

IAP Response

Ref WSH.LR.A2

Our action plan for developing our approach to resilience in the round

22 August 2019



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1. Introduction

In Welsh Water we take consideration of resilience very seriously. We recognise the importance of planning for a range of scenarios to ensure that we continue to provide the best service possible to our customers and the environment. Our commitment to this is shown in our strategic plan, Welsh Water 2050.

Since submission of our business plan in September 2018 we have been considering improvements that we should make to our processes in order to strengthen our current approach. We have carefully considered the feedback provided by Ofwat in the Initial Assessment of Plans and undertaken a review of best practice across our and other sectors. This has led to the creation of our action plan for developing our processes over future years, which is set out in this document.



2. Our current approach

2.1. Overview of approach used in PR19

At Welsh Water, our vision is 'to earn the trust of our customers, every day'. For our customers, safety and reliability is a basic expectation and a fundamental aim for our service. They have told us that prioritising both the reliability and the quality of our service is key for the future. While they have told us that we are currently seen as a highly trustworthy organisation, they also say that if we start to provide a poor service this trust could be rapidly eroded. We therefore recognise that it is essential to plan, invest and prepare for the future to increase the reliability of our service and we invested a considerable amount of energy in the development of our PR19 plan looking at our current and future resilience and opportunities for improvement.

We have used the following working definition of resilience, based on 100 Resilient Cities, and published in January 2017:

"Resilience is the capacity of individuals, communities, institutions, businesses, and systems to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience."

We are committed to building our resilience, and as such it is a recurring theme throughout our business and our plans for the future. Building resilience will enable us to grow and thrive in the face of a range of uncertain and unexpected events, and continue to provide the best service possible to customers. In return, if we have the trust of our customers, we can seek their active participation to help us improve the quality and resilience of our services and the environment. For example, by working with us to reduce water usage, tackle leakage and to reduce problems caused by sewer blockages.

In response to the long-term trends that we are facing, we have developed our long-term strategy, Welsh Water 2050. Meaningful consultation with our customers was a key part of developing this strategy, which has helped us clarify, articulate and frame our approach around the issues that are most important to them. Welsh Water 2050 describes the 18 Strategic Responses we have identified to address the challenges facing our business in the future.

We included a number of resilience schemes in our investment plan. These were promoted from a business review of risk information, which is set out in the Resilience Investment Cases included in our response to the IAP.

2.2. Policy context in Wales

As a company operating mainly in Wales we have some specific duties in relation to resilience which have influenced the development of our approach.

The Welsh Government has emphasised the importance of resilience within the water industry in Wales. For example, its statutory Strategic Priorities and Objectives Statement to Ofwat, published under section 2B of the Water Industry Act 1991, said, "Ofwat has a key role to play in the delivery of a resilient water sector. Ofwat's approach and regulatory framework should encourage, enable and incentivise resilience both in regard to short and long-term challenges. Companies are responsible for ensuring their assets and the services



they provide are resilient against natural hazards and other problems that can be reasonably anticipated and that their services are resilient against asset failure and other threats."

In terms of the broader agenda, "A resilient Wales" is a statutory well-being goal under section 4 of the Well-being of Future Generations (Wales) Act 2015 and, for example, includes, "the capacity to adapt to change (for example climate change)". In addition, the Environment (Wales) Act 2016 advocates a Sustainable Management of Natural Resources approach, defined as "using natural resources in a way and at a rate...to maintain and enhance the resilience of ecosystems and the benefits they provide..."

The National Infrastructure Commission (Wales) was established in 2018 to identify the future infrastructure needs of Wales over the next 30 years in line with the Well-being of Future Generations Act. They have regard to the water industry as a key contributor to their aims and support us in our objectives to work across multiple stakeholders for the benefit of our customers and the environment.

2.3. Systems based thinking in practice

We have used the following working definition of systems thinking, from Peter Senge, The Fifth Discipline: The Art and Practice of the Learning Organisation: "Systems Thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, or seeing patterns rather than static 'snapshots'. Systems Thinking is a discipline for seeing the 'structures that underlie complex situations."

Consideration of the external systems we impact on is very important to us as a business. We are very conscious of the impact we have on the community around us, not only in providing an essential service to our customers but supporting the economy of Wales and maintaining a healthy environment. This is built in to the culture of our organisation.

In creating our long term strategy, Welsh Water 2050, we engaged with a wide range of stakeholders including our Customer Challenge Group, our Independent Environmental Advisory Panel, Natural Resources Wales, British Trust for Ornithology, Citizens Cymru Wales, Waterwise, Wildlife Trust Wales, RSPB Cymru, Salmon and Trout Conservation UK, The Canal & River Trust, Chartered Institute of Plumbing and Heating Engineering, Brecon Beacons National Park Authority, and the Campaign for the Protection of Rural Wales.

In understanding our impact on the environment (particularly the rivers and coastal waters) we undertake modelling of our assets and other contributors to environmental impact. This modelling is used in discussions with Natural Resources Wales (NRW) to agree the most suitable approaches for managing the risks and influence the selection of solutions from across the range of stakeholders who are causing impacts. As an example of this, we will be working with NRW and public service boards to develop Sustainable Management of Natural Resources (SMNR) plans, in accordance with the "place based" approach required under the Environment (Wales) Act.

One of our major projects that we have been developing and included in our PR19 plan is the Brecon Beacons Mega Catchment project. This project started off internally with a driver to protect the quality and quantity of water available for collection in the Brecon Beacons area, which supplies heavily populated areas in South Wales. We have taken full recognition that this area is important for many reasons other than water supply so, in understanding the



problems and solutions, we are working in partnership with other stakeholders for the area, including landowners and the National Parks Authority. Working in this collaborative manner will result in better solutions to meet our needs in the long term but also provide wider benefits for the area.

2.4. Risk identification

At a strategic level we have worked to assess the shocks and stresses that we may experience in the future and clearly set out our challenges for the next 30 years in our long-term strategy, Welsh Water 2050.

We set up a panel of experts from Cardiff University to provide detailed research into the potential drivers of major change across the social, technological, environmental, economic and politico-legal (STEEP) realms, using the latest academic research. They developed a short list of 10 major trends which fed into our risk prioritisation.

Other key sources, such as the National Risk Register and the World Economic Forum's Global Risks Report, were used to support the development of the long list of shocks and stresses. We used impact and likelihood of the risks to develop our shortlist of risks to focus on.

The consultation process for Welsh Water 2050 received great support from our stakeholders and allowed us to test our thinking and ensure we had placed appropriate weight on the risks we had identified.

At a tactical and operational level in the business we have developed and are running a number of different risk processes focused on providing comparability of risk across risks of a similar type. These provide detailed information to understand risks to day to day management and also the medium to long term concerns of the business. These are a rich source of information in developing detailed plans for tackling resilience risk issues and the data from them are rolled up into strategic level reviews. The following table (table 1) lists the processes we use and the types of risk that they consider.



Table 1: Current resilience risk management processes

Process	Scope of review	Approach used	Links to system based resilience approach
Corporate risk register	Strategic level risks being managed across the business	Each department holds their own register of the risks they are currently managing and those on the horizon. The most significant of these are escalated for consideration at our Executive and Board meetings.	The majority of these risks are dealt with as business as usual, however this register can also be the first place where new threats are identified, which can be taken forward for consideration in the resilience framework. A significant proportion of the risks in this register relate to our relationships with external systems and bodies.
Service resilience assessment	Looks across a geographical area to identify overarching and connectivity issues	This approach was trialled in the preparation for PR19 and used workshops in different areas across our region to identify issues that span across assets in the region.	This approach considers the connections between our internal systems and highlights weaknesses in them.
Drinking Water Safety Plans	Catchments, treatment works and networks ("source to tap") consideration of risks to drinking water safety	A generic list of risks to drinking water safety has been created and these are systematically assessed against all assets involved in supplying safe drinking water. As risks increase investment to resolve the deficiencies are generated.	Interdependencies between different systems in the supply network are considered. In general deficiencies will be resolved urgently but this process can also highlight emerging risks for consideration in a wider resilience assessment.
Dams Portfolio Risk Assessment	Dams are considered for risks associated with catastrophic failure	A probabilistic assessment of the risk of collapse is made by considering the condition and design of the dam. Solutions are identified to reduce this risk.	The operation of the dams has wide system effects, not only in providing water resource storage but in supporting ecosystems and failure would have a catastrophic impact on local communities.



Process	Scope of review	Approach used	Links to system based resilience
			approach
Water Resources Management	The availability of water resources	Modelling of supply variability and	Consideration is taken of the
Plan	in an area against expected	demand forecasts. Solutions are	impact of water abstractions on the
	demand over the long-term	tested for suitability.	environment and how this can be
			reduced. This approach reviews our
			critical role as a supplier of
			sufficient water to meet customer
			requirements.
Zonal studies	The operation and performance of	Modelling is undertaken to	High probability low impact risks
	our water networks	understand the root causes of	are prioritised within the
		customer service problems and	immediate investment programme.
		asset condition. Consideration is	This process can also identify low
		made in relation to localised	probability and high impact risks or
		growth projections and how the	system wide issues that are
		network will need to adapt for	escalated for consideration in the
		these.	resilience approach.
Sustainable Drainage Plans	The operation and performance of	We have undertaken these studies	These plans make consideration of
	our wastewater networks	for a number of years to identify	external systems, in particular the
		the root causes of service problems	environment that we interact with
		affecting our customers and the	and local authority highway
		environment. We are currently	drainage. They also identify low
		migrating into Drainage and	probability high impact risks for
		Wastewater Management Plans,	consideration in our wider
		which will create a more detailed	resilience approach.
		view and include a wider	
		consideration of resilience risks.	
Asset lifecycle models	Forecasts for maintenance	We model each asset type	In theory maintenance
	requirements of our existing asset	separately in order to understand	requirements should be fairly
	base.	the maintenance requirements	consistent year on year but due to
		over future years. This is matched	major upgrade programmes in the
		with asset health performance to	past there can be peaks and
			troughs across business plan



Process	Scope of review	Approach used	Links to system based resilience
			approach
		understand the risk to customer	periods. This modelling work allows
		service.	us to forecast any peaks and adjust
			our programmes of work
			accordingly. Allowing a group of
			assets to deteriorate too far would
			compromise our service resilience.
Asset resilience scorecards	Critical assets ("Too big to fail") are	A number of criteria have been	The definition of what constitutes a
	managed to minimise the risk of	identified that could cause these	critical asset considered the impact
	failure	critical assets to fail and have a	on external systems, identifying
		major impact on our customers or	those with most potential to cause
		the environment. These provide	loss of water supply to a large
		the basis for innovative	number of customers, cause major
		Performance Commitments	flooding or serious environmental
		proposed in our PR19 Business	impact. In large part these
		Plan.	scorecards consider low probability
			high impact risks.
Investment Manager	All assets	Investment Manager is our	This system is able to record and
		company system for storing asset	compare all risks across all assets,
		risks and their relationship to	including resilience risks and short-
		service.	term risks. Consideration of
			external systems impact is made in
			the risk quantification.
Lessons Learnt	All incidents	Following operational incidents a	This process mainly identifies
		lessons learnt review takes place	changes to operational practices
		and actions are identified to	but can also identify resilience risks
		prevent or reduce the likelihood of	to review across the wider asset
		a re-occurrence.	base or trends in the types of
			service failure that require a more
			systematic review. Investment is
			then prioritised to address these in
			the short, medium or long term.



2.5. Risk quantification

We have developed our Service Measure Framework (SMF) for use in investment planning and selection of solutions to manage our risks. This has been used within the business for a number of years. It is embedded in our asset risk system, Investment Manager, and supports cost benefit analysis of solutions as they are developed, through our Risk and Value process.

We have included a copy of our service measure framework as an appendix (Appendix 2) to this action plan. We use the standard risk equation of

Probability * size of impact * type of impact

Impacts have been defined by considering the range of service failures that we observe. The descriptions have been used by the business and updated as the framework has been embedded to ensure that it provides an adequate coverage of our business risk.

We quantify risks in monetary terms by placing a unit cost value on each type of impact. These values come from two sources – cost of consequence and social valuations. The cost of consequence data set represents the indicative costs of dealing with service failures. We have built up these costs using expert review to understand the activities that are required when a service failure occurs and using unit costs to understand the impact of these activities. These have been used to create a typical cost for each type of service failure.

Social valuations are largely derived from Willingness to Pay (WTP) results but we work with economists to identify other sources that are appropriate to fill in any gaps. For example, we use valuations for the cost of ill health developed by the HSE to value the impact of drinking water quality failures. Market price data has been used to value the impact of damage to shellfish waters.

Case Study: Application of the service measure framework to a resilience need

We have identified a risk to the resilience of water supply in the Hereford area. Two failure modes have been assessed:

- A pollution incident in the River Wye, either unidentified or arising from malicious intent
- Within the WTW a fire in a motor control centre (MCC)

We have assessed that the likelihood of these failure events is very low (less than once every 10 years) but being so low, they are hard to put a numerical figure to. For the purposes of this illustration we will use a figure of 1 in 100 years likelihood.

The impact of these failures would be a complete loss of supply to the Hereford area, serving 117,000 population, or approximately 50,000 properties, for more than 24 hours.

To calculate the annual risk figure we multiply

0.01 (likelihood of failure) * 50,000 properties * SMF value for >24 hour interruption

We use two SMF values to represent the cost of consequence (£219 per property) and our WTP (£4009 per property).

The total annual risk figure is therefore £2.114m.



2.6. Risk mitigation

In planning and prioritising investments, we use the 5Rs framework; the four 4Rs set out by the Cabinet Office (Resistance, Redundancy, Reliability and Response & Recovery) as well as 'Reflectiveness'; a quality we believe is essential for incorporating lessons from previous experience into our plans for the future. We consider options and deliver activities across all of the 5Rs. Some examples are:

- Resistance: We have invested in cyber security technology and processes but have further to go in order to achieve full compliance with the Security of Network & Information Systems Regulations (NIS Regulations). We are also working towards ISO270001 certification. These precautions protect our assets and our systems from attack that could lead to loss of customer data or problems in delivering our service.
- Redundancy: We have identified a number of locations where reliability of supply can be improved by constructing an alternative main to supply the area, some of which are included in our PR19 business plan. These links provide important back-up in the event of incidents, to minimise disruption to service.
- Reliability: We work to optimise the performance of our assets to increase reliability and minimise service failures. This is part of our business as usual process, as we recognise that small improvements can have as significant an impact on overall performance as the large projects.
- Response & Recovery: We have invested in a fleet of tankers to ensure that we are able to return water supplies as quickly as possible, which has supported an improvement in our reliability of supply performance commitment.
- Reflectiveness: We are investing in modelling to understand the impacts and root causes of service failures. This analysis underpins the rest of our programme development by helping us to understand the optimal strategies to respond to a range of resilience threats.

In selecting the approaches to use in our PR19 business plan we used an expert review process where risks and solutions were drawn from our detailed processes and discussed to identify the highest priority items for inclusion within our plan.

In planning resilience mitigation actions we are conscious of the benefits of working with our stakeholders and the communities which we serve. It is often possible to achieve a better overall solution at reduced cost in the long-term by considering the wider systems that we interact with.

Case Study: Using systems based thinking in risk mitigation strategies

Our RainScape approach is an example of best practice for embedding an environmental foundation to resilience. This programme involves retrofitting surface water systems and providing green infrastructure to slow, treat and return surface water to the natural environment while diverting water from our sewer systems. The benefits that we have seen with this approach to date would not have been possible without a good understanding of the interactions between our systems and the people and environment



in the locality. The involvement of external bodies throughout has helped us to identify and implement optimal solutions.

RainScape can provide a best value approach which protects our customers, environment and networks while supporting growth and promoting well-being. Our Llanelli RainScape scheme is an award-winning approach which is the largest retro-fit of RainScape in the UK. In total 42 hectares, or 20% of the urban drainage area, has been diverted away from combined sewers and into natural watercourses. RainScape provides the following benefits:

- Our customers can benefit from RainScape as it protects them from sewer flooding at a fraction of the cost of a conventional engineering solution, helping to keep our service affordable.
- The community can benefit from RainScape as it enhances public spaces, promotes sustainable transport and improves ecology, promoting community well-being. Our RainScape interventions are developed through public consultation and engagement, with the residents actively participating in the design of the streets. RainScape can also provide room for growth, providing new critical infrastructure that allows opportunities for development.
- Our environment benefits from RainScape as it can promote biodiversity, green the urban environment and maintain flows in our natural waterways. It can reduce the amount of storm water entering our networks, which reduces the likelihood of CSO spills and therefore reduces the risk of pollution. RainScape is also often the most efficient option, providing carbon savings compared to traditional approaches, reducing our contribution to climate change.
- Our networks benefit from RainScape as this approach reduces reliance on critical wastewater assets.

RainScape relies on a joined-up, integrated, systems approach to understanding existing assets and risks and how these will be owned and maintained in future.

Our investment in Llanelli was tested during Storm Callum in 2018, when several other communities in South Wales suffered serious flooding but Llanelli escaped. *Reference: How Llanelli avoided flooding during Storm Callum, BBC, 28 November 2018, https://www.bbc.co.uk/news/uk-wales-46344363*

We were one of the first water companies in the UK to undertake a comprehensive assessment of its resilience. In early 2017, we commissioned Arup to work with us to create the Welsh Water Resilience Wheel, shown below, and used this resilience framework to identify areas of strength and areas for improvement. This wheel was used to underpin our long-term strategy, Welsh Water 2050.

We have split our Resilience Wheel into three key areas: people, infrastructure and environment and finance and governance.

- The people theme covers how we work with our customers, look after our employees, and the work we do to protect the health of customers.
- The infrastructure and environment theme covers how we build and manage our assets to be robust, use resources efficiently, and how we work with the natural environment.



• The finance and governance theme covers how we keep our business financially resilient and affordable for our customers, as well as ensuring that we have good leadership and assurance processes.



2.7. Outcomes monitoring

We believe that monitoring and reporting on our performance is essential for our stakeholders to have confidence in our delivery. We also use it to identify changes or trends that could impact on the resilience of our service.

We included a significant number of outcomes in our PR19 plan that can be used to monitor our resilience, as shown in the following table. Those marked in blue are primary resilience indicators, whilst the remainder are performance measures that can give early warning of emerging resilience issues.

Perfor	mance Commitment	Risk or trend mitigated		
Wt1	Tap water quality compliance	Biohazard		
	index (CRI)	Extreme Weather events		
Wt2	Water supply interruptions	Extreme weather events		
		Asset failure		
Wt3	Acceptability of drinking water	Extreme weather events (causing poor raw		
		water quality)		
Wt4	Water mains burst	Extreme weather events		
Wt5	Water process unplanned	Biohazard		
	outages	Extreme Weather events		

Table 2: PR19 resilience performance commitments



Wt7	Water catchments improved	Climate change		
		Biohazard (Treatment)		
		Land-use change (Treatment)		
BI5	Financial Resilience	Unknown unknowns		
Ft1	Risk of severe restrictions in a	Extreme weather events		
drought				
Ft2	Risk of sewer flooding in a	Extreme weather events (e.g. storm surge,		
	severe storm	flood)		
Ft3	Energy self-sufficiency	Climate change		
		Changing economy		
Ft4	Surface water removed from	Extreme weather events		
	sewers (property equivalent)			
		Regulation (Welsh Government 2016		
Ft5	Asset Resilience (reservoirs)	amendment to Reservoirs Act 1975)		
		lerrorism and vandalism		
		Extreme weather events		
Ft6	Asset Resilience (water	Cyber-attack / control system failure		
	network+ above ground)	Cuber attack (control system failure		
Ft7	Asset Resilience (water	Cyber-attack / control system failure		
	Accet Resilience (westewater	Extreme weather events		
Ft8	Asset Resilience (wastewater	Cyber-attack / control system failure		
	Asset Resilience (wastewater	Cyber-attack / control system failure		
Ft9	network+ below ground)	Extreme weather events		
	Water and wastewater	Extreme weather		
En1	compliance	Biohazards		
		Extreme weather		
		Biohazards		
En3	Pollution incidents from	Legislation		
	wastewater	Sea level rise		
		Power outages and brownouts		
En4	Leakage	Extreme weather		
En6	km of rivers improved	Change in legislation		
En 8	Bioresources disposal and	Biohazards		
LIIO	compliance	Extreme weather events		
Co2	Employee training and expertise	Unknown unknowns		
Sv3	Customer Trust	Change in customer expectations		
	Sewer flooding on customer	Change in legislation		
Rt1	property (internal)	Sea level rise		
		Extreme weather events		
	Sewer flooding on customer	Change in legislation		
Rt2	property (external)	Sea level rise		
		Extreme weather events		
Rt4	Total Complaints	Changing customer expectations		
		Extreme weather events		
Rt6	Worst-served customers for	Extreme weather events		
	wastewater services			



2.8. Corporate governance

The Board of Glas Cymru (which is an identical Board at the holding company and operating company level for Welsh Water) plays a key role in governance and decision-making to ensure the adequacy of our resilience strategies.

For the business as a whole, we have achieved PAS55 accreditation in 2009 and ISO 550000 accreditation in 2017. This external validation of our approach shows the strength of our asset management system, which we use to oversee our approach to resilience planning.

The development of our Welsh Water 2050 strategy was directly overseen by our Executive team and our Board, who reviewed, in detail, drafts of the strategy document and took great care to consider all the issues that could threaten our company resilience. Since the publication our Board has continued to review our resilience strategies, both in special focus sessions and as part of their business as usual activity.

We take the Board's responsibilities for good governance very seriously, and have set out in our 2019 Annual Report (page 66 onwards <u>https://www.dwrcymru.com/en/Library/Group-Annual-Report-and-Accounts.aspx</u>) how we comply both with the UK Corporate Governance Code 2016 (the revised Code published in 2018 will apply to our reporting from 2020 onwards), as well as meeting Ofwat's revised Board Leadership, Transparency and Governance principles which have been in force since April 2019.

A key part of the Board governance agenda is review of the corporate risk register. The strategic risks and current mitigation are reviewed at each routine Board Meeting (eight occasions per year) and at each relevant Committee meeting. The scope of currency of all identified strategic risks is reviewed in detail on a six monthly basis. This register holds a mix of operational risks and long term resilience risks and the executive team are challenged to ensure they have adequate plans in place for managing these.

To complement this, risks are reviewed on a "bottom up" basis at all team meetings across the business and strategic risks are reviewed on a monthly basis by the Executive Team in preparing the update for Board meetings.

During 2018-19, the Board has considered the following resilience issues facing the business:

- Finalising and launching Welsh Water 2050 which focuses on our key responses to
 18 identified strategic challenges and maps our responses against the 7 well-being
 goals as set out in the Well-Being of Future Generations (Wales) Act 2015,
 specifically aiming at building a more resilient framework to safeguard the essential
 services we provide, and to deliver significant development co-benefits to the
 communities we serve;
- Considering the company's draft Business Plan for PR19 and the extent to which each element of the plan aligns with the strategic aims of building resilience as set out in Welsh Water 2050;
- Considering the outputs from customer engagement aimed at facilitating co-creation of the business plan and endorsement of our proposed objectives, and discussion with the Chair of our Customer Challenge Group, who regularly attends our Board



meetings in order to ensure the voices of our customers are central to our planning processes;

- Oversight of operational performance, particularly the lessons learnt from the two significant pollution incidents during 2018 - at Five Fords Wastewater Treatment Works and Felindre Water Treatment Works, and from the operational and cost challenges involved in our response to Storm Emma (in March 2018), the prolonged summer drought of 2018 and Storm Callum (October 2018).
- Reviewing our optimisation of the food waste plant we operate in Cardiff, which supplies power to our Wastewater Treatment Works, increasing our own renewable energy supplies and reducing our carbon emissions, while helping us to control energy costs.
- Reviewing succession planning for senior management roles and considering people development programmes and talent management across the business;
- Reviewing the progress of innovation across all aspects of the business; considering the Company's Visitor Centre Strategy and proposed capital expenditure on projects at Llys y Fran (Pembrokeshire) and Llanishen/Lisvane (Cardiff); and
- Reviewing at a "Strategy Day" dedicated to taking a longer term view of the business, the Company's Statement of Purpose, together with the key challenges it faces in taking steps towards implementing Welsh Water 2050. The issues considered included climate change, the replacement of lead water supply pipes, leakage management, private shared supplies, microplastics in water and wastewater, and additional environmental regulation.



3. Our vision for the future approach

A systems based mind-set will ensure that interdependencies between internal processes and external parties / systems are considered at all stages. It will be used to drive the risk identification and assessment process and be incorporated within resilience mitigations to optimise efficiency of investment.

An integrated resilience framework will ensure that all resilience issues can be considered together and provide approaches that can be used across operational, corporate and finance resilience risks at both a strategic and a detailed level of analysis.

It will encompass:

- A comprehensive risk identification process, operating consistently across the different levels of risk
- A quantified risk assessment process, using risk monetisation to assess risks against the costs of mitigations and including an assessment of natural capital
- A mitigation identification process that encourages consideration of the different types of resilience mitigations, the 5 Rs (Redundancy, Reflectiveness, Response & Recovery, Resistance, Reliability)
- Clear line of sight between selected mitigations and identified risks
- A package of outcomes that reflects the highest priorities of our resilience threats.
- An approach to corporate governance, including Board involvement and Executive oversight, that ensures resilience is considered within company decisions and that resilience risks are reviewed and managed appropriately.



It will be a dynamic process, updated and developed through considering best practice resilience assessment methodologies from within the water industry and other industries. Once the process is up and running we will undertake five yearly wide-scale reviews to ensure that it continues to meet the needs of the business.



4. Assessment of our current approach against our future vision

Since the submission of our business plan we have taken the opportunity for a period of reflection and review of our resilience framework. This has involved internal lessons learnt and a review of materials published by other companies in their submissions. We have also commissioned Arup to undertake a wide ranging review of good practice in other businesses, which we are using as background to support our plans for developing our approach. The report from Arup is included as an appendix (Appendix 1) to this document.

We have undertaken a maturity assessment of our processes against the vision we have set out in Section 3.

Element of our vision	Maturity assessment
Systems based mind-set	2
Comprehensive risk identification process	3
Quantified risk assessment approach	3
Mitigation identification process	3
Line of sight through the decision process	2
Outcomes monitoring	4
Corporate governance relating to resilience	3

Table 3: Summary of maturity assessment against our vision

In the above assessment we have used a scale of 0-4, where 0 means that the process does not exist and 4 indicates best practice.

The summary of our assessment is that we believe that we have many of the right elements already in use in the business. Our focus in the next few years needs to be in integrating and formalising these elements to improve the efficiency of our decision making. The focus and energy that was put into the creation of our Welsh Water 2050 long term strategy shows that we have the right culture to think about, and deliver resilience improvements.

The following sections set out more detail in relation to the findings of our maturity assessment, which has led to the development of our action plan.

4.1. Systems based thinking

We have many examples of how systems based thinking has been used in our consideration and management of resilience risk. It is an important part of our organisational culture that we consider and work closely with the society and environment around us.

Our maturity assessment identified that this approach is quite an intuitive process, rather than a formalised one. Our best practice review has shown that undertaking a mapping exercise of how all our internal systems interact with the external systems will bring greater visibility and should realise greater benefits by giving us a richer picture. It will also support us in prioritising our resources on the most important interactions. It may identify some gaps in our current processes, which we can work to fill.

As we develop the other elements of our framework to improve towards best practice we will also ensure that we take adequate consideration of our system interdependencies.



4.2. Risk identification

We have created a strong set of processes working bottom up to identify resilience risks. We have identified that there is more that can be done to provide a clear linkage between the strategic risk identification and these bottom up processes. The horizon scanning work that formed the basis of Welsh Water 2050 has been very valuable in putting together our strategic plans but, due to its timing in relation to the development of our business plan, we have not fully linked this to the detailed processes that we have in place. This may mean that there are some gaps in our detailed processes, but also that it is difficult to show the line of sight to the plan that we have developed.

We believe that taking our strategic risk identification to another layer of detail will give us greater confidence and visibility that we have adequate controls in place and help us to explain the line of sight in a better manner. In doing this we will be able to incorporate the learning that we generate from completing our systems interdependencies mapping.

4.3. Risk quantification

Our overall approach to risk quantification appears to align well with good practice but we have some concerns about the quantification of low likelihood high impact risks. We recognise that expert judgement has limitations for assessing these risks and there are limited opportunities available for modelling events that have little history of occurrence.

We believe that there are opportunities to work with academia to explore and develop new methodologies to support these assessments.

We are also aware that methodologies in relation to risk valuation are continuously improving and that there are opportunities to improve this, especially in asking customers to value resilience risks, perhaps separately from day to day performance.

To date we have not used natural capital accounting in our assessment of resilience solutions. However, we have been working to develop our approach so that when we roll it out it is able to add real value to our cost benefit analysis.

During 2017 we were involved in the UKWIR project designing a tool for assessing natural capital and including this in our project evaluations. We have also worked with Ricardo Energy & Enviroment in association with Eftec to build on the UKWIR project and test the tool on some of our AMP7 projects. We are fine-tuning the approach for roll-out across our AMP7 programme.



Case Study: Application of natural capital accounting to an overflow scheme

This case study considers a CSO that has been identified as being a frequently spilling storm overflow. Two options of reducing spills at the asset have been assessed to understand how we can apply natural and social capital evaluation in a real world situation.



Dinas Porth CSO is a trunk sewer CSO in the Rhondda Valley, located approximately 1km west of Porth, with difficult access arrangements. The 750mm diameter trunk sewer drains both sides of the steep valley catchment and as such is located in close proximity to the watercourse throughout its length. The asset is deemed to be high spilling (>40 spills annually), with no indication of maintenance concerns in the vicinity that could affect spill performance.

The two options assessed to reduce spill numbers at the asset are:

- Additional traditional storm storage;
- RainScape



The two bar charts represent the results of the assessment against:

- A traditional economic assessment approach - which assesses avoided cost of consequence against measures of service. The asset impacts are relatively minimal (assumed for assessment to be annually one Category 3 Pollution and one customer written complaint) meaning the calculated benefits of both options are outweighed by the investment costs. The process leads to the identification of the traditional storage as the option with the highest benefit cost ratio, although significantly less than one.
- A N&SC assessment approach which includes screening of 21 areas of N&SC benefit, including for example air quality, amenity, education, flooding. Neither option shows a benefit cost ratio greater than one, however the RainScape option, providing significant N&SC benefits, has a much higher benefit cost ratio than the storage option.

The results of the assessment show that there is potential for investment decisions to change significantly following inclusion of wider N&SC considerations into the decision making process. In reality a hybrid option of both would most likely be implemented. There is mounting evidence that natural systems can be combined with traditional grey infrastructure to provide lower-cost and more resilient services¹.



¹ G Browder, S Ozment, I Rehberger Bescos, T Gartner, G Lange, 2019, Integrating Green and Gray - Creating Next Generation Infrastructure, World Bank Group & Water Resources Institute



4.4. Risk mitigation

The range of resilience mitigation approaches that we have undertaken in recent years show that we are open minded to consider more than just traditional engineering solutions to our risks. Our maturity assessment and best practice review has suggested that there would be value in formalising our approach to mitigation identification to create further efficiency in our programme. In particular we will ensure that our systems mapping work is fully considered in this process to maximise the benefits of any work.

Our work in building the Resilience Wheel maturity assessment has created a strong process, covering a wide range of resilience management approaches, but we need to ensure that it is fully embedded in our business as usual review processes to ensure that we make the necessary improvements to move towards best practice.

4.5. Line of sight in decision making process

During the development of our PR19 plan we invested considerable time in selecting the resilience investments to include, relying in part on expert judgement to interpret and prioritise across the volume of risk data that we hold.

With recent developments in data analysis techniques we believe that there is potential to improve our approach to optimising our programme. This should improve the efficiency of our decision making process and help us create a clearer line of sight through the framework from risk identification through to selection of solutions. Our review of best practice has not identified any easy solutions to this problem. We believe that we have the right building blocks to make progress in this area but need to spend some time exploring the nuances of the data we hold.

We have undertaken customer research relating to resilience to inform our PR19 submission but we recognise that this did not link directly to the risk mitigation strategies, other than at a high level through our Welsh Water 2050 research. We think that there are opportunities to explore alternative approaches to customer research that could show an improved link to our selected risk management strategies.

4.6. Outcomes monitoring

We are confident that our outcomes monitoring framework gives us good visibility of our performance in relation to resilience indicators and resilience management output measures. We recognise that we can improve the line of sight from resilience risk identification to the outcomes that we are monitoring and the interdependencies with external systems.

4.7. Corporate governance

The development of our Welsh Water 2050 long term strategy had strong involvement from across the business, especially with our Board and Executive team. We now need to build on this and ensure that consideration of long-term resilience issues gets sufficient priority against the day to day concerns of managing the business, in all the management forums across the business. In addition, we see that there are opportunities to use our systems interdependencies mapping to improve the focus of these management reviews.



5. Action plan

Our action plan is split into two sections. The first section are the actions that are required to update and improve our framework in time for the next price review. These are the immediate actions that have come out of our recent maturity review and need to be undertaken most urgently to make a step change in the capability of our framework.

The second section contains the actions that will form our business as usual activities of reviewing and developing the framework. We expect to undertake regular reviews of the data underpinning our framework, with more wide-ranging reviews of the entire process on completion of each price review, to ensure that we make iterative improvements and future business plans are of the highest quality possible. Some key elements of the business as usual activities have been pulled out into the first section of the plan to show how they will be delivered in time to support the development of our next business plan.

In many places we are still considering the detail of the methodology required to deliver the action plan but have provided further discussion in this document regarding the approaches we are considering. This plan has been reviewed and endorsed by our Executive team as part of our standard governance approach.

Reference	Framework	Action	Completion date
	element		
1	Risk	Complete first pass system interdependencies	December 2020
	identification	mapping	
2		Complete our initial strategic risk assessment and	December 2020
		gap analysis of detailed risk processes	
3		Update the horizon scanning peer review of	September 2021
		business risks	
4		Complete our data collection of prioritised risks	December 2021
5	Risk	Identify methodology for assessing likelihood of	March 2021
	quantification	failure across the plan	
6	and	Review all our bottom up risk identification	March 2021
	prioritisation	processes for alignment with the service	
	-	measure framework	
7		Undertake a review of our social valuations to	March 2021
		identify additional sources	
8		Implement natural capital approach	March 2021
9	Risk	Create solution identification framework that	March 2021
	mitigation	ensures consideration of different types of	
		response	
10	-	Roll out of solution identification framework	March 2022
11		Review resilience wheel assessment and create	June 2020
		detailed action plan to make ongoing	
		improvements	
12	Line of sight	Implement risk and solution prioritisation	March 2021
		methodology	
13	Outcomes	Engage with industry on development of asset	December 2020
	monitoring	health and resilience measures	

Table 4: Our resilience action plan



Reference	Framework	Action	Completion date
	element		
14		Collect data and test / benchmark new asset	March 2022
		health measures	
15		Establish a revised set of resilience measures for	March 2022
		use in the PR24 plan	
16		Establish the reporting that shows line of sight	March 2023
		from resilience risks to plans to outcomes	
17	Corporate	Publication of our next long term plan	March 2022
	Governance		

Reference	Framework	Action	Frequency
	element		
18	Risk	Regular updates of the system	5 yearly or by
	identification	interdependencies mapping and strategic risk	exception
		assessment, including horizon scanning	
19		Regular updates of the detailed risk assessments	Specific to each
			process
20	Risk	Review of methodology	5 yearly
	quantification		
	and		
	prioritisation		
21	Risk	Review of methodology	5 yearly
22	mitigation	Review of action plan against resilience wheel	Annual
		maturity assessment	
23		Review of Innovation Strategy	Annual
24	Corporate	Review compliance with the British Standard for	5 yearly
	governance	Organisational Resilience (BS65000) and	
		International Risk Management Standard (ISO	
		31000)	
25		Work with external bodies to establish forums	Annual
		where cross-sector issues can be discussed	
26		Review of resilience at Board	Annual
27		Review of development reported in APR	Annual



5.1. Discussion of detail behind identified actions

Action 1: Complete first pass system interdependencies mapping

Undertaking systems interdependencies mapping will help us understand where to prioritise our efforts in risk management. We have identified an approach of using a matrix based assessment linking key risks / threats, internal systems and external stakeholders, where each relationship is given a weighting to indicate relative importance.

	Internal				External	
	System System S		System	System	System	System
	1	2	3	1	2	3
Risk 1	1	2	1	0	1	1
Risk 2	0	0	1	2	3	1
Risk 3	0	2	2	1	1	1

By totalling the values in the rows and columns we will understand the most critical risks, systems and stakeholders. This will ensure we are focusing our analysis and mitigation efforts on the most critical areas.

Our first task in completing this action will be to define the list of elements to include in the matrix to ensure that we have sufficient granularity to inform later prioritisation without overwhelming ourselves in too much detail.

Once the first pass mapping has been completed we will freeze it whilst the rest of the framework is put in place and then develop a process for regular updating, which is expected to take place every five years.

Action 2a: Complete our initial strategic risk assessment

In developing our Welsh Water 2050 strategic plan we undertook a high level risk and threats identification analysis. This identified eight broad categories of future trend that could threaten our resilience:

- Change in customer expectations
- Protecting essential infrastructure
- Demographic change
- Changes to the structure of the economy
- Policy and regulatory change
- Climate change
- Environmental change
- Protecting public health

In order to develop the line of sight to resilience mitigations we will take this analysis to the next level of detail, mapping more specific risks against our internal systems, in line with the systems mapping undertaken in Action 1. For example, with respect to climate change we



will record the different impacts of climate change and which of our systems are impacted. This will allow us to create more specific management plans.

Action 2b: Complete our gap analysis of detailed risk processes

Once we have completed Action 2a we will have a clear list of the risks that we are managing as a business. We will then be able to map this to our bottom up risk processes to ensure that each one has an appropriate level of analysis. For some a company level analysis will be appropriate, and this will be captured. For others an asset level analysis will be required, which we will ensure is covered by one of our detailed processes.

Action 3: Update the horizon scanning peer review of business risks

In 2016 we commissioned Cardiff University in association with Arup to produce a horizon scanning identification of the challenges to resilience that we face. The results of this are now embedded within our Welsh Water 2050 strategy and will be incorporated in our detailed strategic risk assessment process. However, we believe that it is important to continue to challenge our thinking by using external expertise, especially with individuals who are connected into the latest academic research. We will update this report in time to inform the preparation of each five year business plan.

Action 4: Complete our data collection of prioritised risks

Following on from Action 2b we expect to identify some risks where we have not currently got sufficient data to understand the scale of the risk at asset level. We will use the systems interdependencies mapping and a broad brush quantification approach to prioritise these data collection needs. The highest priority gaps will be filled in time to inform preparation of the next business plan. For the remaining gaps a plan will be put in place to fill these at an appropriate pace.

Action 5: Identify methodology for assessing likelihood of failure across the plan

Assessing likelihood of failure for low probability events is very difficult, where there is often no record of failure. This value can have a significant impact on risk prioritisation, especially in relation to high consequence events. We will work with academics to identify whether there are any techniques we could develop to standardise and improve our expert judgement approaches. We will also consider the suggestions identified in our best practice review, regarding ways in which the likelihood assessment can be incorporated into the prioritisation without an inappropriate influence.

Action 6: Review all of our bottom up risk identification processes for alignment with the service measure framework

As identified in Section 1 of this action plan we currently operate a range of different risk identification and management approaches that have been designed to manage specific areas of risk within the business. Many of these have been designed with alignment to our service measure framework to provide a consistent approach to risk quantification. However there are some exceptions. In order to facilitate the combined risk prioritisation processes we will need to ensure these are all aligned. This action will test each approach against the framework, identify actions required to achieve consistency and implement these actions.



Action 7: Undertake a review of our social valuations to identify additional sources

The monetary valuations attached to the service measure framework are vital to allow risks to be compared. We currently rely on a mixture of cost of consequence data and willingness to pay results as a basis for these valuations. We are concerned that these do not adequately represent customers concerns about low probability high impact events so will explore whether additional customer research will be of value to relate resilience investment to maintenance investment. We will also work with experts in economic valuation to fully review our sets of valuations and improve the coverage of our resilience programme. Some examples that have already been identified are the use of Gross Value Added to incorporate our impact on the local economy and ensuring that we can value the benefits of education as an approach to improving our interaction with customers over the long term.

Action 8: Implement a natural capital approach

With the preparation work we have undertaken in the last few years we are ready to incorporate natural capital assessments within our investment decisions for AMP7 BAU and AMP8 plan development. It is important that this analysis is targeted correctly so that it provides benefits in the decision making process without creating bureaucracy that slows down project delivery. We are still exploring screening tools that will identify the problems that will benefit from assessment and whether a simplified or a detailed approach will be appropriate.

Actions 9 and 10: Create and implement a solution identification framework

We have demonstrated in our PR19 plan that we consider a range of different solutions in developing our long-term plans including solutions that benefit external systems as well as our internal systems. However this practice is not currently formalised within the company so it may be that it there are opportunities in some cases to deliver more efficient solutions with greater benefits externally.

These actions will design and implement a solution identification framework that can be used across operational, capital and financial resilience risks to provide a checklist and ensure a suitable range of mitigation options are considered for each risk. It will also ensure that there is appropriate reference to our systems interdependencies mapping to identify solutions with multiple benefits to external parties.

Action 11: Review resilience wheel maturity assessment and create a detailed action plan to make ongoing improvements

In our PR19 submission we included a resilience maturity assessment, our Resilience Wheel. This shows our current maturity against a range of resilience management strategies. Arup have also undertaken an assessment of where we should aim to improve by the end of AMP7 to align with wider best practice. We will review this resilience wheel and strengthen the line of sight to our strategic risk assessment. We will also develop an action plan of activities to improve maturity, challenging ourselves to see where we can push beyond current best practice. Monitoring and reporting on our progress in making improvements to our resilience maturity will then be included within our corporate governance review cycles.



Action 12: Implement a risk prioritisation methodology

In order to identify resilience priorities we will need to put together risks identified through the various different approaches and quantified through our service measure framework to create a prioritised list. We know that within each individual process the prioritisation approach works well but we are unlikely to create a balanced programme if we were simply to merge the results into one long list.

The first decision will need to be the scope of the prioritisation. One possible filter would be to concentrate on the low probability high impact risks, but taking a broad definition of resilience, we should include a wider set of risks incorporating emerging asset health concerns (e.g. spikes in capital maintenance arising from large quality funded programmes at a particular time in the past), issues relating to population growth and changes in customer expectations.

With this broad filter applied there will be issues of comparability that need to be addressed to derive a balanced programme including:

- Whether quantified customer research gives an adequate reflection of the broad range of customer priorities (how to ensure more qualitative feedback, such as support for education programmes, is adequately covered)
- Whether low probability, high impact risks can be compared appropriately with high probability lower impact risks
- How to compare detailed level risks and solutions with company level baskets of risks and solutions (e.g. risks of supply interruptions caused by assets being flooded, compared to customer education programmes to reduce water consumption)

Action 13: Engage with industry on development of asset health and resilience measures

Over the last few years there have been a number of industry led groups looking at possible measures for comparing resilience and asset health problems, led by UKWIR and Water UK. These have been very valuable but the development of the PR19 plans has identified some weaknesses in these measures so there is more work to do in development. We note that an UKWIR project relating to asset health is now being progressed. We wholeheartedly support this work and commit to being active participants of any groups that are created.

Action 14: Collect data and test / benchmark new asset health and resilience measures

Following on from the industry reviews of measures we have found that it takes time to implement and test new measures. It is often only when a definition is implemented in practice that the need for detailed assumptions is understood and this is when differences between company figures can emerge. We recognise the need to test and benchmark any new measures as quickly as possible for them to provide practical comparability in future price reviews.

Action 15: Establish a revised set of resilience measures for use in the PR24 plan

Alongside the common performance measures relating to resilience we included a number of bespoke resilience measures in our PR19 plan. We will undertake a full review of these following on from the completion of Actions 1 and 2 to ensure that they still reflect our



highest priority resilience issues. We will also review the delivery of the existing measures to understand whether any developments are needed for future monitoring. This will lead us to agreeing a revised set of measures in plenty of time to frame our PR24 plan.

Action 16: Establish the reporting that shows line of sight from resilience risks to plans to outcomes

We will develop our reporting capability for future price reviews so that we can demonstrate how the resilience risk assessment and its prioritisation has influenced and been key to developing our future plans and how our performance commitments link to this. This will follow naturally from the strengthened framework for consideration of resilience risks, their mitigations and the prioritisation tools we are working to develop. We will be able to show the priority of the risks that have been selected for mitigation, the options considered for mitigating the risk and the options selected. Each option will be linked to one or more performance commitment to demonstrate the benefits of our plans. The systems interdependencies mapping will be used to show the wider benefits of our plans outside our own objectives.

Action 17: Publication of our next long term plan

The development of, and consultation on, our Welsh Water 2050 strategy was a hugely valuable activity for our company. In particular, it challenged our thinking about our role in the wider society and links to external systems. We plan to repeat this process prior to developing our next five year plan to ensure that our long term approach remains applicable and that our short term plans can be framed in the context of this long term approach.

5.2. Discussion of detail behind ongoing review and development actions

Actions 18-21: Methodology reviews and analysis updates

Once the framework methodology has been developed it will be important to keep it up to date and current as best practice improves and our understanding of resilience issues improves. There will have to be a period where the methodology freezes in order to develop a coherent business plan and these actions show how frequently reviews will take place.

Action 22: Review of action plan against Resilience Wheel maturity assessment

Once our Resilience Wheel action plan has been agreed we will undertake a formal review on an annual basis to ensure progress is being made at the appropriate pace.

This review will involve reporting of action progress through our governance forums and assessment of the benefits that have been seen from delivered actions. The owner of each action will be responsible for reporting on any constraints in delivery and monitoring relevant evolving best practice. The executive team will then review the need to reprioritise resources to maintain progress in improving our maturity.

Action 23: Review of Innovation Strategy

Innovation will be an important tool in delivering resilience improvements at an efficient cost. We have successfully used Welsh Water 2050 and our Strategic Responses to frame our Annual Innovation Conference. As we update our risk assessments and deliver our Resilience Wheel maturity improvements our understanding of resilience priorities and



urgency will change. We will update our Innovation Strategy to ensure it remains focused on our latest set of priorities and emerging risks. It will enable external bodies and academia to look for opportunities within their research agendas to help us with our identified Strategic Responses, leading to proactive and targeted research and development. This linkage of forward thinking resilience risk management to innovation will give us the best opportunity to ensure technology is in place in time to react before future risks impact on our service.

Action 24: Review compliance with relevant standards

We currently hold ISO550000 Asset Management accreditation. We will review other standards that are appropriate to this area, British Standard for Organisational Resilience (BS65000) and International Risk Management Standard (ISO 31000) to understand our level of compliance and consider whether formal accreditation would be appropriate.

Action 25: Work with external bodies to establish forums where cross-sector issues can be discussed

In the development of our Welsh Water 2050 strategy we had good engagement from the community in Wales in respect of the issues we face and how we impact on external systems. We intend to continue this engagement and will explore the establishment of forums where key issues can be discussed and plans integrated to optimise problem resolution for the people of Wales.

Action 26: Review of resilience at Board

Our Board is fully engaged with consideration of long-term and resilience issues which are incorporated into all decision-making on a business as usual basis to ensure that relevant issues are taken into account when making decisions.

The Board expects to continue to devote a full day focus session on an annual basis to reviewing Long Term Strategy issues in more detail. This will be informed by reviews held within our operational teams (wholesale and retail) on an annual basis of the prioritised resilience risks and our approaches to management of them. Annual business plans are also presented to the Board for approval by each business division. Our Executive team will consider the results of the operational reviews and updates of our corporate and financial resilience positions before preparing the information to present to our Board.

The effectiveness of the Board and Committees and of the Chair are reviewed on an annual basis and this review includes consideration of the approach and effectiveness of consideration of strategic and resilience issues. The output from the effectiveness plan includes an improvement plan each year. In 2020 we will be involving an external Board evaluator, as we do every three years.

Action 27: Review of development reported in APR

It is important that we are transparent with our customers and stakeholders in relation to the progress we are making in tackling resilience. We will include a statement within our APR of our progress against this action plan and the key resilience risks we are addressing at the time.



Appendices

Appendix 1: DCWW Resilient Systems Approach

Appendix 2: Service Measure Framework