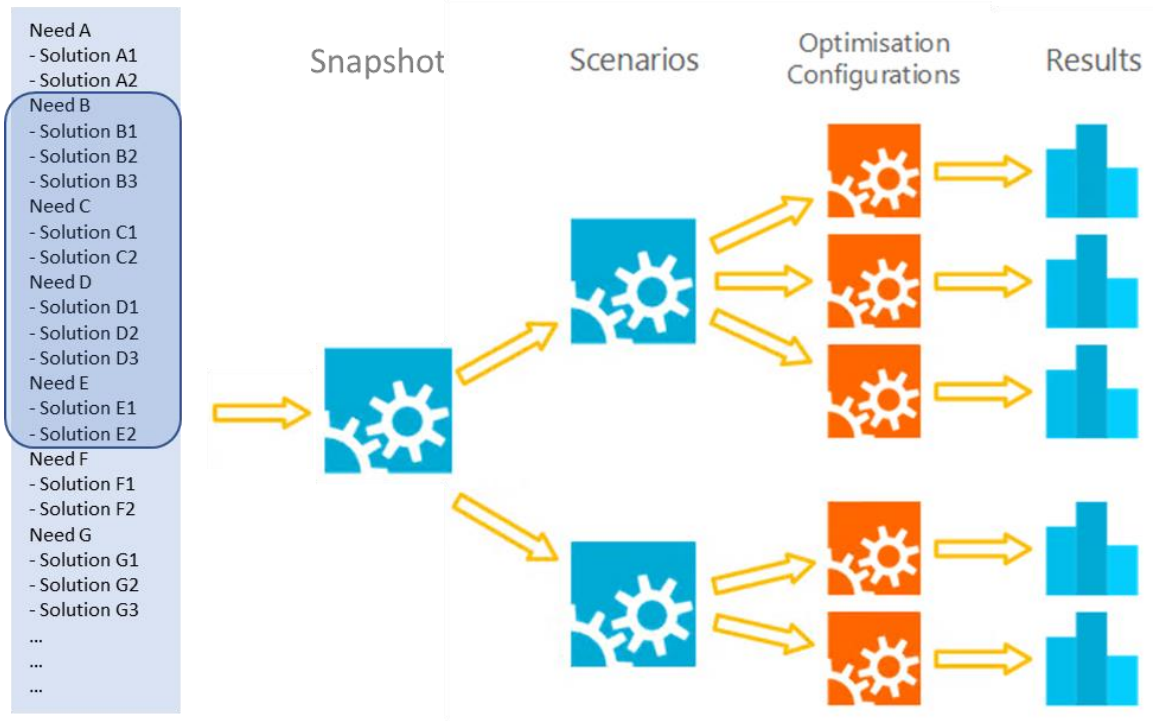


Figure 10 – EDA Portfolio optimisation configuration

We use the outputs of EDA to determine the optimal investment plan for our customers and other stakeholders. Section A4-5 below expands more on the principles of EDA portfolio.

The final decision making considers the risk of each need and the BCR and/or the NPV for the associated interventions, alongside broader organisational objectives, customer preferences and legal obligations and regulatory commitments. This includes consideration of the Long-Term Delivery Strategy (LTDS) which integrated

adaptive capacity into our decision-making – enabling long-term resilience through a core pathway of low-regrets interventions and enabling activities.

A4-5. EDA Portfolio optimiser

Wessex Water uses the Arcadis Gen software, Enterprise Decision Analytics (EDA) as our decision support and planning tool. We use both the asset investment planning module for asset deterioration modelling (see WSX10 - Maintaining our services commentary and analysis for more information on how we use this) and the portfolio planning module (EDA Portfolio) for support with planning, optimisation and options selection. The overview and process workflow of EDA is shown in Figure 11 below.

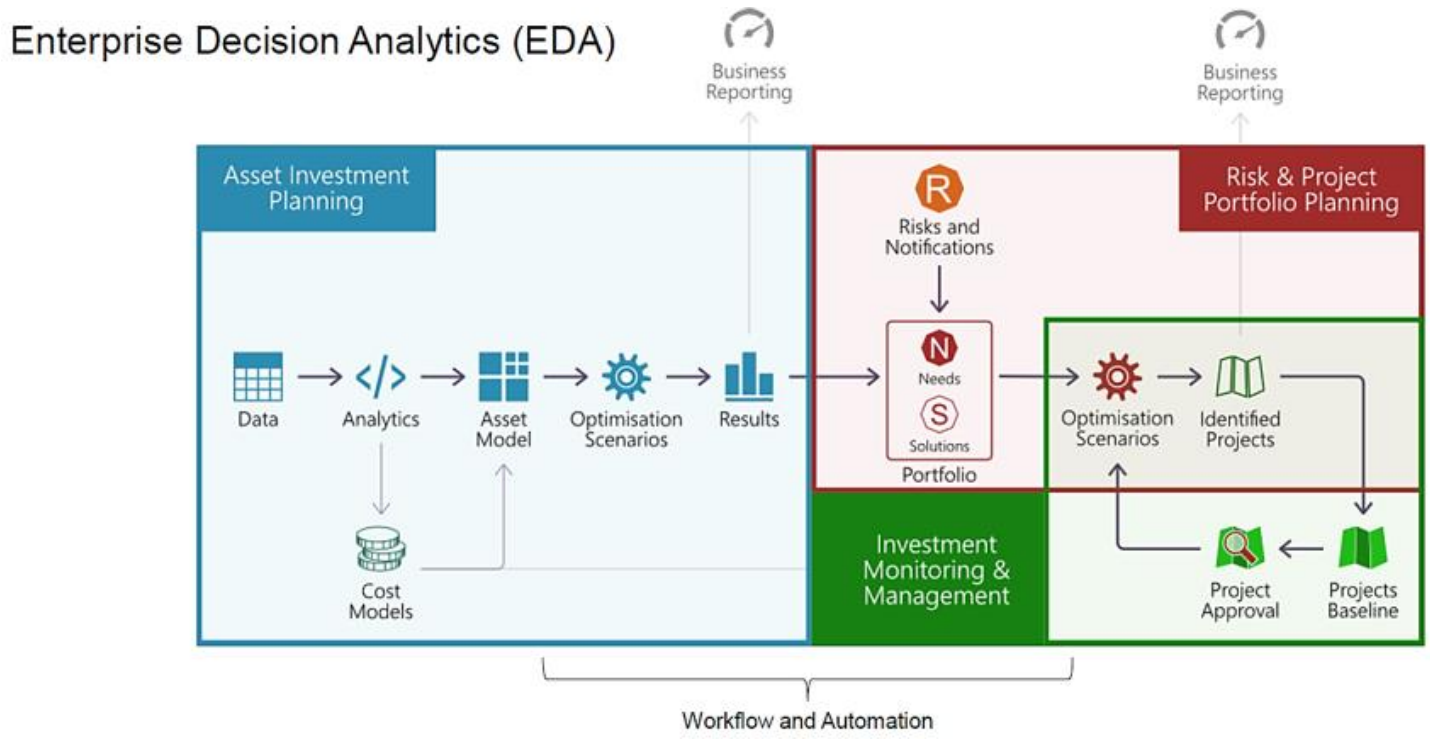


Figure 11 -11 Overview of Enterprise Decision Analytics (EDA) system

The EDA Portfolio provides users with the ability to add all of their investment needs into a repository, ready to be optimised. Each need represents the baseline values such as ‘do nothing’. Against each need, users can add one or more solutions. The optimiser will pick either the need or one of the solutions (it cannot pick multiple as they are mutually exclusive) depending on the optimisation question posed.

The optimiser chooses when to complete the solution (if picked). The measure values (i.e. costs, service, performance etc.) take the need profile until a solution is picked. From then on, the solution values are taken. If time to benefits are applied, it is possible to cause a lag between when solution costs are applied and when the benefits to service come into effect or the user can enter the benefit change in the appropriate service timesteps relative to the cost profile to define this. This is shown conceptually in the image below for illustrative purpose.

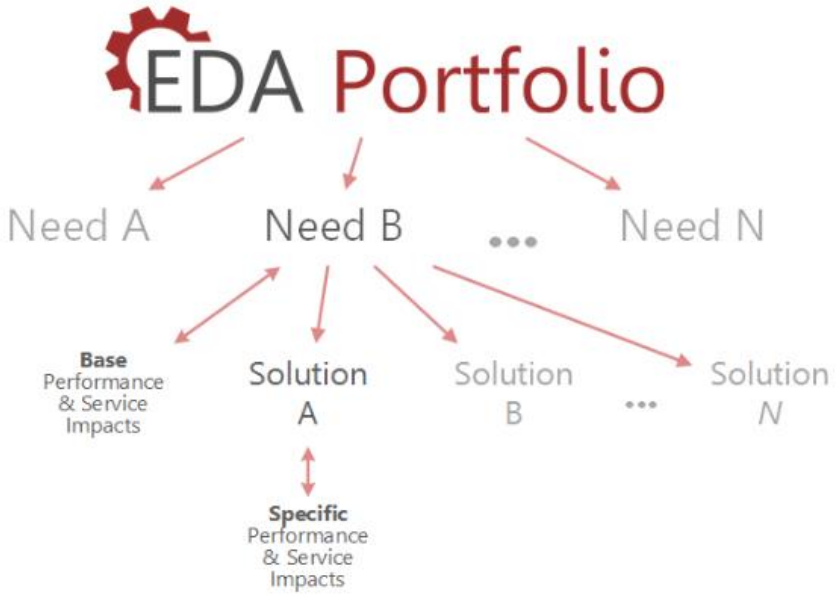


Figure 12 - EDA Portfolio needs and solutions

A4-5.1.1. Service Measure Framework in EDAP

In EDA, the user defines an associated annual frequency of failure in addition to a quantity value for each service measure impact category. In order to calculate the total risk associated with a need or solution, the four capitals (Financial, Natural, Social and Human & Intellectual) are then calculated for each impact category by multiplying their associated monetary weighting with the product of the associated frequency of failure and quantity values. An example expression for an individual impact category and an individual capital (i.e. financial) is as follows:

$$Capital\,Value\,(Risk) = FoF * Q * £$$

Where:

- Capital Value is the total risk / value associated with one of the capitals (i.e. financial) for the impact category
- FoF is the frequency of failure allocated to the need / solution.
- Q is the quantity allocated to the to the need / solution.
- £ is the monetary weighting applied to the capital for the impact category.

This calculation is replicated for each combination of impact category and capital.

A4-5.1.2. Benefit cost ratio and net present value

In order to calculate the total risk associated with a need or solution, the four capitals (Financial, Natural, Social and Human & Intellectual) are then calculated for each impact category by multiplying their associated monetary weighting with the product of the associated frequency of failure and quantity values.

Calculating capex annualised over the expected financial life of the investment ensures long-term investments are balanced fairly against short-term ones. In order to annualise capex, we use an annuity factor based on the Weighted Average Cost of Capital. The number of terms is equal to the asset life of the investment. Where multiple investment lines (asset lives) are applicable, the capex is then split between these lines before annualization, based on their relative proportions. The annualised capex is applied for the asset life years following the capex. As such, if

there was additional capex in year 2 then the calculation would apply again and the values in subsequent years would be added together.

A4-5.1.3. Optimisation method and use

Gurobi is the linear optimisation solver used by Arcadis Gen in EDA Portfolio.

- EDA uses Gurobi for portfolio optimisations. Although possible to add, no user-defined timeout has been set on the optimisations and as such, the results are the true optimum.
- Gurobi is a mixed integer linear programming solver (MILP) that allows users to set bounds/constraints and goals. Gurobi looks to minimise or maximise the goal(s) while ensuring it is within the constraints.
- A goal is represented to the optimiser as follows:

$(w_1 * \sum_1^n g_1) + (w_2 * \sum_1^n g_2) + \ldots$

In the above formula, w_t is the weighting applied to each goal and g_t is the value associated with a measure for each project and n is the total number of projects. Subscript 1 and 2 represent each goal. Where there is one goal, the above can be simplified to $w_1 * \sum_1^n g_1$. In layman's terms, this means that the optimiser sees the goal as the sum of all values associated with the measure for all projects multiplied by the goal weighting, and where there are multiple goals, these are added together.

- Constraints are represented to the optimiser as follows:
    - Upper bound $\sum_1^n x \leq u$
    - Lower bound $\sum_1^n x \geq l$
    - Upper and lower bound $l \leq \sum_1^n x \leq u$

where x is the measure value for the constraint for each project (which is again summed up for all projects, denoted 1 to n) and u and l are the upper and/or lower bounds respectively. In layman's terms, for each constraint, if it is an upper bound then the total value across the portfolio can equal but cannot exceed the constraint. Likewise, for lower bounds, the total value across the portfolio can equal but cannot be below the constraint. Where these are both in effect, then it creates a threshold between the upper and lower bounds.

EDA has been used to run the following optimisations for Wessex Water:

- Best BCR – a simple goal where the benefit cost ratio (BCR) is maximised as the only goal of the optimisation. The BCR is calculated as follows:

  (Pre-Risk NPV – Post Risk NPV) / (CAPEX NPV + OPEX NPV)

  Pre Risk NPV is the total risk based on the need and Post Risk NPV is the total risk of the solution, both across the NPV period. Pre-Risk NPV – Post Risk NPV therefore provides the benefit over the NPV period. OPEX and CAPEX NPV are described in more detail under *Net Present Value Calculations*.
- Least Cost – two goals are applied where the OPEX NPV and CAPEX NPV are added together with equal weights. The objective of the optimisation is to minimise the total of these values.

Constraints have been added where required on CAPEX and to optimise our plans to meet various performance profiles, regulatory targets and commitments.

A4-6. Our asset management framework

Our Asset Management Framework (AMF) sets out the process and tools that we use to manage our assets. This includes managing risk and resilience. The framework includes policies, strategies, plans, information management, decision-making processes and capital and operational delivery. It provides a number of important functions:

- It provides a clear line of sight so that everybody who works for or on behalf of Wessex Water understands how they contribute towards the delivery of our company objectives. The line of sight translates organisational objectives from our strategic direction statement into asset management policy, strategy and objectives, which cascade down into more detailed asset management plans and lifecycle activities.

- It ensures that our senior management decisions, strategies, and plans take into account the bottom-up, fact-based realities i.e. asset capabilities, performance, opportunities and constraints through our risk management and resilience framework and our investment decision-making framework.

- It provides our delivery staff with direct visibility of the purpose of the work they undertake – so they understand why it is needed, not just when and how to do it. This helps with identification and prioritisation of risks as well as encouraging innovation through identifying better ways of achieving objectives.

- Our approach to asset management is top down, looking at customer preferences and bill impacts, but also bottom up which looks at the needs to invest and the key interventions needed to achieve the objectives.

The interaction between our Risk and Resilience framework and the AMF has been summarised in **Error! Reference source not found.***3*. The stages of the risk and resilience framework have been mapped to the AMF to highlight areas of alignment.

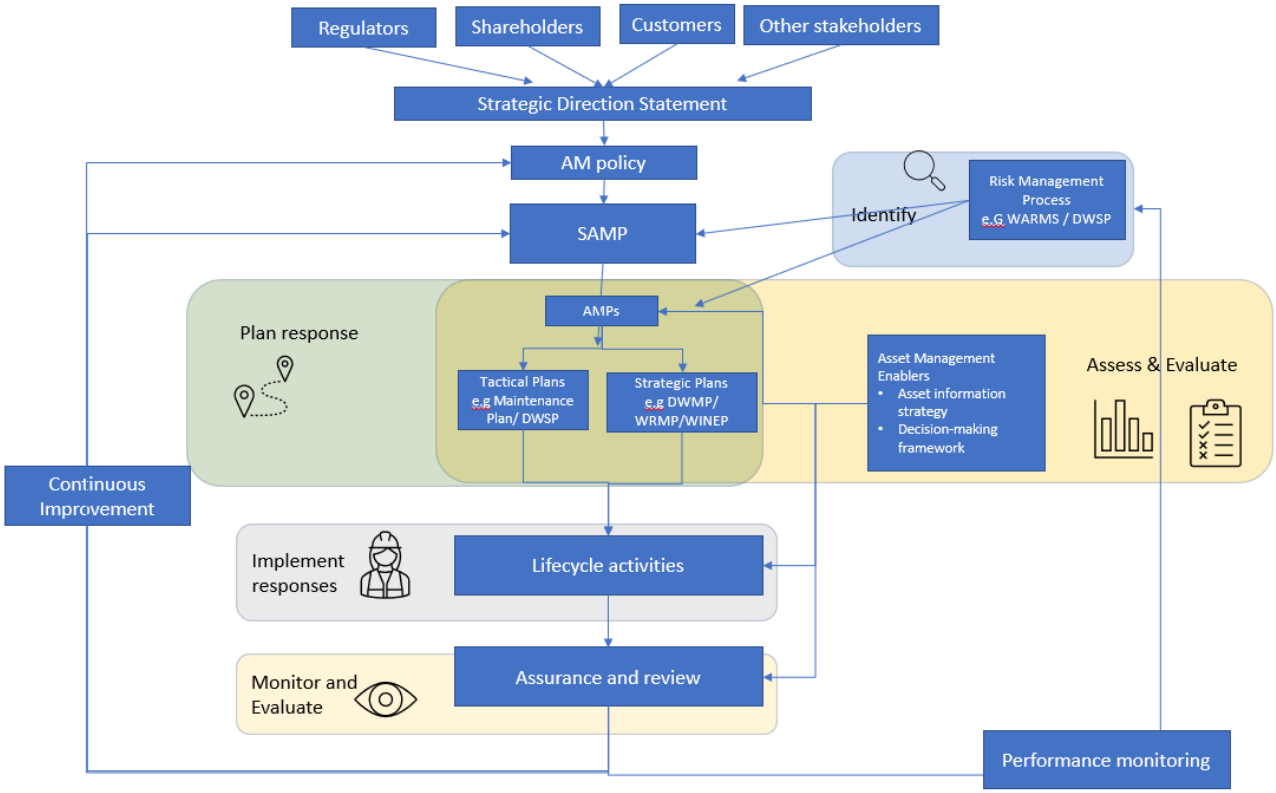


Figure 13 – Risk and resilience in AMF

The AMF enables us to operate a resilient system to serve our customers to their expected level of service. In this section we specifically highlight the parts of the AMF which help us achieve this and how this links to our risk and resilience framework.

It should also be noted that the AMF is currently under review and there are a number of resources which are planned for improvement in this AMP and next.

As part of the AMF we maintain supporting processes which ensure that our decision-making is robust. This includes our asset information management systems. Data underpins everything we do and through improving data we can further improve our progress against our purpose and drive the business vision: to provide outstanding water and environmental services.

To ensure that we collect and use high quality data and information for assessment and evaluations we maintain the following:

- **Asset Information Strategy** - We are refining our asset information strategy which helps us to manage our data effectively and ensures we have the best possible information to base our decisions on. This will dovetail into the overarching Wessex Water Data Strategy which will help align principle across all data types. – including asset data. Our asset information strategy includes:
    - Data & Information Management - our standards and business processes.
    - Data & Information Lifecycle - how we manage data from creation to deletion.
    - Data & Information Control – how we manage change, competencies and assure our information is accurate.

- **Asset Information Tools** - We use a number of digital tools which allow us to assess and evaluate risks. We then use this information to plan how to manage our assets.

A4-7. Business continuity and emergency planning

At Wessex Water, our focus on business continuity is on the continued delivery of our key services at acceptable predefined levels following a disruptive incident. We define key services as:

- The provision of clean wholesome drinking water
- Protecting public health; and
- The provision of sewerage and sewage treatment services all without a detrimental impact on the environment.

Business continuity management (BCM) identifies potential impacts that threaten Wessex Water. It provides a framework for building resilience and the capability for an effective response that safeguards the interests of key stakeholders, reputation, brand and value-creating activities. Business continuity plans contain an assessment of the key risks shocks and stresses that could impact our activities (either caused by external factors or our internal actions or lack of them) and the impact that they would have on our services. These are generally high consequence but low probability events. We then assess the mitigation measures and controls we have in place to prevent those impacts occurring.

Our emergency planning aims to prevent incidents occurring where possible, and when they do occur, reduce, control or mitigate the effects of the emergency. Our emergency response plans, which are part of our AMP, relate to specific catchments and zones and focus on recovery activities that are undertaken once an incident e.g. pollution incident, has occurred. These plans will include key contacts and escalation activities and the location of emergency equipment.

This allows us to develop plans to improve our service resilience and reduce the impact to our customers- particularly for low probability / high consequence events which it may not to be the best value to implement solutions now. Our Business Resilience Policy provides a clear commitment to establishing business resilience through a number of processes, set out below in Table 6.

Table 6 – Business Resilience Policy summary

Process	Description
Business Continuity Arrangements (BCA)	Each principal threat (determined from the principal risks) for which it is considered that the company should have an appropriate business continuity plan in place is documented as a BCA. These documents identify the specific measures that need to be undertaken across the company in preparation for the 11 principal threats.
Business Continuity Incident Response Plans (BCIRP)	These documents provide a tactical response in the event of a principal threat materialising into a business continuity incident. Key roles, responsibilities and contacts are identified in order to respond to such an incident.
Business Continuity Plan (BCP)	Each individual business area has its own business continuity plan in place which identifies its business critical activities and recovery time objectives (RTO) for reinstatement. The plan will include a business impact assessment that identifies those activities of the business area that are considered critical activities, the risk and subsequent impacts to those activities, the current controls and any gaps. For those BCA threats which potentially impact business critical activities, the business continuity plan should provide details of a recovery plan for the individual BCA threats with agreed recovery timescales. This should include details of the appropriate work arounds that would be put in place for the duration of any event or incident. These business continuity plans may be supported by individual consequence management plans and local emergency plans as necessary.
Consequence Management Plans (CMP) and Local Emergency Plan (LEP)	Where appropriate, detailed plans to manage individual threats and other significant potential incidents not covered by the identified BCAs are provided in consequence management plans (CMP) drafted by the individual business areas. In addition, local emergency plans (LEP) are provided to document planned responses to individual operational incidents on specific critical operational and non-operational sites.
Integrated emergency management plan	This outlines the core requirements for managing any level of incident. It is designed to complement the knowledge and experience possessed by Wessex Water personnel and should be used as the framework within which the organisation manages all incidents regardless of their nature.

A5 Cost Estimating Methodology

A5-1.1. An overview of business as usual

Accurate estimation of the final project costs, risks and project duration is essential for Wessex Water in particular because we:

- constantly assess that our internal delivery approach is getting the best value for money
- need to ensure we maximise the utilisation of our internal resources
- need to accurately compare a range of no-build, low-build and construction options on a whole life totex basis to ensure the best value is delivered
- use the information to combine projects into programmes of work to deliver maximum efficiencies
- test the effectiveness of our framework contract prices to ensure they remain competitive.

Each solution option is then reviewed technically and financially as part of our financial governance processes and the lowest whole life cost option is selected unless there are specific circumstances where this is not feasible/appropriate. This option then proceeds to contract award and delivery as a project. Projects greater than £5m in value are approved by the board. The financial and programme progress of each project is reviewed every month and reported to the board with corrective action taken if risks materialise or third-party delays require an escalation to the executive.

This standard process, applied to each project as business as usual, feeds straight into the estimation of the projects assessed for each business plan. However, further assessments of efficiency are carried out for business plan estimates. This is because solutions are sometimes assessed for business plans prior to the completion of appraisal and outline design. This design work will then happen during the price control in which the work is planned to be delivered.

A5-1.2. Our business plan pricing methodology

For the business plan we have used 4 different pricing models:

1. **Bottom Up Estimates (BUEs)**
    - The preferred approach where applicable and uses the internal estimating team to provide an accountable, consistent and transparent estimating and review process with the following advantages:
        - Proven track record for technical, buildability, programme and accurate estimating
        - Vast experience of:
            - Price Reviews
            - WW standards
            - Enabling Works
            - Operational and H&S requirements
            - Civil Works
            - Mechanical and Electrical Works

- Mature relationships with:
  - Design teams
  - Supply chain
- Access to current market rates and supply chain

2. **Unit Rates Built from historical project building blocks**
   - Building blocks were generated from historical projects and priced bottom up where appropriate or with subject matter experts (SMEs)

3. **Historical delivery costs**
   - Analysis of historical totex costs to generate future costs; this was also the method used to calculate the non-construction %s

4. **Strategic Cost Models**
   - Using available cost data and strategic cost models where generated and applied. The methodology and process used to generate the models have been assured by the cost consultant, CKBS.

Scope definition

The pricing model chosen depends on the design information available. The scoping information for the BUE estimates was provided by internal design teams in the form of bottom-up cost estimating schedules. The estimating schedules include:

- New assets
- Asset modifications, including demolition and disposal.
- Asset sizing information
- Indirect scope i.e. pipelines, cable ducting and access roads etc

For some programme areas, scoping information was not available to the level of detail highlighted above. This largely aligns to the other three pricing methods where basic yardstick information was limited to, for example, overflow storage volumes, continuous water quality monitoring locations. In some cases, further guidance from regulators will confirm the scope definition. Further investigation work is included within the business plan to develop the detailed information to finalise solution option costs.

Accounting for optimism bias

The methodology used to calculate Optimism Bias incorporates the recommendations and templates produced from the water industry wide Cost Consistency Methodology report February 2022, produced by Mott MacDonald as part of the SRO strategy. The recommendations predominantly follow the Governments Green Book which recommends that optimism bias is accounted for in investment appraisal:

> *"Optimism bias is the demonstrated systematic tendency for appraisers to be over optimistic about key project parameters, including capital costs, operating costs, project duration and benefits delivery. Over optimistic estimates can lock in undeliverable targets. To reduce this tendency appraisals should make explicit adjustment for optimism bias. The Green book recommends applying overall percentage*

adjustments at the outset of an appraisal. The initial optimism bias estimate should not be locked in but can be reduced as an appraisal develops and the cost of specific risks are identified."

As we do not have our own evidence for historical levels of optimism bias, we have used the generic levels provided in the green book. For PR24 we have used the templates recommended in the Cost Consistency Methodology and, dependent on the complexity of any given project, we have, in conjunction with the independent cost consultant ChandlerKBS, produced an average and complex set of scores based around the Green Book and Cost Consistency Methodology descriptions. We have then looked at each individual project and identified the mix of standard and non-standard assets then applied this mix to the scores to generate the optimism bias % which is then added to the central estimate.

Certainty / Uncertainty Analysis

Due to the level of scope definition provided at Business Planning stage, we would identify the estimate class, as defined by the Association for the Advancement of Cost Engineering (AACE), as a Budgetary Estimate or Class 3 and, therefore, an expected accuracy range of between -20% and +30% to the outturn cost.

For each business plan, the approach involves:

- assessment and risk-based prioritisation of maintenance works using our risk management process as well as benefit valuation for all projects as appropriate to ensure we optimise the programme to best value our customers, the environment and asset health.
- assessment of options for delivering the outcome. For example: catchment-based solutions, innovative technologies, procurement and BIM initiatives with the lowest totex whole life cost.
- site visits, where appropriate, to confirm the exact scope of works and to determine any specific environmental, third-party, land or planning constraints that could impact a project cost or more likely the programme. These are then factored into the estimate if they are definite issues or included in the risk register with an appropriate likelihood applied
- an independent assessment by a cost consultant of the non-work rates applied to projects, such as project management and design fees
- market testing of work item costs using our independent cost consultant, covering mechanical and electrical items of work from quotations, and civil works based on quantities of materials
- review of the opex impacts of the delivery of new capital works, assessed using latest framework rates.

All of this information is prepared using a standard cost estimate sheet for each project which generates the breakdown of the works by asset lives. A central record is then compiled, with the appropriate taxonomy applied to allow the population of the totex business plan data tables.

A final series of scenarios has then been run to test the optimisation of the plan and the totex profile to ensure it provides the best opportunity to deliver the outcomes that customers require, and/or within the regulatory dates defined.

Assurance

The cost consultant, ChandlerKBS, has provided assurance on each of the pricing methodologies. Their reports are detailed in Annex A4 of WSX45 (Annexes – Assurance reports).

A5-1.3. Evidence of efficiency in capital delivery

Multi-faceted delivery model

Wessex Water is unique in the industry in maintaining a strategy that retains an in-house engineering and construction delivery team, and this reduces our reliance on major sub-contractors whilst also, lowering our exposure to market conditions.

Efficient, high-quality delivery is paramount. Over 80% of our expenditure is competitively tendered, either through supply chain or frameworks which leverage our engineering and construction position in the market and in our supplier/hub arrangements. Externally benchmarked projects such as the Durleigh WTW Reconstruction and Sturminster Newton STW projects have demonstrated that E&C's prices are more competitive than the external market.

Utilising in-house services provides Wessex Water with the ability of ensuring its service to the industry and customers are at the highest standards. With an end-to-end approach, the entirety of service is directly overseen by our skilled workforce ensuring, we obtain and maintain through progressive learning the most efficient outcomes.

Our workforce is supplemented, in many areas, by external partners however, with SOE managing standards and outcomes carefully, this extension provides for a seamless joined up and integrated collaboration of services.

During AMP7, the Wessex Water Sustainable Engineering and Operations Team (SOE) has created a multi-faceted delivery model using:

- tiers 1 & 2 medium to large main contractors on design & build or multiparty collaboration contracts supplementing delivery capacity and providing further benchmarking opportunities.
- tiers 2 & 3 small to medium-sized main contractors on a build-only basis, labour-only contractors to supplement SOE's own labour on projects.
- package contractors such as piling, shaft construction, directional drilling, formwork, reinforcement, concrete, mechanical and electrical installation (M&E), structural steelwork.
- in house civil engineering on build-only schemes, supported by specialist package contractors and labour-only contractors. Working collaboratively with design & build contractors
- in-house Mechanical & electrical on build-only schemes, supported by specialist package contractors and labour-only contractors
- in-house specialist services

All design consultants, main contractors, subcontractors, package contractors and suppliers were selected through an OJEU process, prior to the start of AMP8. Framework lists were then created for use by SOE and the wider business.

SOE as programme manager

SOE, in a collaborative process, programmes and project manages main contractors such as Galiford Try, Trant Engineering, Envolve and Tilbury Douglas and designers such as Atkins, SWECO, Pell Frischmann, Aecom, Stantec and Mott MacDonald.

This is done using NEC 3 Option A and C basis albeit, in AMP8 we shall be transiting to NEC 4 Options A and C with:

- build-only designs procured through design consultants.
- multiparty collaboration procured through Tiers 1 & 2 main contractors.
- design & build procured through Tiers 1 & 2 main contractors.

As programme manager, SOE's role encompasses pre-statement of need, concept, outline and detail design; planning approval, consents, land access and acquisition; site investigation; public, press and stakeholder consultation (including EA, Defra, DWI, English Nature); overall project management and coordination of design consultants and contractors.

With the utilisation of multiparty collaboration and design & build partners SOE's services benefits from a flexible strategy to address peak demands in programme volume.

Internal designs

In addition, an element of the AMP7 programme is carried out by SOE using designs it has produced internally and then constructed using a mix of SOE's own direct labour, labour-only subcontractors and tendered packages to smaller subcontractors (e.g. piling, formwork, reinforcement, concrete) and suppliers of process equipment.
.
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- package contractors such as piling, shaft construction, directional drilling, formwork, reinforcement, concrete, mechanical and electrical installation (M&E), structural steelwork.
- in house civil engineering on build-only schemes, supported by specialist package contractors and labour-only contractors. Working collaboratively with design & build contractors
- in-house Mechanical & electrical on build-only schemes, supported by specialist package contractors and labour-only contractors
- in-house specialist services

All design consultants, main contractors, subcontractors, package contractors and suppliers were selected through an OJEU process, prior to the start of AMP8. Framework lists were then created for use by SOE and the wider business.

Direct labour

SOE also carries out: all sewerage mains rehabilitation and clean water mains-laying; unplanned reactive repair and maintenance of Wessex Water Services Limited (WWSL) clean water and sewerage pipeline assets using its own direct labour (approximately 240 employees). This work is supplemented by labour-only subcontractors, during peak requirements.

In-house businesses

SOE has grown and developed its own in-house businesses such as the CCTV crews, sewer pipe lining and direct labour reinstatement gangs that are used for road, highway, pavement reinstatement. This is also supplemented by labour-only subcontractors and reinstatement contractors during peak requirements.

Further recently-delivered initiatives

- Growth of our internal design resources and expansion of design specialisms.
- Creation of SOE's Mechanical and Electrical division to reflect the success of the Civils business.
- 3 Challenge Process.
- Technical standards.
- In-house CCTV.
- In-house sewer lining.

Each of these initiatives is a major undertaking for any business. However, with an existing internal structure we have undertaken their delivery in a business as usual environment with minimal risk.

A5-1.4. Examples of how E&C has shaped efficiencies

Below are some examples of the benefits and influence that this relatively new capability has provided in shaping efficiencies.

Example 1: The 3 Challenge Process

The 3 Challenge Process is now embedded within our delivery plans in order to promote challenge in day to day decisions and processes, and to make sure we deliver the best value to the business. It can be applied at the very outset of a project to challenge the fundamental scope, or at any stage throughout a project to challenge specific issues. This process ensures we deliver the best value for our customers and aligns our standardised solutions with our BEST company values and commitments. Where appropriate, challenges may be incorporated within the relevant Design Standards.

The 3 Challenge ethos is broken down into three simple considerations, set out in Figure 14 below:

Type of Challenge	Description
Meets the Need	Do we need to do it at all? If so, what solution delivers just enough?
Standard	Apply the standard where appropriate. No extra.
Enhanced	Can an enhanced solution provide a beneficial whole life cost? This needs to be demonstrated with supporting business case.

Figure 14 – 3 challenge ethos

Example 2: Technical Standards Groups

This is an important foundation in achieving strong governance and effective integration within Wessex. Our Technical Standards Groups are made up of representatives from across the business. Each member has technical expertise in their respective areas and is tasked to ensure that the company maintains a consistent and robust approach to design, when maintaining, renewing and installing plant and equipment.

Example 3: Advanced procurement – visibility for the supply chain

The Early Procurement Initiative (EPI) is intended to identify specific groups of equipment, materials and plant that can be bulk procured, strategically and centrally. We target all areas of delivery including treatment, networks, M&E and utilities. The overall objectives of the EPI are to:

- take the learning and benefits from early procurement from the Grid and P Dosing and apply them at a programme level
- evaluate the benefits of advance procurement in preparation for AMP7
- be more resilient to market pressures
- ensure programme resilience and risk mitigation
- develop greater understanding for delivery in future years
- support the AMP6 transition to AMP7
- deliver best value for the company.

To date we have bulk-procured the following items:

- inlet screens
- ready-mixed concrete and plastic pipes
- packaged ferric dosing units.

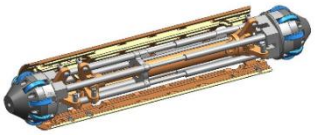
Example 4: Innovation

As we are the asset owner, we've found that we are best placed to solve our own problems. To that end we've designed, instigated research and brought new techniques to fruition, including:

The MAC extensometer: for non-destructive testing of tunnel linings in order to establish structural capacity and, potentially, longevity as designed by Dr Olivier Thépot of Eau de Paris. The system is undertaken in conjunction with geological investigations and sample UCS crushing of tunnel lining cores to establish a finite element analysis of the tunnel. We have undertaken our first research, and we are proposing our second project in Autumn 2018.

CIPP rising (force) main lining: we have recently completed our first rising main liner, which is 400mm in diameter and 120m long, to the new ISO 11297 : 4 : 2018. We are proposing several more and can provide full mathematical evidence of design. We are proposing to undertake further research in conjunction with other water and sewerage companies around Europe.

Epoxy lining for infiltration sealing: we worked with EPROS and Onsite Central Ltd to perfect this system and have utilised it for the last seven years. Excluding ground water reduces pumping costs, power and maintenance and premature CSO initiation. It provides more capacity in the sewers for future development, prevents flooding and reduces costs of treatment.



Re-rounding robotics: Sewers beyond 10% deformation require re-rounding prior to lining. As there were no known devices available to do so worldwide, we developed our own.

Example 5: General procurement

We have developed our current and future service delivery strategy and refined our unique, added value skills and capabilities to ensure we provide a competitive and efficient delivery approach across the asset lifecycle.

There is a background of resource shortages and continuous churn in consultant and contractor ownership. This leads to uncertainty. Our approach provides significant savings as well as resilience and security.

- In-sourced £100m of design and M&E services in AMP6 and reduced external spend.
- In-house provision of design and M&E services at a lower out-turn cost based on AMP values of work.
- In-house design delivers services 35% more efficiently than consultants in AMP5.
- Forecast design savings of £17m across AMP6, providing like-for-like services.
- In-house M&E delivers services 6.5% more efficiently than contractors in AMP5, saving £4.6m.
- The in-house design and construct across civils and E&E drives further capital savings.
- Technical standards forecasting to deliver £10m of savings this AMP.