



Sydney
WATER

Climate Change Adaptation Program

Winner of NCCARF
2013 Climate Change
Adaptation Champion
Award: Business



NCCARF
National
Climate Change Adaptation
Research Facility



An aerial photograph of a coastal city, likely Sydney, Australia, featuring a large body of water, a city skyline in the distance, and a prominent rocky cliff in the foreground. A large yellow semi-transparent overlay covers the upper portion of the image, containing white text and decorative brackets.

**The Australian urban
water industry is one of
the first industries globally
to invest in adaptation
due to climate variability.**

Kevin Young, Managing Director, Sydney Water



Staff from across the business contributed to the Climate Change Adaptation Program. They helped assess current and future climate impacts on our infrastructure and operations, enabling us to quantify local impacts, costs and benefits and to prioritise potential adaptation options.

Message from the Managing Director

The Australian urban water industry is one of the first industries globally to invest in adaptation due to climate variability.

The Climate Institute recently assessed the water industry as relatively advanced in their climate change adaptation preparations. However, this preparation and investment has mainly been focused on water supply security. The priority now is to address the emerging risks to our infrastructure.

Sydney Water has been recognised as a national leader in preparing for climate change and variability, receiving the NCCARF Climate Adaptation Champion Award in the Business category. Under the Sydney Water Climate Change Adaptation Program, we have developed and implemented leading processes, decision logics and tools to calculate and deliver least-cost performance and servicing standards, over time and in changing climatic conditions.

The national award is a tremendous recognition of Sydney Water's leadership in the broader industry. As an organisation, we are committed to being forward thinking, and customer focused, scanning the horizon for upcoming challenges and finding innovative ways to contribute to the liveability of Sydney, the Blue Mountains and the Illawarra.

The Sydney Water Climate Change Adaptation Program shows what can be accomplished with high levels of internal and external support.

Kevin Young
Managing Director



About Sydney Water’s Climate Change Adaptation Program

Sydney Water has completed an intensive three year Climate Change Adaptation Program to better understand, quantify and reduce the potential impacts of future climate change on the organisation and its customers.

This booklet summarises our adaptation journey:

- how it began
- key projects findings
- organisational learnings
- the multi-faceted approach required to protect our supply chain.

Our commitment to understanding the future risks and opportunities of climate change has provided a baseline of information, tools and in-house capability.

This summary is our effort to share our experiences and help develop adaptation thinking within the water industry, with a view to future collaboration.

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Starting the climate change adaptation journey

Sydney Water is responsible for water, wastewater, recycled water and some stormwater services to over 4.6 million people in Sydney, the Blue Mountains and Illawarra. With such a large asset base it makes good business sense to consider anything that could have a financial or operational impact on our business. Climate change and extreme weather events are just another set of risks that we must prepare for to minimise costs and performance issues.

Climate change provides an opportunity to revisit current thinking about how we plan and prioritise and how we engage with other organisations and stakeholders.

Like many starting out in the climate change adaptation journey, we first assessed our risks and identified potential adaptation measures through a qualitative risk assessment. While this was a good starting point, we quickly realised that we had a lot of work to do before we could move towards implementing adaptation options.

We completed a qualitative risk assessment in 2008, adapting the general approach outlined by the Australian Greenhouse Office (2006) to suit our corporate risk management framework. The risk assessment identified a large number of potential climate change risks for Sydney Water.

Staff knowledge and engagement suggested that the corporation was well-positioned to respond to climate change challenges, due to our long history of responding to extreme weather and climate-related events.

Our past experience has established an enterprise risk management framework and strong emergency management culture, supported by a program of scenario exercises and stress testing. Looking back, there are key triggers that have shaped our organisation and its current ability to respond. We have learnt from these events and changed both policy and operational procedures in response.

While we have implemented these lessons learnt from extreme events and emergency incidents, the future holds even greater challenges in regard to chronic climate change impacts such as sea-level rise. The qualitative risk assessment helped identify priority areas and inform the development of the Sydney Water Climate Change Adaptation Program. The program aims to use learnings to be more adaptive rather than responsive, acting before impacts occur.

Climate change and extreme weather events are just another set of risks that we must prepare for.

Sydney Water's qualitative risk assessment

While climate change will present economic, social and environmental challenges to Sydney Water, the qualitative risk assessment identified that we are well-positioned to respond. This is because we:

- understand how climate and weather influences current operations
- have extensive experience in managing extreme weather and climate-related events
- have invested in the broader area of climate change science
- have an adaptive management approach, embedded in corporate planning and risk management protocols.

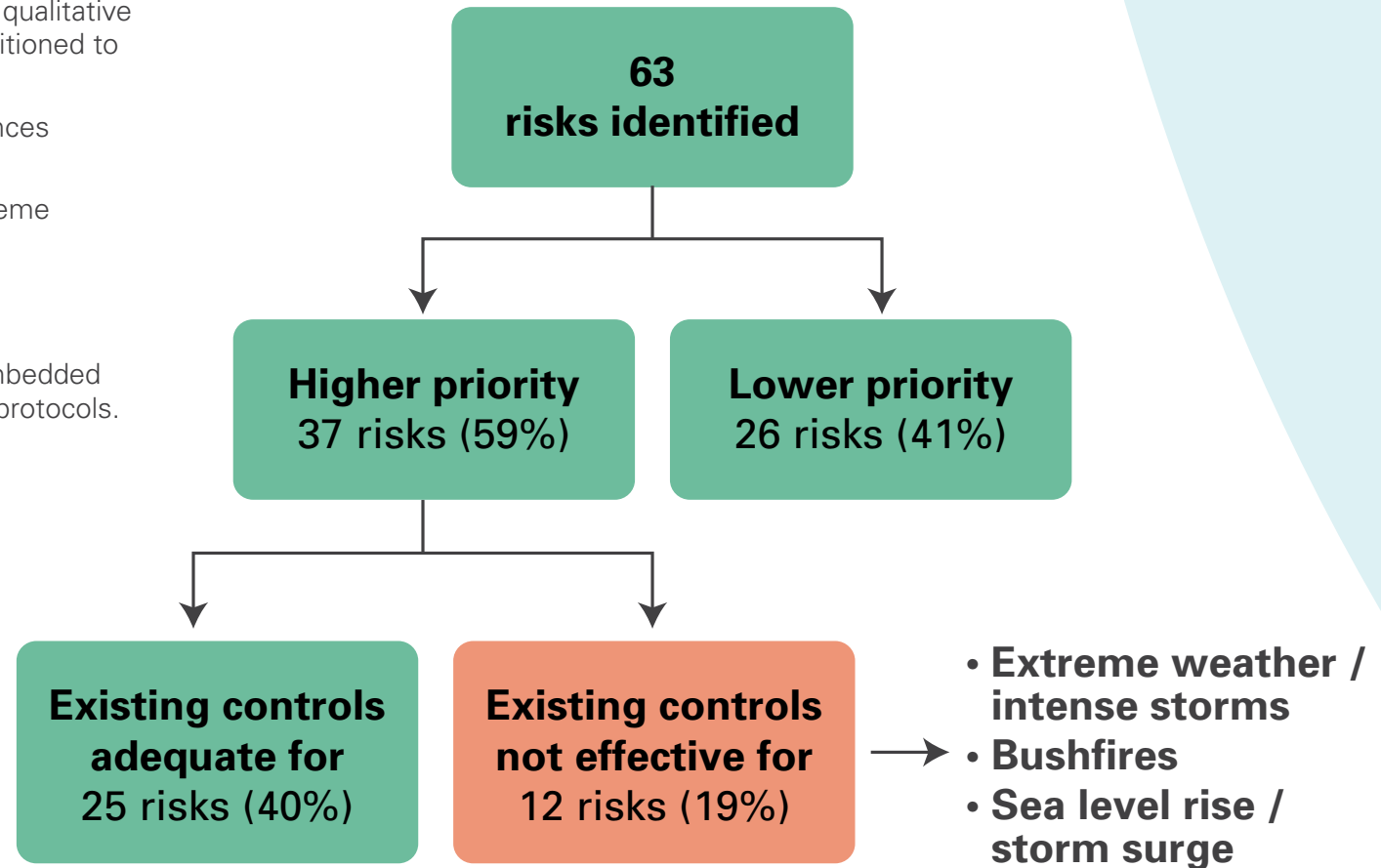


Figure 1: Qualitative risk assessment

Key findings

A key finding from Sydney Water's risk assessment was that the organisation already addresses many of the identified risks. However, climate change could alter the likelihood and the consequences of those risks occurring. All of the divisional level risks (63 in total) align with the risks already documented in the corporate risk register. We assessed almost 60% of the identified climate change risks as high priority and in need of further investigation (37 in total).

About two thirds of these higher priority risks (25 risks) were assessed as having effective existing controls to reduce the likelihood or consequence of the 2030 climate change scenario. The remaining third (12 risks) highlight the priority areas for us to address. These 12 risks relate to sea level rise (combined with storm surge), bushfires, intense storms and extreme weather.

Strong input from the risk assessment participants demonstrated an understanding of current climate/weather influences on business operations. But it also highlighted the need to quantify the local impacts, costs and benefits to help assess potential adaptation approaches. To address this need, Sydney Water launched its Climate Change Adaptation Program at the end of 2009.



Identified climate change risks to Sydney Water infrastructure include:

- more frequent or intense extreme events (flood, storm, wind and bushfire)
- sea level rise inundating low lying assets
- higher temperatures and lower flows in water and wastewater networks that impact drinking water quality and accelerate corrosion of sewers
- drier soils damaging buried assets and encouraging tree root invasion and increasing critical main breaks.

Ultimately, these factors may lead to changes in design standards, setting of serviceable asset life and new modelling approaches.

Other risks are related to impacts on water supply and demand:

- higher temperatures, lower (and potentially less regular) rainfall and higher evaporation, leading to lower inflows to dams
- higher temperatures and longer dry periods leading to increased customer demand, particularly for outdoor water use
- more favourable conditions for algal blooms in bulk water supplies.

Sydney Water's Climate Change Adaptation Program

Sydney Water recognised that risks from future climate and weather extremes were an emerging issue for the water sector. In response we embarked on this three year Climate Change Adaptation Program.

The program intent was to build on existing business capability and systems to better understand and quantify climate change risks. This understanding enabled us to deliver targeted, prioritised adaptation options to inform future investment.

It was also important to embed climate change risks within the business to ensure that we address these risks as part of a whole-of-business planning approach. This avoids climate change being seen as a stand-alone issue.

The three key challenges for the Sydney Water Climate Change Adaptation Program became the program themes:



Understand the vulnerability of the business to climate change impacts.



Identify current resilience to respond to events and where gaps may exist.



Develop costed and prioritised adaptation options for the business to implement.

Theme 1 Vulnerability	Theme 2 Resilience	Theme 3 Adaptation
Objective Understand (qualitatively and quantitatively) Sydney Water’s additional exposure to arising acute and chronic climate change hazards. Key projects • NSW and ACT Regional Climate Modelling (NARClIM) • Determining asset exposure and vulnerability Outputs • Regional climate projections • Extreme event exposure maps • Identification of critical assets and their exposure to hazards • Asset supply chain dependency and indirect exposure maps • Asset vulnerability mapping • Operational impact footprints • Consequential socio-economic impacts	Objective Assess current practice and adaptive capacity, including upstream and downstream interdependency impacts, eg electricity and telecommunications. Key projects • Learning from past climate events • Resilience benchmarking Outputs • Collation of lessons learnt, costs and impacts from past climatic events • Hazard specific fact sheets • Timeline of events that helped shape our current resilience • Benchmark of Sydney Water’s strengths and weaknesses against other utilities, highlighting areas that can improve resilience	Objective Develop a portfolio of responses that can be integrated into Sydney Water’s business planning and operational processes to reduce future impacts. Key projects • AdaptWater™ • Demonstrating climate change adaptation of interconnected water infrastructure Outputs • Climate change adaptation quantification methodology and information hub, produced as an online tool, AdaptWater™ • Guidelines for planning adaptation for infrastructure with shared ownership

Figure 2: Overview of Sydney Water’s Climate Change Adaptation Program

Program design

2009 - 10

We designed the program with clear linkages and progression through the three themes, with each building on the last and informing the next. The outputs of the Vulnerability theme, for instance, were used to inform the Resilience theme by identifying potential gaps in current practice and adaptive capacity. Similarly, the Adaptation theme was then informed by the outcomes of both the Vulnerability and Resilience themes.

Sydney Water has implemented one of the most leading edge, holistic and technically robust climate change adaptation programs in the Australian business community at this point in time.

Chris Lee, Senior Team Leader Impacts and Adaptation,
NSW Office of Environment and Heritage

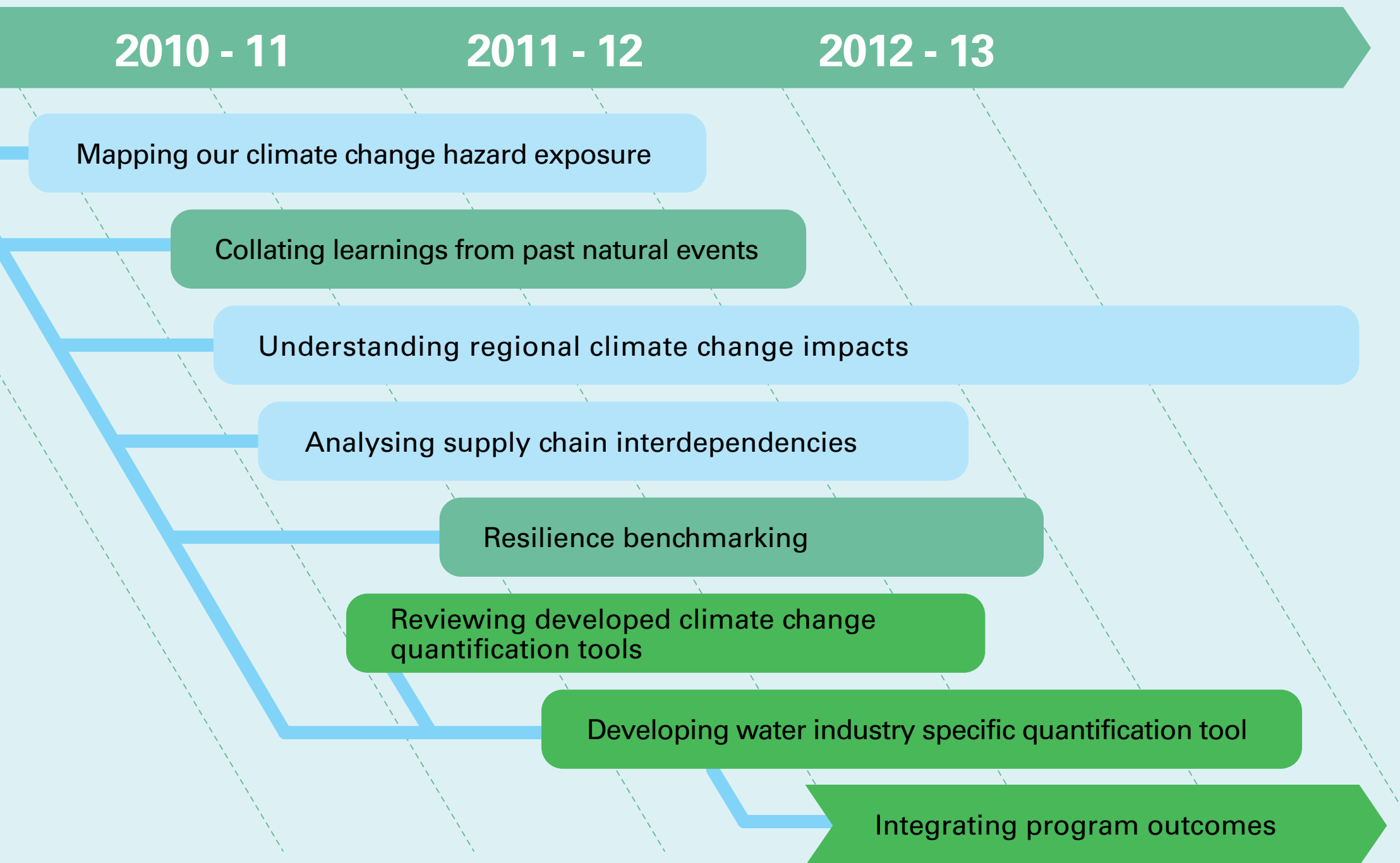


Figure 3: Path to adaptation

Theme 1 Vulnerability

Purpose

After completing a qualitative risk assessment in 2008, it was clear that without understanding the hazard exposure on a local level, we would be unable to adequately assess our vulnerability and develop appropriate adaptation responses.

Making assumptions about impacts during a qualitative risk assessment process helps to identify priorities. However, gaps remain in understanding when and how to best address these risks.

In Theme 1 Vulnerability, we set out to understand (qualitatively and quantitatively) the regional exposure to acute and chronic natural hazards.

To help make the potential risks more real, we mapped the hazard exposure of our asset base.

Aims

The specific aims were to:

- assess the exposure and vulnerability of critical infrastructure (water, electricity and telecommunications) to potential acute and chronic natural hazards
- identify supply chain interdependency with electricity/telecommunication providers and our indirect vulnerability due to their exposure
- assess the points of vulnerability, including quantifying the impacts of disruptions in electricity/telecommunication supplies on water and wastewater operations for given climate scenarios and the cascading impacts on dependent communities, businesses and other critical infrastructure assets.

Process

The projects for Theme 1 included assessing the potential exposure of Sydney Water's infrastructure, including the electricity and telecommunications systems they rely on, to sea level rise, coastal recession, bushfire and storm wind hazards.

We identified partners with extensive knowledge, data and experience in running numerous multi-agency exercises to test critical infrastructure when exposed to different threats including extreme climate events.

We partnered with:

- the Commonwealth Attorney-General's Department under their Critical Infrastructure Program for Modelling and Analysis (CIPMA)

- the Office of Environment and Heritage in the NSW and ACT Regional Climate Modelling (NARClIM) project. NARClIM uses a regional climate model to produce high resolution projections that consider local topography and coastal processes. This provided us with robust projections of likely future climate change. We have been able to use these future climate projections in vulnerability assessments, business planning and forecasting.

Outputs

Key outputs for Theme 1 include:

- a series of digital maps highlighting the exposure of our assets to climate hazards directly and indirectly through their dependencies on electricity and telecommunications
- a series of schematic diagrams depicting the interconnections between water, electricity and telecommunications assets and their hazard exposure
- a spatial data set and queryable data table showing operational impact footprints of the specific scenarios
- consequential socio-economic analysis for two case study areas
- regional climate projections for temperature, rainfall, wind, relative humidity and sea surface temperature
- written report of the exposure analysis
- staff sessions on exposure mapping results and guidance on interpretation and appropriate use.

Learnings

The key learning in understanding our vulnerability has been appreciating the complexity and scale of the task.

We staged the project to first understand asset exposure, which is relatively easy compared to determining asset 'vulnerability'. Determining vulnerability involves more detailed assessment of the exposure, in light of the asset's ability to cope with a hazard. We considered asset specific contingency plans, supply chain dependency and state of damage. Defining how vulnerable Sydney Water is requires an assessment of each asset's robustness, reliability and the ultimate redundancy it contributes to the system.

This was a challenge when you consider the number of assets required to deliver services to over 4.6 million people, so we had to prioritise. We considered the criticality rating of each asset, assessing the most important assets first.

The water security of the Sydney region is highly dependent on cross-sector critical infrastructure relationships, specifically the system of assets and networks that supply electricity and telecommunication services. The incapacity or loss of these services would have a debilitating effect on Sydney Water's ability to deliver water and wastewater services.

The success of the analysis relies on input from multiple supply chain providers and protection of highly confidential information regarding their assets. Sharing the project outcomes with our stakeholders and developing stronger networks within our supply chain was not only important to the project, but also helps us manage our current assets by understanding current risks and contingency plans.



Sydney Water embraces the cross-sharing of information with other utility sectors, providing the opportunity to benefit the wider community.

Commonwealth Attorney – General's Department
through CIPMA

Flagship project: Determining asset exposure and vulnerability

Background

CIPMA is part of the national security umbrella. It has the skills and access to sensitive data required to examine the relationships and dependencies between critical infrastructure systems, and then demonstrate how a failure in one sector can affect the operations of critical infrastructure in other sectors.

Methodology

In the collaborative project with CIPMA, we took a multi-stage approach (see Figure 4). The project started by mapping Sydney Water's exposure to climate hazards, including sea level rise, coastal recession, bushfire and storm wind. This identified the assets with the greatest potential to be impacted by climate change.

The next stage involved identifying infrastructure interdependencies. This analysis looked at our assets' reliance on electricity and telecommunication supplies. This information was then used to assess and quantify our vulnerability, including the consequential impacts. We selected two case study areas from our area of operation (the Blue Mountains and the Illawarra), to demonstrate the full vulnerability and consequence analysis.

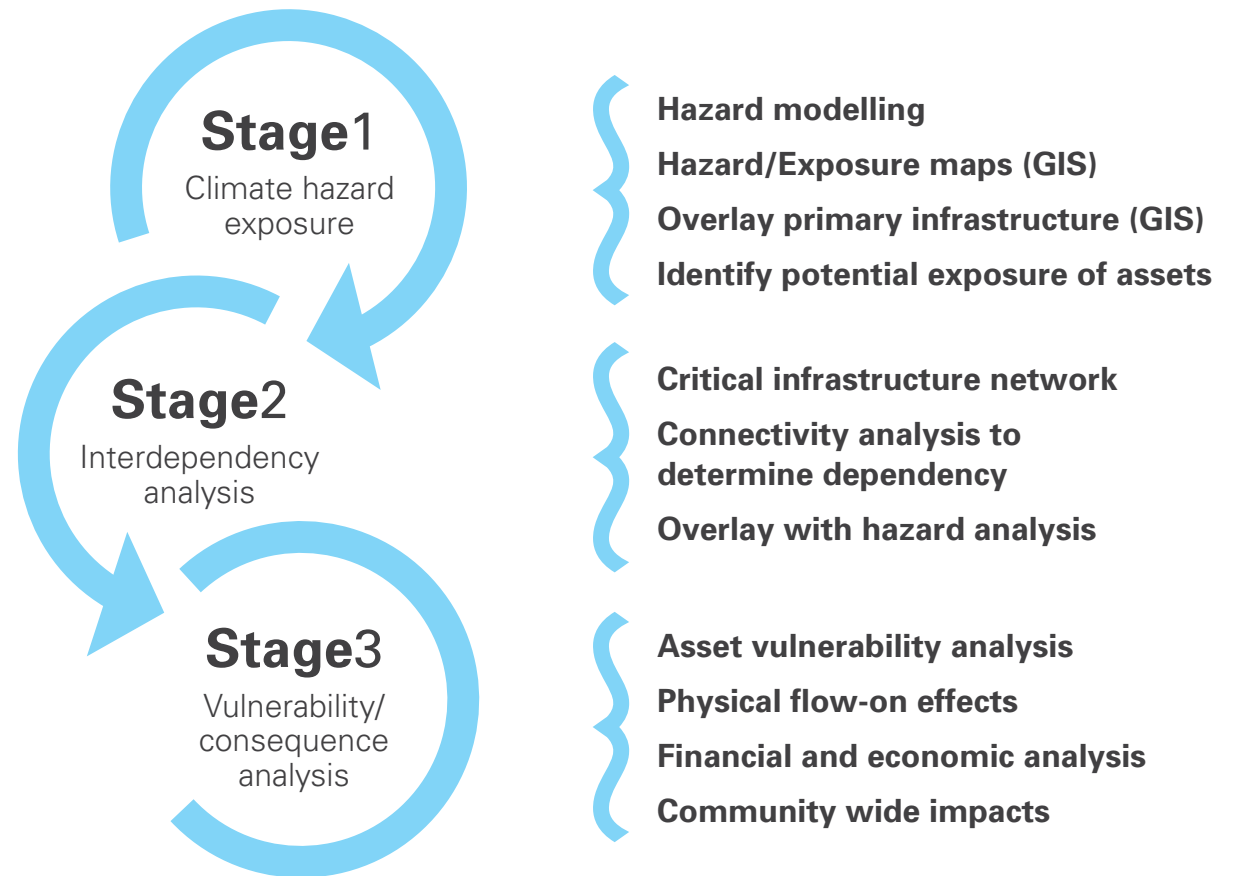


Figure 4: Overview of the CIPMA project stages



Outcomes

Stage 1

The modelling showed lower wind speeds in the urban and flat areas and higher wind speeds in the Blue Mountains, North Sydney, South Sydney and the Wollongong and Shellharbour regions. Within Sydney Water's area of operation the South Coast and North West service areas have the highest number of assets exposed to bushfire, with fewer assets in the Northern Districts, South West and North Coast service areas. Additionally, based on future sea level estimates provided by the NSW Government, 84 wastewater pumping stations will be inundated by 2050, increasing to 192 by 2100 and underground assets, such as water and wastewater mains, could also be significantly impacted.

Stage 2

This stage produced a series of maps highlighting the exposure of Sydney Water assets to hazards through their supply chain dependencies. It also produced detailed schematic diagrams depicting the interconnections between and exposure of water, electricity and telecommunications assets.

Stage 3

The consequence analysis studied the flow-on effects of an asset outage to Sydney Water's operations and the broader community. Potential consequences include flow on effects to other assets and financial impacts, such as repair and replacement costs.

The broader community consequences affected by a loss of water supply include impacts on major businesses, community facilities, and the characteristics and size of the affected population.

Theme 2 Resilience

Purpose

Resilience is important for any organisation, but particularly for an essential service provider such as Sydney Water.

Climate change is only one of many pressures and elements of uncertainty that an organisation must face. Greater competition, global financial uncertainties, emerging technological innovations and ever-changing community expectations all make resilience essential for long-term business sustainability.

Resilience can create greater optimism, adaptability and independence. It can lead to more innovative problem solving and faster recovery times when things don't go to plan.

Theme 2 set out to understand our existing resilience to extreme event disruptions and identify:

- how well placed we are to minimise or prevent these disruptions from occurring
- our ability to respond to and recover from a disruption
- our capacity and willingness (culture) to anticipate change.

Aims

The specific aims of Theme 2 Resilience include:

- benchmark Sydney Water's current resilience and ability to cope with natural events
- identify areas of improvement and recommend targeted actions to increase our resilience to future extreme events
- inform Sydney Water's strategic approach to managing and planning for extreme natural hazard risks.

Process

Our first step was to investigate Sydney Water's long history of exposure to extreme natural events, to better understand how we currently respond and recover.

We engaged Risk Frontiers to study the impacts of past extreme events on our organisation and how they have helped shape our current emergency management culture. Our history showed us how each significant event improved our emergency response and planning. There are key triggers that have shaped our organisation and its current resilience, instigating changes to both policy and procedures in response to event learnings.

We also considered whether common meteorological indicators could be used to give advanced warning of certain natural hazards occurring. Risk Frontiers researched a set of over 500 natural hazard events in NSW between 1925 and 1999. These past events did not show consistent indicators to predict natural hazards.

Finally, Sydney Water funded a national water industry resilience benchmarking project to identify strengths and opportunities to improve our ability to adapt to future climate events that are likely to become more frequent and intense and might compromise our ability to deliver core services.

Outputs

The key outputs for Theme 2 include:

- information on past natural events including lessons learnt, costs, impacts, the challenges posed by natural extreme events on Sydney Water's business and how we have responded to them in the past
- easy to read hazard fact sheets for bushfire, flood and severe storms to inform our future planning and mitigation
- a timeline of significant events that have helped to shape our current resilience
- benchmark of Sydney Water's resilience and identifying our strengths and weaknesses against other water utilities.

Learnings

While we recognise that the intensity, frequency and duration of future climate events is likely to be different, the 125 year history of Sydney Water is testament to the organisation's resilience and continued delivery of essential services despite enormous changes over that period.

Sydney Water's Climate Change Adaptation Program has increased our understanding of our current state of resilience and our past performance in responding to extreme events. Our history shows that each significant event has improved our emergency response and planning. We have learnt from these events and changed both our policies and procedures in response.

For example, the 1994 fires were the catalyst for improvement to water distribution during events and communication between Sydney Water and the fire services. Key improvements included:

- maps and educational materials showing the location and use of mains and hydrants
- new processes for coordinating emergency response and communicating with the fire services.

We found the insurance and emergency management sectors have a great deal to offer in understanding past events and managing risk. Rather than trying to 'reinvent the wheel', we engaged Risk Frontiers to learn from their expertise on natural hazards risks developed while working for the insurance industry.

We originally intended to identify current gaps in direct organisational response to extreme events. But as the program evolved, we found that resilience is much more than just responding to an event. It must encompass the organisation's ability to better prepare for change, whatever that change might be, and to continue to deliver a valuable service to our customers in an uncertain world. This emphasised the importance of issues beyond operational protocols to encompass:

- corporate strategic planning
- staff engagement
- effective partnerships
- strong leadership.

Our aim is to be more resilient by building even stronger networks, improving situation awareness, continuing to manage our vulnerabilities and focusing on promoting an agile workforce. This will allow us to be entrepreneurial and to thrive under all conditions, to be ready for change and able to harness the opportunities that change brings.

The willingness of water utilities to jointly work toward stronger resilience across the sector has been impressive and I believe will result in improved service to their communities.

John Vargo, ResOrgs

Flagship project: Resilience benchmarking

Background

Sydney Water worked with ResOrgs to carry out a national water industry resilience benchmarking project of five Australian water utilities. The purpose was to identify our strengths and opportunities to improve our ability to adapt to future extreme climate events.

Methodology

We chose the utilities in this study based on their high reputation for resilience while covering a wide range of water company settings (large and small, urban and rural, with a range of ownership structures) and because they face a range of hazards, many with climate change implications.

ResOrgs developed the resilience model used in the benchmark study from its research, including work by the Australian Attorney General's Department. It consists of three attributes:

1. Leadership and Culture
2. Networks
3. Change ready

These three attributes are made up of 13 indicators that are used to assess an organisation's resilience in key areas (Figure 5).

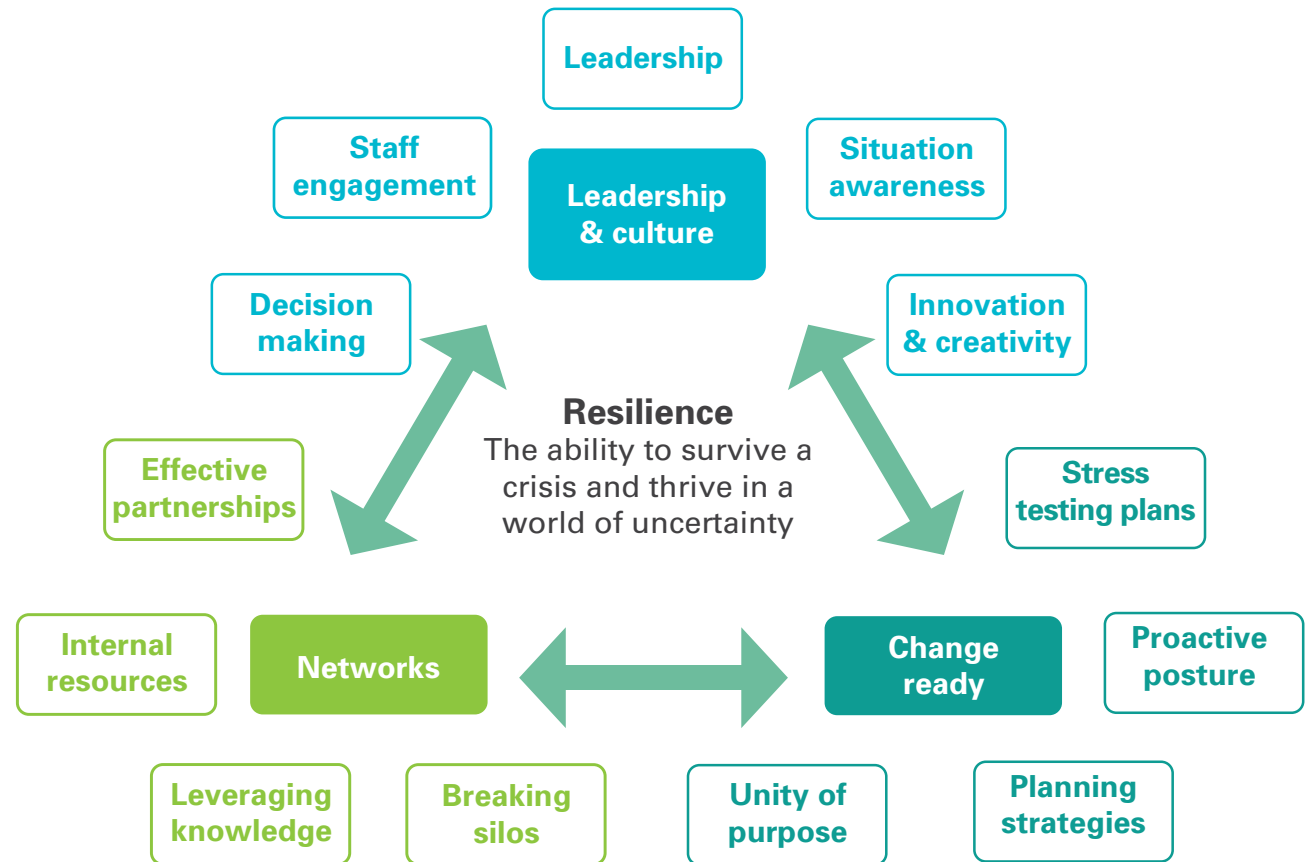


Figure 5. Resilience indicators developed by ResOrgs (www.resorgs.org.nz)



Outcomes

The hazards that concerned these water utilities varied for a range of reasons, including location, mitigation steps taken and the organisation's history. In general, the recent experience of the individual utility had the biggest impact on how they viewed each hazard's importance.

The hazard of most concern was loss of critical service. This could be deemed a technical dependency hazard, not a natural hazard. The next three hazards of highest concern were all natural hazards that could worsen due to climate change: drought, flooding and bushfires.

The benchmarking found that Sydney Water's resilience strengths were largely in emergency response and planning. It found we have strong emergency and risk management processes, including:

- good processes for debriefing exercises after emergencies and converting learnings to actions
- highly effective staff response during an emergency due to a strong 'one-in-all-in' attitude
- robust communication processes during emergencies, for both dealing with the media and communicating with networks
- a strong network of relationships and good mutual aid arrangements
- good processes for designing redundancy into operational and IT assets
- high level environmental scanning and gaining a global strategic outlook.

The study identified opportunities for improvement, including incorporating the more adaptive leadership and decision making style seen during an emergency response into 'business as usual'. With a more adaptive style of leadership there is high trust, improved effectiveness and well established delegation, including the ability of the organisation to repurpose resources from one part of Sydney Water to another.

Theme 3 Adaptation

Purpose

The purpose of the final theme was to embed climate change adaptation into existing business practices and processes, including budget cycles, risk management, and monitoring/review processes. Because we are regulated by the government, our climate change adaptation responses must be effective, justifiable and a sound investment. These requirements highlight the need for quantitative analysis to support decisions.

Aim

The specific aims of Theme 3 Adaptation include to:

- develop a flexible, scalable and responsive adaptation management framework, which can compare the impact of climate change and adaptation measures on cost, asset life, risk likelihood and consequence
- identify and assess adaptation responses to possible climate change futures that include our risk tolerance, regulatory framework and trigger points for action
- produce prioritised adaptation responses supported by cost-benefit analysis and multi-criteria assessment for infrastructure, maintenance, operations and customer servicing.

Process

Developing a way to quantitatively analyse climate change risks and adaptation options enables us to build these into business decisions. In 2010, we engaged Climate Risk Pty Ltd to review available modelling techniques. This informed us of current national and international approaches, but also showed us there was no existing framework that would create the outcomes we needed. This was the critical step that helped identify the requirements of our own climate change quantification tool.

We approached the Water Services Association of Australia (WSAA) to partner with us to develop a climate change adaptation tool for the Australian water industry. Together with Climate Risk Pty Ltd we secured co-funding from the Australian Government as part of the Coastal Adaptation Decision Pathways Program, and with the project participants, Melbourne Water, City West Water, SA Water, Queensland Urban Utilities and Water Corporation, developed the AdaptWater™ Tool.

While AdaptWater™ helps address risks to Sydney Water's assets, our success in adaptation hinges on our interactions with stakeholders, and their views of climate change risks and the need for adaptation measures. By taking a coordinated approach, infrastructure providers can more efficiently implement adaptation options by sharing and reducing costs.

We partnered with the Sydney Coastal Council's Group and the NSW Office of Environment and Heritage to develop information, guidance and capacity building activities for organisations who manage interconnected water infrastructure.

The study highlighted a number of barriers to climate change adaptation for interconnected infrastructure. From this project, we developed a step-wise framework for considered adaptation in a collaborative, consultative way, recognising the complexity of interconnected issues.

Outputs

The key outputs for Theme 3 include:

- AdaptWater™ – the climate change adaptation quantification tool and information hub for the water industry
- a six step framework to plan adaptation measures for water infrastructure that is shared between different agencies, such as stormwater systems.

Learnings

We found that developing a climate change adaptation quantification methodology was the most challenging component of the entire program. We were unable to identify any existing quantification tools that assess climate change risks to specific assets or to the whole network. We needed a system that was sensitive to spatial variations and operational characteristics of different asset types. Also, the method had to be robust and transparent, because the tool will be crucial to future investment decisions.

Transferring the acquired knowledge to the business and building the organisation's capacity to understand climate change risks and evaluate adaptation options is the next big focus.

AdaptWater™ must be applied more broadly across our area of operations to test the tool and integrate the outputs into business decisions. We will be continuing to raise awareness, build organisational capacity and engage with key external stakeholders.

Working in partnership with the broader water industry into the future will also enable us to share learnings, which will feed into further development of AdaptWater™. The industry will be able to develop a common approach to investment in climate change adaptation. This will shape discussions with regulators to achieve balanced outcomes for customers and for our business. This strongly reflects Sydney Water's corporate objectives of being customer focused and forward thinking.

Building upon extensive work from Sydney Water, AdaptWater utilises world leading climate change adaptation expertise and the most up to date climate change data, which means that water utilities can assess short to long-term risk to infrastructure.

Adam Lovell, Executive Director, WSAA

Flagship project: AdaptWater™

Background

AdaptWater™ is an online climate change adaptation tool, which enables the water industry to quantify climate change impacts and compare adaptation options. It serves as the hub for climate change information, so that asset managers can access a single information source to find out how climate events may affect assets or systems and what they should do about it.

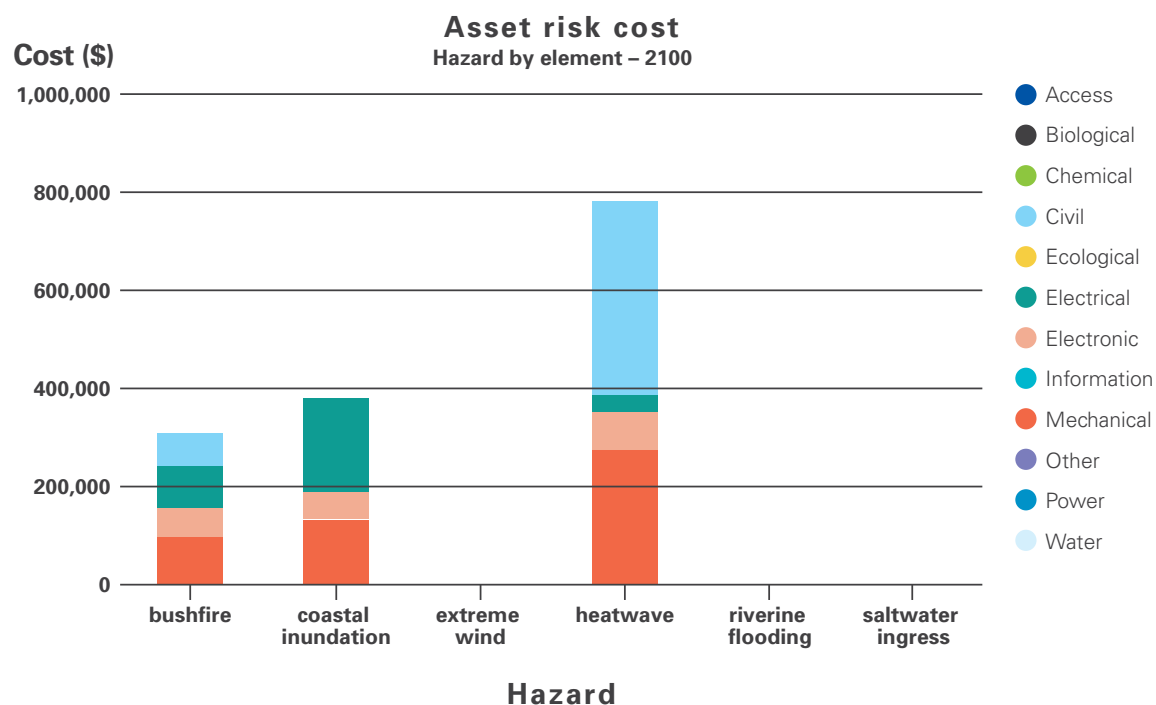


Figure 6. Asset risk cost for different climate hazards

Methodology

AdaptWater™ runs specified scenarios and interrogates the asset data in real time to calculate the consequences of climate change hazards in terms of the risk they present to an organisation's key performance indicators (KPIs). AdaptWater™ goes beyond any other tool, because it uses detailed utility data to break down each unique asset into its elements (civil, electrical, mechanical, electronic, etc. see Figure 6) and defines the major material characteristics and design of each component to establish its damage threshold and failure points.

AdaptWater™ can prioritise assets that are most at risk or most costly under the chosen climate change hazards. Once you determine the risk cost of impacts, you can develop and compare a sequence of adaptation options to the unadapted asset or re-evaluate alternative adaptation options.

AdaptWater™ displays the outputs in tables, graphs or spatial representations of risk. Outputs include:

- dynamic charts and satellite maps which show how the impacts to assets progress with time
- expandable tables for each data set, including at an individual asset level
- charts showing comparison of adapted, business-as-usual and base assets
- reports that compare adaptation options against financial and non-financial KPIs
- net present values for each adaptation option
- exportable CSV files that allow data to be imported into other software packages.



Outcomes

The outcomes of AdaptWater™ will provide benefits to Sydney Water and to the wider industry. This has been recognised in receiving the 2013 Australian Water Association NSW Research Innovation Award.

Key benefits of AdaptWater™ include:

- assessing and quantifying impacts and adaptation responses to climate change
- preparing for future financial commitments in regard to changes in infrastructure and operating regimes
- communicating the impact and costs of climate change to stakeholders, including regulators
- providing input into existing asset management decision frameworks
- developing a national standard for climate change adaptation reporting in the water industry.



2013 AWA NSW Research Innovation Award
for AdaptWater™

Broader program learnings

The program benefits extend beyond enhanced understanding of what climate change adaptation might mean for Sydney Water. We learnt that understanding what climate change adaptation means to an organisation is a journey. It involves not only the individual organisation, but also many other players who form part of our supply chain. This certainly adds to the complexity of the challenge.

Leadership is key to getting the organisation on board with climate change adaptation. Buy-in from the whole business ensures the best integration of climate change adaptation measures with current planning processes, data management, emergency management, asset management and risk protocols. Emergency management experience, in particular, really helped to ground climate change within the business, because staff could relate to the many examples of extreme events that the organisation has managed over the last 125 years of operation.

Understanding climate change impacts is about managing uncertainty and risk. When faced with a complex and global issue like climate change, it is vital that we draw on the wealth of experience within the organisation, the industry and the wider community, for advice and insight. The program helped us capture and consolidate existing information, experience of past events and management strategies.

While recognising the risks that climate change poses for the organisation, the program also helped us identify opportunities that climate change could bring to improve our operational efficiency, without increasing the financial burden on our customers.

From the beginning, we knew the program wouldn't provide all the answers, even after three years of intensive work. What we have achieved is a baseline of information, tools and capability that we can continue to build on and update.





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What does the future hold?

Sydney Water has a long history of providing water and wastewater services to Sydney, the Blue Mountains and the Illawarra and we have faced many extreme events that have threatened these services. The outcomes of the Climate Change Adaptation Program build on our experience to help us overcome the mounting challenges of the future.

The business is now using the outcomes from the program, such as the exposure maps, datasets, fact sheets and reports, when planning new assets and maintaining existing operations. Sydney Water continues to invest in climate change adaptation and to monitor program outcomes.

The impact of climate change is also emerging as a key issue for planning future urban development. Sydney Water is committed to understanding what impact climate change will have on our cities and how water utilities can contribute to adaptation initiatives. The challenge going forward is to avoid complacency to ensure that the organisation remains well positioned to adapt.

This is not something we can do in isolation and we look forward to further collaborations with government and industry partners.





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Acknowledgements

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External Advisory Group:

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Project Partners:

Water Services Association of Australia, Commonwealth Attorney-General's Department, Sydney Coastal Councils Group, Climate Risk Pty Ltd, NSW Office of Environment and Heritage, Melbourne Water, SA Water, Queensland Urban Utilities, City West Water, Water Corporation, Gippsland Water, ActewAGL, Hunter Water, Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, National Climate Change Adaptation Research Facility.

External service providers:

ResOrgs, Risk Frontiers, Element Solutions

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