South East Water

Climate Adaptation Action Plan

Contents

Aboriginal Acknowledgement

South East Water proudly acknowledges the Traditional Owners of the land on which we work and live, and pay respect to their Elders past, present and emerging.

We acknowledge their songlines, cultural lore and continuing connection to the land and water. We recognise and value the rich cultural heritage and ongoing contributions of Aboriginal people and communities to our society in Victoria.

We acknowledge Australian Aboriginal peoples have a long and proud history of living in Australia, through many changes in climate, and have traditional and ongoing knowledge and expertise specifically in climate adaptation.

MD's message

Our purpose – at every level of our organisation – is to deliver a continuous flow of healthy water for life.

This means bringing our customers the clean water they need, and safely managing the wastewater they don't. It means thinking ahead, and inventing what we need to do now, so that future generations can rely on us, too.

1.91 million people count on our water, sewerage, and recycled water services, every day and every night. Our service area borders more than 270 km of coastline and covers a land area of 3,640 km2, from Port Melbourne to Portsea and approximately 30km east of Pakenham. This includes the lands and waters of the Bunurong people, some of the lands of the Wurundjeri Woi Wurrung people to our north, and an area in our far northeast around Longwarry that currently has no Registered Aboriginal Party.

Each year, we support healthy, thriving communities by delivering more than 137 billion litres of drinking water, and collect and treat more than 108 billion litres of wastewater. This comes from the toilets, showers, laundries and kitchens of homes and businesses, and is treated at our local water recycling plants and Melbourne Water's Eastern and Western treatment plants.

From our treatment plants, we produce around 2,300 megalitres of recycled water used for residences, businesses, agriculture, and open spaces. We also recycle biosolids for soil improvement and generate renewable energy from biogas and solar.

To provide our services, we manage more than 26,500 km of pipeline, and own, operate and maintain some $4.8 billion of assets.

Since 2016, climate change impacts are increasingly clear. From the Black Summer bushfires of 2019 – 20, to the severe outages caused by storms, heatwaves, and flooding. But our purpose doesn't change.

We recognise that this is a real, present, and growing threat – to our customers, and the services we provide them. That's why, over the last decade, we've worked to better understand that threat. Adapting, as best we can, to what the future holds.

This Climate Adaptation Action Plan is a result of our analysis of the risks of climate change to our business, our customers, and our environment. Through the actions within, we aim to manage those risks safely and efficiently, for generations to come.

Lara Olsen

Executive Summary

The scientific consensus is clear: human activity is causing climate change. The international community has agreed to keep the global average temperature increase far lower than 2 degrees Celsius (above pre-industrial levels) – ideally, working towards an increase of only 1.5°C. Meeting this goal will require global emissions declining to net-zero or even net-negative levels by the second half of the century.

However, we recognise some changes in the earth's climate are inevitable, despite all mitigation efforts. Climate change is already impacting our business, given the warmer, drier conditions and increasing frequency and severity of natural disasters. Further negative impacts are expected.

Wherever we operate, our customers expect safe and reliable services at fair and affordable prices.

A changing climate shouldn't change this. We'll continue our risk-based approach, and explore how climate change might impact the safety, standard and affordability of our services. We'll also consider the various potential future scenarios, covering the best ways to mitigate each risk, their likelihood, and potential consequences.

In this Climate Adaptation Action Plan, you'll find the following:

1.

How the plan addresses our legal obligations, best practice frameworks such as Australian Standards and industry guidelines. Also how we reference the Taskforce on Climate-related Financial Disclosures reporting framework.

2.

Our understanding of the science of climate change and how it applies to us, as well as the data used in our Climate Adapt risk assessment project.

3.

The risk assessment process we used in the Climate Adapt project which led to this plan.

4.

The actions we'll be taking over the next five years to manage climate change risks – to South East Water and our customers.

We'll deliver the plan between 2022 and 2027. This aligns closely with our pricing period, when our prices (and funding model) are determined by our regulator, the Essential Services Commission. In 2027, we'll revise the plan in time for the 2029 – 34 pricing period.

Here, the focus is adapting to climate change. For details on how we plan to mitigate our emissions and contribute to lower risks of climate change, refer to the Climate Mitigation page on our website.

Strategic context

01

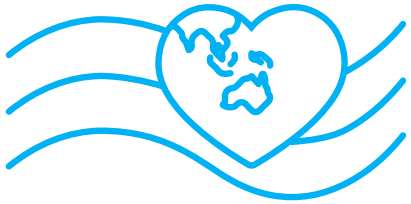
Relevant policies and documents

Responding to climate change is everyone's responsibility. This includes all levels of government, industry, communities, and the people of Victoria.

We're no exception, and water businesses like ours play a critical role in both climate change mitigation and adaptation.

South East Water began its climate change adaptation journey in 2010, developing a Climate Change Risk Assessment and Adaptation Management Plan that identified 24 actions. Based on the data available at the time, the central theme of the 2010 plan was ongoing risk assessment and data collection. An independent review of the plan in 2016 found we made considerable progress across the majority of these actions.

This updated plan is a result of the Climate Adapt project, which delivered a comprehensive climate risk assessment across all aspects of the business in 2020 and 2021 – making it a significant improvement on past climate adaptation plans.



In line with the Victorian Water Act and Statement of Obligations for climate adaptation we will:

- Operate and provide services that minimise environmental impacts and demonstrate reasonable progress integrating climate change adaptation into all planning and decision making.
- Develop an Urban Water Strategy including measures to adapt to climate change.
- Comply with relevant guidelines for forecasting the impact of climate change, including:
  - The Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria (Department of Environment, Land, Water and Planning (DELWP), 2020)
  - The Guidelines for Assessing the Impact of Climate Change on Sewerage (DELWP, expected 2022).
- Comply with the Central and Gippsland Region Sustainable Water Strategy (DELWP, expected 2022).
- Comply with the Water Cycle Climate Change Adaptation Action Plan (DELWP, 2022).
- Develop and implement plans, systems, and processes to manage assets and reduce risks, including adaptation measures to address risks that arise from climate change.

Our Climate Adaptation Action Plan also references the following key documents:

- Managing Climate Change Risk – Guidance for Board Members and Executives of Water Corporations and Catchment Management Authorities (DELWP, 2019).
- AS 5334_2013: Climate change adaptation for settlements and infrastructure – a risk-based approach (SAI Global, 2013).
- Climate Change Adaptation Guidelines (Water Services Association of Australia, 2016).
- Our Environment Policy (2021).
- Our annual Climate Change Commitments Internal Audit Report (2021).

Collaborative Action 1: The Water Cycle Climate Change Adaptation Action Plan (WCCCAAP)

The WCCCAAP is a 5-year plan developed by the Victorian Government to deliver on the Climate Change Act 2017, focusing on water supply, sewerage, drainage, and flood management. It identifies key risks either championed by the water sector, or where the water sector participates in a risk championed by another sector.

Analysing these risks, the WCCCAAP produce five key outcome areas and 19 draft actions, delivered across the 5 years of the plan.

Although led by the Victorian Government, the WCCCAAP provides an excellent opportunity for us to ensure action against risks with a broader scope than our organisation. By working with the government and other stakeholders, there's potential for us to significantly increase the resources for addressing risks and improving climate adaptation actions. Either way, we'll look to reduce the risk to our customers in the most efficient and effective way possible.

Taskforce on Climate-related Financial Disclosures reporting framework

Water businesses have an obligation to consider the impact of, manage, and report on climate risk.

The Victorian Government says this outright, in the *Public Administration Act 2004 [Vic]* and the *Financial Management Act 1994 [Vic]*, as well as in the *Managing Climate Change Risk* guidance for Board members (2019). *Managing Climate Change Risk* refers specifically to the Taskforce on Climate-related Financial Disclosures (TCFD) reporting framework.

We refer to the TCFD framework for managing climate risks, including the potential costs, to guide the information, risks and opportunities we share with our customers and stakeholder groups.

We first disclosed climate risks in line with the TCFD framework in the 2019 – 20 annual report. From there, we asked independent experts to:

1. Evaluate our 2020 disclosures for completeness and robustness against the TCFD framework using Ernst and Young's (EY) *Climate Risk Disclosure Barometer*, including a gap analysis;
2. Benchmark our performance against other Australian water businesses, leading international water businesses, and other major national businesses; and
3. Develop a roadmap for us from the 2020 disclosures to better meet the TCFD framework recommendations.

The expert assessment found that our internal practices are significantly better than the disclosures of our local and international water industry peers in both coverage and quality. EY's annual report 2020 – 21 found our reported practices:

- Addressed 100% of TCFD recommendations (our 'coverage' score is 100%); 18% better than our highest water industry peer, and equal to leading practice in TCFD disclosures worldwide; and
- Were fully aligned with 64% of TCFD recommendations (our 'quality' score is 64%); significantly better than the highest water industry peer's score of 24%.

We aim to continue improving our disclosure in line with the TCFD , being transparent to customers and key stakeholders on climate risks and our response to them. *Appendix A* provides a summary of the key TCFD elements, and our performance against the recommendations outlined in our 2021 Annual Report. It showcases the effort we need to become 'fully aligned' to the TCFD.

Going forward, key parts of improving our performance against these disclosures will be:

- Developing financial metrics and costings of future climate impacts and disclosing these risks if they are material. The complexity lies in the uncertainty of future climate impacts.
- Assessing our scope 3 emissions and similarly disclosing these when material. Here, the complexity is accounting for greenhouse gas emissions across our supply chain.

100%

TCFD recommendations addressed

18% better than next best industry peer.

Climate change impacts and projections

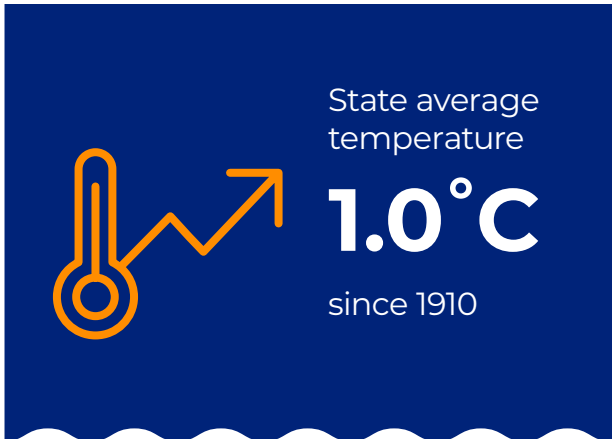
02

Current climate impacts

Victoria's climate is changing, influenced by both natural variability and global climate change. According to DELWP's *State Climate Science Report* 2019:

- The average temperature across the state has warmed by just over 1.0°C since official Bureau of Meteorology records began in 1910.
- Over the past 30 years, Victoria's cool season rainfall has declined compared to last century.
- The mean sea level for Melbourne (recorded at Williamstown) has risen approximately 2mm per year since 1966.
- There's been an increase in dangerous fire weather and fire season length across southern Australia since the 1950s.

The International Panel on Climate Change's Sixth Assessment Report gives more updated information. Globally, 2011 – 20 was 1.59°C warmer over land than 1850 – 1900, and the average global sea-level rise has increased – from 1.9mm/year between 1971 – 2006, to 3.7mm from 2006 – 18. The report also found the chance of heatwaves, droughts, flooding, and fire weather with multiple drivers has increased since the 1950s.



We've seen these changes first-hand. In 2019, we coordinated water supply to Gippsland communities during the aftermath of the Black Summer bushfires; in 2020, storm-driven power outages meant we, along with other water authorities, had to ask thousands of customers to boil drinking water because of potential contamination. We've learnt a lot from these incidents, and improved our operations where we can. However, it's clear that climate change is already directly impacting our business and our customers.

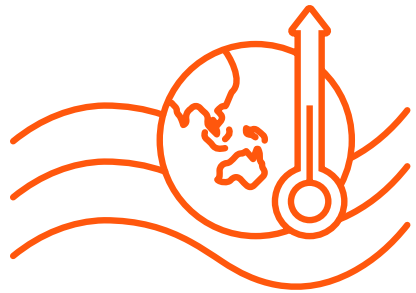
Projections of the future

Climate change is one of the most significant and far-reaching developments South East Water and our customers will experience over the next century.

By responding to it, we must not only mitigate our own contribution to greenhouse gases, but understand and adapt to the changes affected by global economic activity. This means understanding up-to-date climate science, the strengths and weaknesses of that science, and applying this knowledge to our assets.

To develop our understanding of climate change, we're using the following sources:

- International Panel on Climate Change's (IPCC's) publications, principally the regular Assessment Reports.
- The CSIRO's publications regarding climate science.
- The Victorian Government's publications on climate science, including Victoria's Climate Science Report 2019, the Victorian Water And Climate Initiative, the Victorian Climate Projections (2019 link), and the Victorian Future Climate Tool.
- Supplementary research conducted by groups such as Water Research Australia.



We applied these data sources in scenario planning to consider a broad range of possibilities. This included the most extreme future climate pathways noted by the IPCC in 2020, looking at gas emissions futures through Representative Concentration Pathways (RCPs). More information on the RCPs is available on the IPCC website.

To identify near-term risks and across the lifetime of our assets, we considered each scenario for time horizons: 2020 – 40 (averaged to 2030), 2040 – 60 (2050) and 2080 – 2100 (2090). We chose:

- RCP 8.5 to consider a high greenhouse gas emissions future and the worst possible impacts of climate change on our assets.
- RCP 4.5 to sit in the middle, the mid-tier climate impacts where moderate emissions continue.
- RCP 2.6 to consider the risks for our business, and the government, transition to a low-carbon future (e.g. implementing a carbon price).
- The 2090 timeline to look ahead and capture the full scope of climate change consequences.
- The 2030 timeline to understand the immediate impacts.
- The 2050 timeline to consider the lifetime of assets that are built or under construction.
- You can find more detail on how we applied scenario analysis in the Risk Assessments section below (and *Appendix C*).

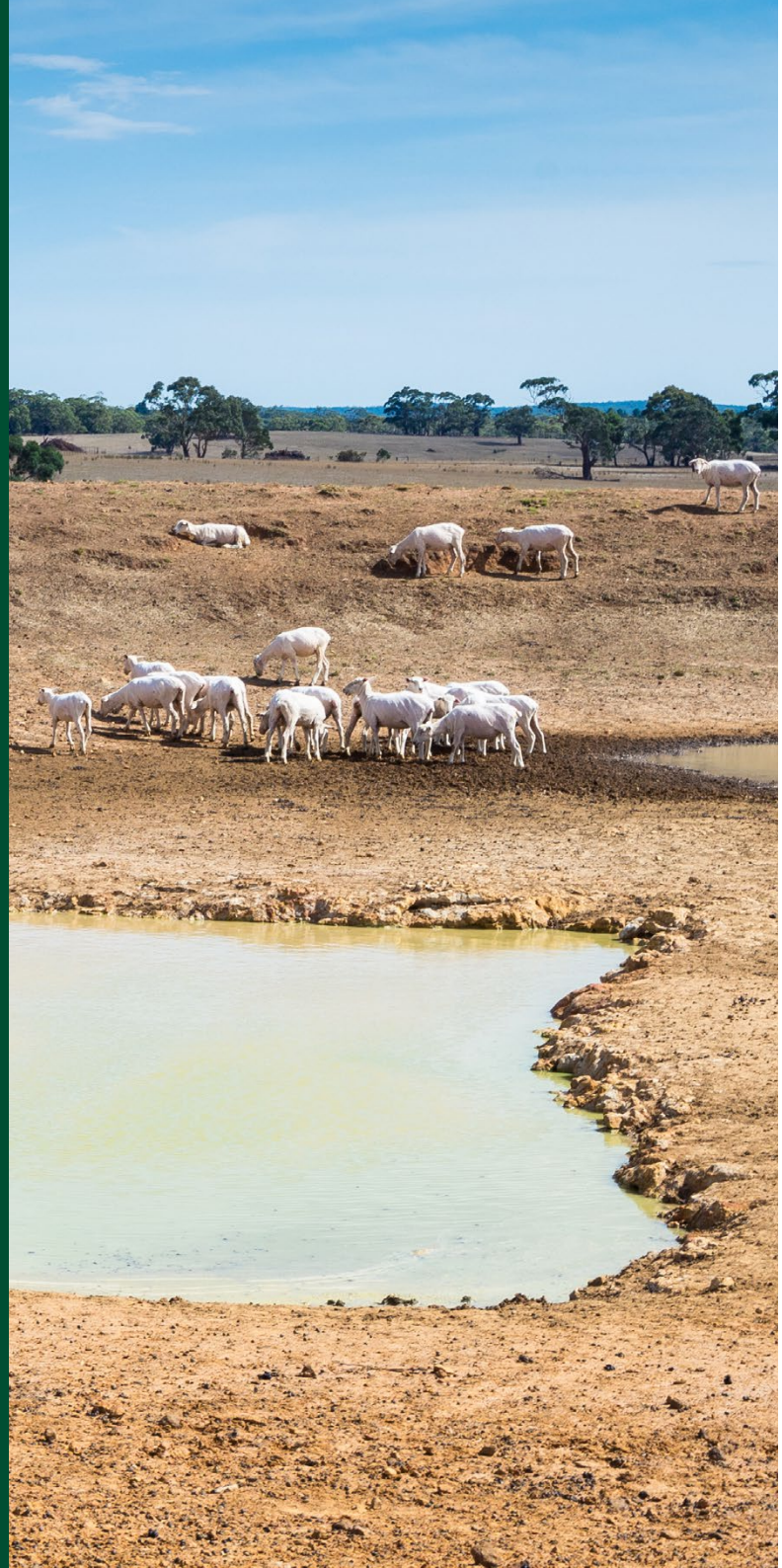
Our 2020 – 21 Climate Adapt project incorporated the latest climate data available for our region at the best resolution for each dataset. We chose to integrate the data into our systems rather than use an external model, which meant we could overlay data like flood maps with our own asset data – not just during the project, but for the duration of this plan.

By producing tools that incorporated the data at varying complexities, we could assess the levels of risk for different assets. The data we used and resolution for each dataset were then compiled into our Climate Change Risk Assessment Tool. It's worth noting some years and parameters (such as temperature or rainfall) for some RCPs did not have data available.

Our datasets included Victorian Climate Projections 2019 as per resources from the government and CSIRO as well as purchasing specific data on sea level rise, drought, bushfire, fluvial (river) and pluvial (flash and surface water) flooding. Dataset, parameter and resolution information are available in *Appendix D*.

Taking action

03



2016 Climate Adaptation Plan review

This Climate Adaptation Action Plan (and the Climate Adapt project that led to its development) is based on the previous 2016 Climate Adaptation Plan.

The 2016 Plan identified the five major climate hazards posing the greatest threat to South East Water:

- Extreme temperatures
- Extreme rainfall events
- Decreased annual average rainfall
- Increased average annual temperatures
- Sea-level rise (with storm surge).

The 2016 plan also identified 56 actions considering these and various other hazards. We committed to them by 2021, with two longer-term actions dependent on climate.

5 major climate hazards

- Extreme temperatures
- Extreme rainfall events
- Decreased annual average rainfall
- Increased average annual temperatures
- Sea-level rise (with storm surge)

Summary of climate adapt process

In 2020, South East Water launched Climate Adapt, a comprehensive program designed to identify and determine controls for the risks of a warming climate. Climate Adapt built on our previous risk assessments through a bottom-up approach.

Internally, we'll develop capabilities by combining the latest climate data and modelling with our employee's deep understanding of our assets and operations. Then, we'll incorporate the outcomes into our asset and operations planning for our 2023 – 28 Pricing Submission period. Following additional community consultation, the Essential Services Commission will either accept or reject our pricing model proposals for those five years.

Collaborative Action 2: Improve climate resilience of South East Water's water supply and demand

Climate change has already resulted in lower average rainfall and temperature increases. Combined, this means less water for us and our customers. These changes are projected to continue, and worsen, under 2 of the 3 climate scenarios considered. However, our risks are shared with other stakeholders, including DELWP, other water businesses, catchment management authorities, and more. Because of this broad impact, we're addressing these risks in partnership with Melbourne Water, Yarra Valley Water, and Greater Western Water.

Primarily, our vehicles for action are the Central and Gippsland Region Sustainable Water Strategy (CGRSWS) and the Greater Melbourne Urban Water Systems Strategy (GMUWSS) (Water for Life) 2022. The CGRSWS is a 15-year long-term plan developed to secure a sustainable water supply for all users. It identifies threats to water availability and quality, and proposes directions and actions to help water users of all kinds – including environmental, irrigation, urban and Traditional Owners.

The Water for Life Strategy is created and owned by the combined Melbourne Metropolitan Water organisations, Greater Western Water, Melbourne Water, South East Water, and Yarra Valley Water. It commits South East Water and the other water organisations to address declining water availability and increasing demand, and aligns with our requirements in the CGRSWS. The Water for Life draft is available now. You can find out more on the strategy's website.

Context

Climate Adapt was influenced by key changes in the Victorian water industry's climate change environment:

- In 2018, the Victorian Government published its Pilot Water Sector Adaptation Action Plan, driving the Victorian water sector's long term climate change strategy and informing the Water Cycle Climate Change Adaptation Action Plan 2022 – 26 (WCCCAAP – Draft published in 2021). The document revealed the government's priorities for climate adaptation in the Victorian water industry. By completing the Climate Adapt risk assessments, we could provide key input on the development of the draft WCCCAAP.
- In 2019, the Victorian Government and CSIRO released the Victorian Climate Projections 2019 – local-scale projections of Victoria's climate future. This new data allowed a closer examination of our climate risks.
- In 2021, the International Panel on Climate Change published its Sixth Assessment Report Climate Change 2021: *The Physical Science Basis*. Two more reports – one on Impacts, Aspects and Vulnerability and one on Mitigation of Climate Change – are due in early 2022. These reports set the global context for climate change, providing critical information that will help us refine our scenario selection.
- We're preparing for the next regulatory pricing period (2023 – 28); including capital and operational spending plans. This provides opportunities to incorporate climate adaptation needs.

Project Outline

The project was split into 7 key phases, as outlined in *Figure 1*. After planning and data collection, the project began with the selection of internal Risk and Resilience Managers (RRMs) to identify and prioritise risks by business segment, and provide clear ownership for each one.

The RRMs performed detailed risk assessments that were validated within the business groups, then by branch managers, and finally presented to the Climate Adapt Steering Committee (CASC).

This process incorporated risk management throughout the business, putting robust governance structures in place – through the branch managers, and then the executive (CASC), who was ultimately accountable. *Figure 2* illustrates the high-level process and governance arrangements of Climate Adapt.

Figure 1

1

Planning + Launch

Project initiation.

Agreement on draft scenarios and time horizons.

2

Data Package

Preparation of climate data package. Collation of most recent climate data from multiple public and private sources and integration of data into Power BI & our GIS system.

3

Identify Risks

Climate risk training on how to perform scenario-based risk assessments and facilitated workshops to identify, prioritise and allocate risks for further assessment.

4

Risk Assessment

RRMs undertook risk assessments on their allocated risks. Consultants provided technical support including interpretation of climate science and engineering implications.

5

Validate Risks

Consultants facilitated risk validation workshops. RRMs presented their risks to the group to validate likelihood and consequence ratings.

6

Branch Manager Validation

RRMs presented risks and results to branch managers for input and in preparation for meeting with the CASC.

7

CASC Presentations

Final presentation of risk registers to CASC for consideration, validation, and feedback.

Governance

Effective climate adaptation requires good governance – of both the Climate Adapt project, and the Climate Adaptation Action Plan.

The CASC was established to ensure the highest level governance of climate risk across South East Water, and was chaired by our Managing Director. The following table summarises how the same level of governance will be applied to implementing the Climate Adaptation Action Plan.

Figure 2

Responsibility	Owner	Mechanism
Oversight of high-level strategic planning and management of climate risk in accordance with Managing Climate Risk: Guidance for Board Members and Executives of Water Corporations and Catchment Management Authorities (DELWP, 2019).	South East Water Board.	Annual reporting by the Environment team to Board, through the Customer Services Solutions Committee.
Direction of strategic planning and management of climate risk.	South East Water Executive.	Annual reporting by the Environment team.
Delivery of strategic planning with respect to climate risk, as well as management of climate risks identified by the South East Water Environmental Management System (EMS).	Environment Manager.	Delivery of the Climate Adaptation Action Plan. Oversight and management of the EMS.
Delivery of strategic actions identified in this plan.	Group Managers of relevant business areas.	Reporting to Executive through internal management channels.
Risk identification, assessment and control with respect to specific assets, operations and systems.	Risk and Resilience Managers as identified in the EMS.	Reporting through the EMS

Risk Identification

We identified our climate risks through a multi-step process:

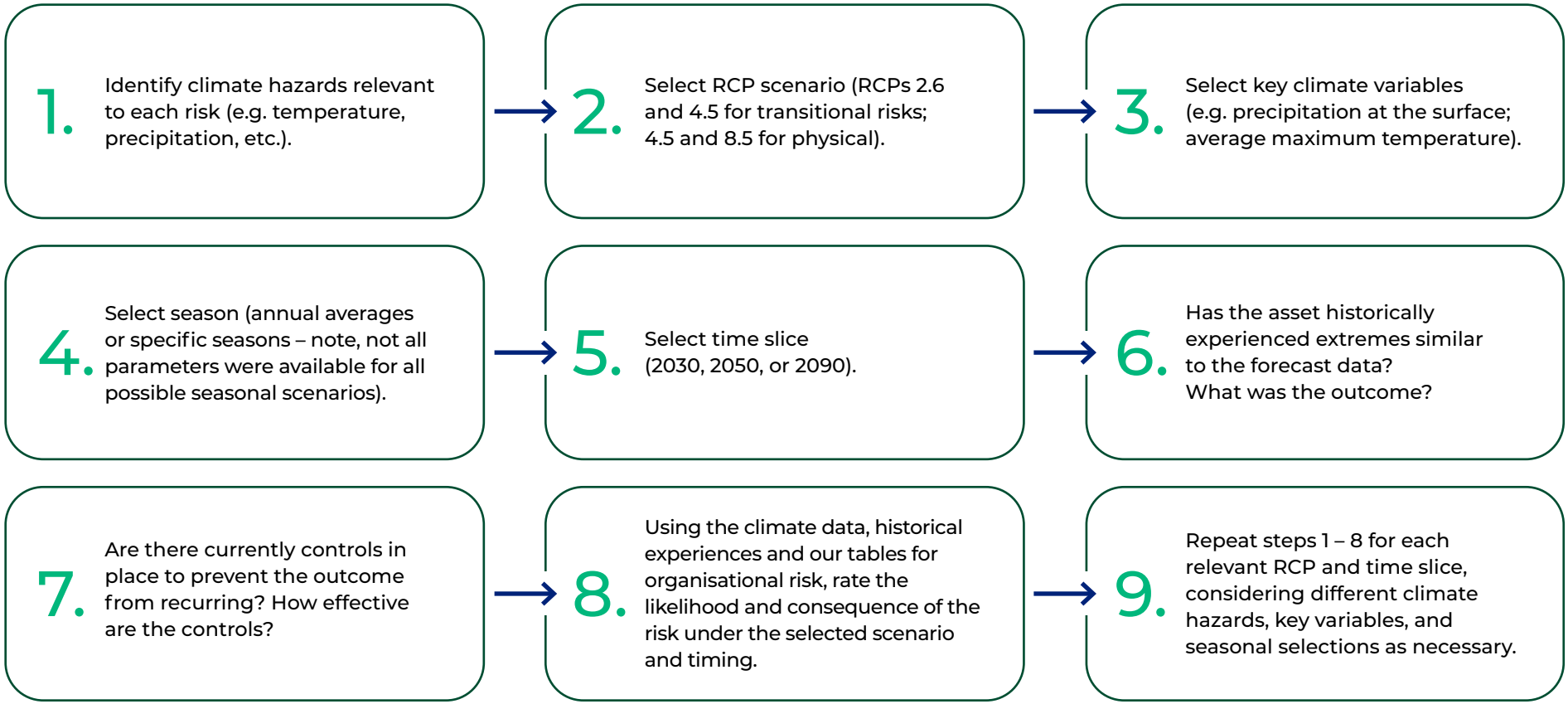
1. The Liveable and Sustainable Futures branch identifies new climate risk information available
2. A review and evaluation of risks included in the 2016 Climate Change Adaptation Plan.
3. An asset risk and resilience workshop with business asset managers to make sure new analysis is warranted.
4. Preliminary risk scans over 5 key business areas: Water Recycling Plants, Sewer Network, Water Network, Water Resources Planning, and Corporate Services.
   These scans:
   a. Found at a high level, key climate hazards and the potential impacts for physical risks (and some transitional)
   b. Considered relevant areas of vulnerability to climate change, in a method similar to the 'core functional area' process recommended by the WSAA Climate Change Adaptation Guidelines (see Section 1: Strategic Context).
5. Reviewed comparable risk assessments across the industry.

We identified 178 climate-related risks, spread across risk registers for each key business area (with one register per Water Recycling Plant). The full list was then recorded in our Environment Management System; you can find the key risks in *Appendix B*.

Risk Analysis and Evaluation

Each climate risk was initially assessed in a workshop by managers from relevant business areas and consultants with climate science and climate risk assessment expertise. The workshops allocated risk assessment responsibility to ‘Risk and Resilience Managers’ (RRMs).

The climate risk assessment process is summarised as follows (with more detail provided in *Appendix C*):

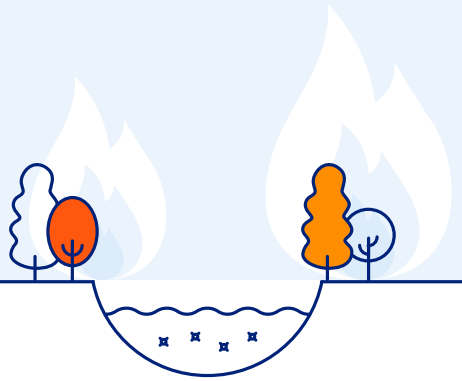


As a result of the risk assessment, 19 risks (13 physical and six transitional) were rated high or extreme in threat in the near term (2030); these are relevant to pricing periods 2023 – 28 and 2028 – 33. Bushfires result in the highest number of risks (7), then drought (5). The high and extreme risks are dominated by costs that might impact customers.

Climate change in 2030
The risks to your water supply

Climate change is here, and low-cost improvements now can limit serious problems in the long run.

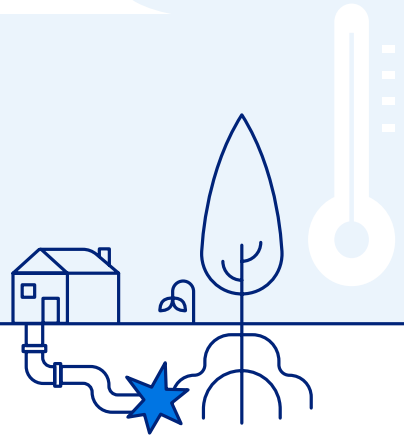
MORE FREQUENT BUSHFIRES



Fire can damage infrastructure and contaminate water with ash. Bush regrowth surrounding dams and rivers can then absorb up to 50% of the drinking water.

- More asset damage
- Long term reductions in how much water is available
- Short term water source contamination
- Maintenance and repairs after incidents

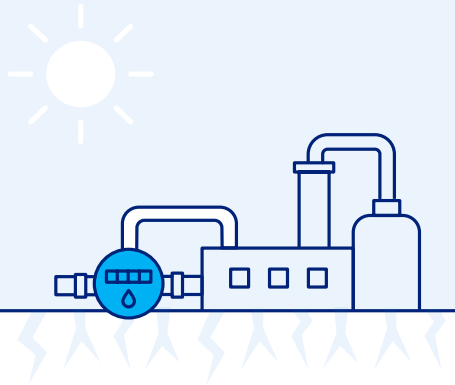
REDUCED RAINFALL & EXTREME TEMPERATURE AVERAGES



Drier and hotter weather will gradually reduce available water – but increase our need for it.

- Our dams will take longer to fill
- River and groundwater levels will gradually fall
- Summer use – from drinking and showers to garden watering – will increase
- Tree roots seeking water will increasingly damage the sewer network, causing leaks

DROUGHT & REDUCED WATER AVAILABILITY



More frequent and severe dry conditions will occur; without man-made water sources we may not have enough water in drought-time.

- Dam levels will be lower and drain quicker, increasingly risking a need for restrictions
- Manufacturing more water may lead to an increase in bills
- Very dry soils can shrink, damaging the sewer network and causing leaks

EXTREME RAINFALL & FLOODING EVENTS

Increasingly extreme events then flood the network, leading to contamination, damage, and leaks.

- Water entering the network can cause more wet weather sewerage spills
- Saltwater entering the network causing corrosion and impacting recycled water
- Localised soil erosion, damaging the water and sewer networks and causing leaks

Control Planning

RRMs were tasked with identifying and implementing controls for these risks, either using currently available resources or those acquired via the Price Submission 2023 – 28.

Our efforts to control a given risk will be driven by the projected value to our customers

According to Australian Standard 5334-2013, risk controls are options that could involve:

- Avoiding the risk
- Taking or increasing the risk
- Removing the risk source
- Changing the risk likelihood
- Changing the risk consequences
- Transferring or sharing the risk with another party or parties
- Retaining the risk.

Our goal is to control risks so that by 2027, zero risks carry extreme threat ratings for 2030, and high threat ratings apply to as few as possible. However, by nature, some climate risks (bushfires, for example) aren't completely controllable and can have very severe consequences. To carry an extreme threat rating, a risk may be rated catastrophic in consequence but likely to occur less frequently than 1 in 5 years. Or, rated moderate in consequence, and likely to occur annually.

A catastrophic consequence might result in an unplanned loss by South East Water of over $26 million, while a moderate consequence would entail a loss of $3 – $13 million. This means our efforts to control a given risk will be driven by the projected value to our customers. In some cases, this could mean a risk threat rating remains high or extreme, despite controls being in place, because of the costs involved.

Based on this, climate change risks will be controlled using the following methodology:

1. Key climate risks

The risks assessed as high or extreme in 2030. Each of these has been considered by RRMs as part of their asset and business planning for our next price submission, with specific controls developed and implemented during 2022 – 30. *Appendix B* contains a full list of these risks, the RRMs responsible, and the planned control actions. These risks will be reviewed biennially and at this plan's revision in 2027.

2. Climate science monitoring

Our risk assessments are built upon our understanding of Victorian-specific climate science (available circa December 2020). We'll review the state of climate science biennially to inform future risk assessments and inform the need for assessment revision.

3. Tier 2 risks

Risks rated lower than high or extreme in 2030 are tier 2 risks. These will also be assigned responsibility and reviewed regularly. The review process is separate from that for key climate risks – risks that are low, and remain low in all scenarios, will only be reviewed if triggered by new information. On the other hand, risks that are low in 2030 but become high or extreme in some scenarios will be reassessed more frequently. All risks will be reviewed at this plan's revision in 2027.

4. Collaboration

As climate impacts are, by nature, cross-border, through collaboration we can reduce the effect on our customers. This means working closely with DELWP and other key policymakers to influence and deliver policy that gives customers the best outcome. We'll also identify and act on specific project opportunities with local stakeholders – for example, our collaboration with five other organisations to deliver the Fisherman's Bend Water Sensitive City Strategy (WSCS), which will deliver climate resilience through flood management, potable water demand management, and urban ecology actions.

Integrated water opportunities

Although climate change presents many risks, it also represents an opportunity to improve our business. Water is becoming less available and more in demand, and our Integrated Water Management (IWM) lets us meet these needs. It's a chance to think about the many different sources of and uses for water and design our systems to suit. We're already investigating these opportunities across the business – at our Aquarevo development and Fisherman's Bend, we're drastically reducing drinking water consumption using recycled water and rainwater. These examples also protect customers from other climate risks, like flooding.

As we move into our Climate Adaptation Action Plan, no specific actions discuss IWM. Instead, it is delivered through the Greater Melbourne Urban Water and System Strategy (see *Collaborative Action 2*) and Central Region Sustainable Water Strategy (See Section 1: Strategic Context). Empowered by these strategies, we'll work with partners across our three river catchments to deliver projects designed for each. Then, we'll report on these projects through joint IWM plans, captured through the GMUWSS full report.

A plan for action

04

Goals

This strategy sets 5 climate adaptation goals to achieve by 2027. These climate adaptation goals are built on our customer outcomes statements, key organisational targets you can find on our website. Of the statements, this plan places strong emphasis on two:

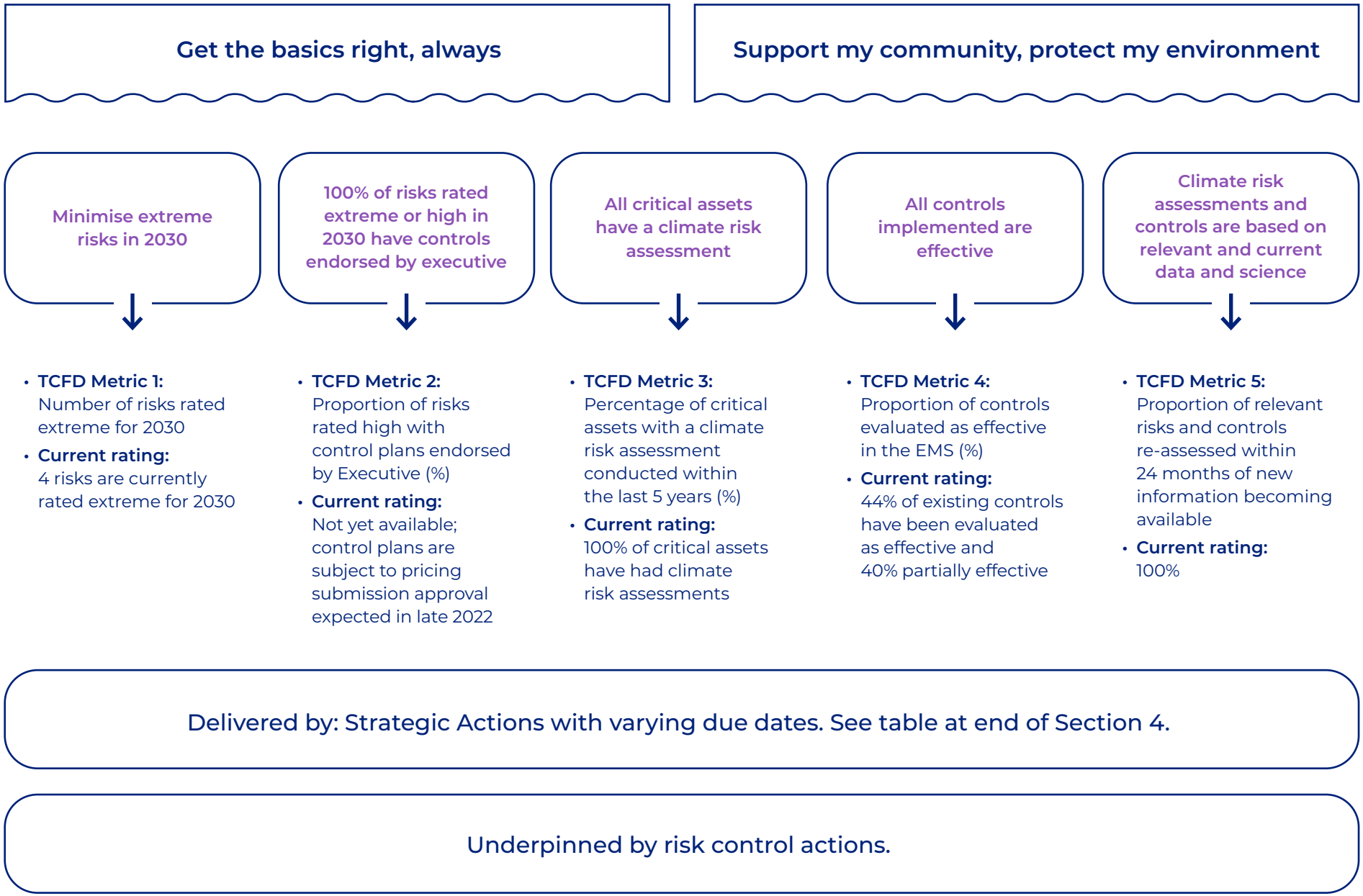
Customer Outcome 1:
Get the basics right, always

Customer Outcome 5:
Support my community, protect my environment

Each climate adaptation goal has an accompanying metric that we will publicly report on, as per TCFD disclosure recommendations. A set of strategic actions supports each goal, intricate and repeatable steps to help strengthen our system against climate risks. Finally, listed in *Appendix B* are direct risk control actions. These respond to risks identified in Climate Adapt, and generally include one or more specific actions that will be monitored through our Environment Management System (EMS).

Figure 3 summarises our climate adaptation goals and governance of them; each goal is then discussed individually in the following pages. The Strategic Action List table, summarising the full list of goals and strategic actions and including timelines and responsibilities, can be found at the end of Section 4.

Figure 3


Get the basics right, always
Support my community, protect my environment
Minimise extreme risks in 2030
100% of risks rated extreme or high in 2030 have controls endorsed by executive
All critical assets have a climate risk assessment
All controls implemented are effective
Climate risk assessments and controls are based on relevant and current data and science
• TCFD Metric 1: Number of risks rated extreme for 2030
• Current rating: 4 risks are currently rated extreme for 2030
• TCFD Metric 2: Proportion of risks rated high with control plans endorsed by Executive (%)
• Current rating: Not yet available; control plans are subject to pricing submission approval expected in late 2022
• TCFD Metric 3: Percentage of critical assets with a climate risk assessment conducted within the last 5 years (%)
• Current rating: 100% of critical assets have had climate risk assessments
• TCFD Metric 4: Proportion of controls evaluated as effective in the EMS (%)
• Current rating: 44% of existing controls have been evaluated as effective and 40% partially effective
• TCFD Metric 5: Proportion of relevant risks and controls re-assessed within 24 months of new information becoming available
• Current rating: 100%
Delivered by: Strategic Actions with varying due dates. See table at end of Section 4.
Underpinned by risk control actions.

Case study 1: Improving our resilience to extreme weather events

Bushfires and other extreme weather events have become more intense and frequent under climate change. As global temperatures rise, these trends are expected to intensify. As a result, we've implemented operational and planning-based controls.

Operationally, we've updated our incident management system and Bushfire Management Plan – and were able to coordinate mutual aid for East Gippsland in the 2019 Black Summer bushfires.

In planning, on top of calculating Bushfire Attack Levels (BALs) for our most high-risk assets, we used DELWP bushfire simulation software to simulate impacts on 77 of our critical assets. The combination of these BALs and simulations lets us plan bushfire controls specific to each asset – for example, a high BAL rating may signal that we need to trim and manage the vegetation at a treatment plant, while a simulation showing high-intensity burns might trigger the installation of a heat-resistant casing for a key water pump station.

Additional controls are identified in *Appendix B* and the Environment Management System.

We believe our planned controls for bushfires and extreme weather events are appropriate but can always be improved. This includes our current incident management review process, as well as upgrading our accounting system to consider trends in spending, resource commitment and the impact of incidents over time, which would improve forward projection spending efficiency.

Case study 2: Improved risk monitoring and maintenance tools

Emerging science and technologies may improve our risk assessments. One example is digital twinning technology; sophisticated software that builds a complete simulated model of an asset or system. With a digital twin of our systems and assets, it may be possible to simulate risk events – and visually show risk analysts the impacts of climate scenarios. By moving risk assessment away from purely conceptual and closer to lived experience, we might gain additional insights.

We're currently taking part in a digital twinning research project with Melbourne University Infrastructure Engineering, as a part of the Australian Research Council's (ARC's) Industrial Transformation Research Program for the ARC Research Hub for Resilient and Intelligent Infrastructure Systems in Urban, Resources and Energy Sectors. In 2022, we'll conduct a high-level evaluation of whether this technology is likely to offer significant improvements to climate risk assessments.

Goal 1

Minimise the number of risks rated extreme in 2030 through active control measures.

- **TCFD Metric 1:** Number of risks rated extreme for 2030.
- **Current rating:** 4 risks are currently rated extreme for 2030.

We're ambitious in achieving zero extreme climate-related risks – primarily, because climate change is a fundamental, large-scale, and complex change. Achieving this goal does not mean climate change will no longer impact South East Water.

Instead, we've budgeted for controls against all 4 risks currently rated extreme in 2030, to lower this threat rating. This may mean reducing the likelihood or consequence of those risks.

To do this, we'll:

a. Deliver 100% of risk controls identified in Climate Adapt and monitored through the Environment Management System. A summary table is available in *Appendix B*.

b. Consider, and potentially implement, likelihood and consequence tables targeting climate change impacts on our business. Consequence tables may need to address impacts such as multi-sector impacts of bushfires, or bringing forward expenditures.

c. Communicate with customers on the possible impacts of climate change so they understand the risks, and let us know their preferred levels of investment to manage them. Investments will ensure climate adaptation is factored into long term planning.

Goal 2

100% of risks rated high or extreme in 2030 have controls endorsed by executive.

- **TCFD Metric 2:** Proportion of risks rated high with control plans endorsed by Executive (%).
- **Current rating:** Not yet available; control plans are subject to pricing submission approval expected in late 2022.

For some risks, a high threat rating is appropriate. It may be because the consequence is so high that a 'high' threat rating is the lowest possible, or that the cost of control is disproportionate to the risk.

For example, worsening bushfire conditions increase the risk of a severe bushfire in our catchments, which could be disastrous. This would remain a 'high' risk, as this consequence remains severe even if it is infrequent. Instead, our controls aim to maximise our resilience to bushfire impact on our water sources, with a high level of accountability to ensure the most appropriate controls. Actions 1a, b and c will also contribute to the effectiveness of action 2.

For maximum accountability, we'll:

a. Report annually to the executive and Board on the Climate Adaptation Action Plan progress, including the status of controls for risks rated high or extreme.

Goal 3

All critical assets have a climate risk assessment as part of our standard risk management processes.

- **TCFD Metric 3:** Percentage of critical assets with a climate risk assessment conducted within the last 5 years (%).
- **Current rating:** 100% of critical assets have had climate risk assessments.

The Climate Adapt risk assessment was conducted for all existing assets – and new critical assets will need one too, as part of our standard risk management processes. That means:

a. We'll incorporate a multi-stage climate risk assessment process, allowing us to identify which assets need an in-depth assessment and which require only a high-level scan (2022). For example, critical infrastructure such as treatment plants and key pump stations – which have a significant impact if they fail – will undergo more rigorous risk assessment, while infrastructure such as desktop computers would likely receive high-level scan-based assessments.

b. Internal communication and training will be developed and delivered, supporting employees in their understanding and proactive application of climate risk assessment processes (2023 and ongoing).

c. All new or renewed critical assets will be assessed for climate risk (2022 and ongoing).

Goal 4

All controls implemented are effective.

- **TCFD Metric 4:** Proportion of controls evaluated as effective in the EMS (%)
- **Current rating:** 44% of existing controls have been evaluated as effective and 40% partially effective

Climate adaptation is based on future projections and science that is uncertain. This makes it difficult to reliably put long term controls in place, or determine their efficiency. At some point, it's almost inevitable that we'll implement controls that either over or underestimate the resulting risk.

This is not a reason for inaction, and our duty to our customers is to monitor and evaluate control implementation to ensure their effectiveness. To do so:

a. All controls will include effectiveness measures and a record of control cost (2022).

b. Our public reporting will be fully aligned with the recommendations of the TCFD (by 2026).

c. Control efficacy and efficiency will be evaluated at this strategy's review, and ineffective controls will be corrected (2027).

Goal 5

Climate risk assessments and controls are based on relevant and current data and science.

- **TCFD Metric 5:** Proportion of relevant risks and controls re-assessed within 24 months of new information becoming available (% relevance based on hazard and/or impact type).
- **Current rating 100%:** No new information has been identified since the completion of the Climate Adapt risk assessments in 2021.

Climate science is a developing field, particularly when looking at actual versus predicted greenhouse gas emissions, interactions between global climate change and regional climate patterns (e.g. El Niño/La Niña), and localised impacts.

To ensure our climate risk assessments remain up to date we'll:

a. Monitor climate science and control technology through ongoing and biennial review of information provided by key sources (identified in Section 2).

b. Develop (2022) a list of research priorities to improve our knowledge of key climate hazards and impacts, and seek opportunities to promote research aligned with these topics.

c. Review the impact of new climate science technology on the Climate Adaptation risks and controls, revising existing processes where necessary.

Strategic Actions and how we'll deliver them

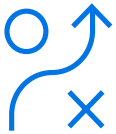
The Strategic Action List table on the following page summarises these actions with timelines and responsibilities.

Strategic action list

This table provides a full, summarised list of the actions in the Action Plan.

AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Goal 1	Minimise the number of climate risks rated extreme in 2030 through active control measures	2027	Number of risks rated extreme for 2030	Annual	Relevant risk owners	Public website
1A	Deliver 100% of risk controls as identified in *Appendix B* and monitored through the Environment Management System	2027	Percentage of controls for high and extreme risks delivered on schedule	Annual	Relevant risk owners	Environment Management System (EMS)
1B	Consider and potentially implement likelihood and consequence tables targeted to climate change impacts on South East Water	2023	Likelihood and consequence tables are appropriate to climate change risks	Once-off (2023)	Branch Manager, Liveable and Sustainable Futures Risk, Assurance and Quality Manager	EMS
1C	Communication with our customers on the possible impacts of climate change and need for action	EMS	Customer ratings of South East Water's effective long-term planning	Annual	Branch Manager, Liveable and Sustainable Futures; Marketing, Communications and Engagement Manager	EMS

AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Goal 2	100% of controls for risks rated 'high' or 'extreme' for 2030 are endorsed by executive	2025	Percentage of relevant controls endorsed by executive	Annual	Relevant risk owners	Public website
2A	Report annually to executive and Board on the progress of the Climate Adaptation Action Plan, including the status of controls for risks rated high or extreme	2027	Frequency of reporting to executive and Board	Annual	Branch Manager, Liveable and Sustainable Futures	Through an annual paper to executive and Board



AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Goal 3	All critical assets are assessed for climate risk as part of our standard risk assessment processes	2023	Percentage of critical assets with a climate risk assessment conducted within the last 5 years	Annual	Relevant risk owners	Public website
3A	Incorporate a multi-stage risk assessment process to suit different assets' risk assessment needs	2027	Post-implementation survey results	6-months post-imple-mentation	Branch Manager, Liveable and Sustainable Futures; Group Manager, Strategic Asset Management; Group Manager, Asset Performance and Resilience	EMS
3B	Develop and deliver internal communications and training to support use of the risk assessment process	2023	Survey of risk assessors after training	Annual	Branch Manager, Liveable and Sustainable Futures; Group Manager, Strategic Asset Management; Group Manager, Asset Performance and Resilience	EMS
3C	All new or renewed critical assets are assessed for climate risk	2023	Percentage of critical asset business cases that include a climate risk assessment	Annual	Asset planners and asset managers; Group Manager, Strategic Asset Management; Group Manager, Asset Performance and Resilience	EMS

AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Goal 4	100% of controls are effective	2027	Proportion of controls reported against are evaluated as effective in the EMS	Annual	Relevant risk owners	Public website
4A	100% of controls include effectiveness measures and a record of control cost	2027	Percentage of controls with effectiveness measures and costs recorded	Annual	Relevant risk owners	EMS
4B	South East Water's public reporting will be fully aligned with the recommendations of the TCFD	2026	South East Water's score in the EY TCFD Barometer	Biennial	Branch Manager, Liveable and Sustainable Futures	Annual Report/Public Website
4C	Control effectiveness and efficiency are evaluated, and corrective actions are implemented where necessary	2027	Cost-benefit analysis of controls implemented	2027	Relevant risk owners, Branch Manager, Liveable and Sustainable Futures	2027 Adaptation Action Plan

AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Goal 5	All climate risk assessments and controls use up-to-date information	2022	Percentage of relevant risks or controls re-assessed within 24 months of new information becoming available	Annual	Risk owners	Public website
5A	Monitor climate science and control technology through ongoing and annual review of information provided by key climate science sources	2023, 2025	Summary report on state of climate science.	2023, 2025	Branch Manager, Liveable and Sustainable Futures; Research and Development Manager; relevant risk owners	EMS
5B	Develop and promote a set of research priorities to improve knowledge with respect to key climate hazards and impacts for South East Water	2022	Number of research priorities with research underway or delivered	Annual	Branch Manager, Liveable and Sustainable Futures; relevant risk owners; Research and Development Manager	EMS
5C	Revise existing risk assessments and controls implemented when new information becomes available	2023, 2025	Percentage of climate risks reviewed for change in projected values	2023, 2025	Branch Manager, Liveable and Sustainable Futures; relevant risk owners	EMS

AAP Action	Target	Target date	Metric	Reporting frequency	Responsible	Reporting location
Collaborative Action 1	Collaborate with DELWP and water sector partners to deliver relevant actions in the Water Cycle Adaptation Action Plan	2027	Number of collaborative projects SEW has participated in that align with WCAAP actions	Annual	Branch Manager, Liveable and Sustainable Futures; relevant risk owners	EMS
Collaborative Action 2	Deliver on the climate change-related actions in the Greater Melbourne Urban Water System Strategy	2027	Percentage of climate-related actions in the GMUWSS on track	Annual	Branch Manager, Liveable and Sustainable Futures; relevant risk owners	EMS
Case study 1	Enhance our systems to enable improved tracking of incident occurrence, costs, severity, controls implemented and impact	2022	Percentage of incidents captured in the system	Annual	Branch Manager, Liveable and Sustainable Futures; Risk, Assurance and Quality Manager, Network Operations Manager	EMS
Case study 2	Assess the possible benefits of digital twinning for climate adaptation	2023	Participation in the Australian Research Council's Industrial Transformation Research Program for the ARC Research Hub for Resilient and Intelligent Infrastructure Systems in Urban, Resources and Energy Sectors	Annual	Branch Manager – Liveable and Sustainable Futures; Group Manager – Strategic Asset Management	EMS

Appendices

05

Appendix A: The Taskforce on Climate-related Financial Disclosure

Thematic area	TCFD recommended disclosures
Governance	a. Board oversight
	b. Management's role
Strategy	a. Climate-related risks and opportunities
	b. Impact on the organisation's businesses, strategy and financial planning
	c. Resilience of the organisation's strategy
Risk Management	a. Risk identification & assessment process
	b. Risk management process
	c. Integration into overall risk management
Metrics and Targets	a. Climate-related metrics in line with strategy and risk management process
	b. Scope 1, 2, 3 GHG metrics and the related risks
	c. Climate related targets and performance against targets

Thematic area	TCFD recommended	Rating	Effort required
Governance	a. Board oversight	●	○
	b. Management's role	●	◔
Strategy	a. Climate-related risks and opportunities	●	◔
	b. Impact on the organisation's businesses, strategy and financial planning	●	◑
	c. Resilience of the organisation's strategy	●	○
Risk Management	a. Risk identification & assessment process	●	○
	b. Risk management process	●	◔
	c. Integration into overall risk management	●	○
Metrics and Targets	a. Climate-related metrics in line with strategy and risk management process	●	◔
	b. Scope 1, 2, 3 GHG metrics and the related risks	●	●
	c. Climate related targets and performance against targets	●	◕

Disclosure maturity

● Aligned to TCFD
● Considered in detail
● Partially considered
● Not considered

Level of effort to close gap

○ Maintain
◔ Minimal
◑ Moderate
◕ High
● Significant

Appendix B: 2030 High and extreme risks, responsibilities and controls

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
25	Water Entitlement and water resource management policy changes reduce consumptive allocation	Increased cost of water as higher proportions of more expensive water (e.g. desalinated and alternative waters) are needed to maintain sufficient supply	Likelihood: Almost Certain Highest Consequence: Moderate Threat rating: Extreme		DELWP	Greater Melbourne Urban Water System Strategy (publication anticipated 2022, actions delivered 2022 – 27), Drought Preparedness Plan (to be finalised in 2022), Water Security Working Group (ongoing)
209	Bushfire impacts major catchments, leading to long term decreases in yield	Increased cost of water as higher proportions of more expensive water (e.g. desalinated and alternative waters) are needed to maintain sufficient supply	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High	Water Resources Manager	Melbourne Water	
213	Droughts cause acute lack of water availability	Higher proportions of more expensive water (e.g. desalinated and alternative waters) are needed to maintain sufficient supply. Most acute droughts may lead to customer service levels not being met	Likelihood: Unlikely Highest Consequence: Catastrophic Threat rating: High		Melbourne Water	

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
214	Rainfall reductions gradually reduce dam storages	Increased cost of water as higher proportions of more expensive water (e.g. desalinated and alternative waters) are needed to maintain sufficient supply	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High		Melbourne Water	Greater Melbourne Urban Water System Strategy (publication anticipated 2022, actions delivered 2022 – 27), Drought Preparedness Plan (to be finalised in 2022), Water Security Working Group (ongoing)
215	Increased average temperature increases water demand	Increased cost of water as higher proportions of more expensive water (e.g. desalinated and alternative waters) are needed to maintain sufficient supply	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High		Melbourne Water	
91	Bushfire damage to assets impacting operations	Unavailability of critical services or systems for between 1 and 5 days, affecting a large number of customers	Likelihood: Unlikely Highest Consequence: Major Threat rating: Medium	Treatment Plants Planning Manager Water Network Reliability Manager Sewer Network Reliability Manager	Emergency Management Victoria	Up to date Bushfire Attack Level assessments conducted of assets (ongoing) Conduct works specific to each site as identified by BALs and appropriate bushfire modelling (2026)

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
207	Extreme rainfall impacts major catchments or treatment assets, leading to acute water quality impacts	Increased cost of water as additional treatment is needed to maintain sufficient supply. Customer service levels aren't met and customers are issued boiled water notices	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High	Water Quality Manager	Melbourne Water	Melbourne Water incident response planning (ongoing); Implement relevant recommendations from the review of the Silvan Dam Incident (2026); Installation of remote monitoring and control capabilities for water quality and chlorine dosing sites (2024)
210	Bushfire impacts major catchments or treatment assets, leading to acute water quality impacts	Increased cost of water as additional treatment is needed to maintain sufficient supply. Customer service levels aren't met and customers are issued boiled water notices	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High	Water Quality Manager	Melbourne Water	
149, 219	Rising sea levels and reduced water availability leads to increased sewage salinity	Unavailability of recycled water to agricultural customers. Adverse impacts on treatment processes	Likelihood: Almost Certain Highest Consequence: Minor Threat rating: High	Treatment Plants Planning Manager Sewer Network Reliability Planning Manager	South East Water	Analyse and prioritise catchments by risk (2022 – 28) and apply controls to highest-risk catchments (2024 – 33)

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
206	Emergency incident response impacts on resourcing	Lack of employee capacity at peak periods, leading to repeated impairment to delivery of critical services for up to 0.5 days per incident	Likelihood: Almost Certain Highest Consequence: Minor Threat rating: High	Group Manager Network Operations Business Resilience Advisor	Various	Increase available incident response resourcing and ensure ongoing competency; Develop and/or maintain emergency management plans for fire, flood and storm events; Ongoing, review all incidents of level 1 or higher; Collaboration with Regional Emergency Management Teams (ongoing)
142, 147	Intense rainfall overwhelming sewer network capacity	Repeated spills with day-scale impacts on immediate areas; unavailability of critical services for up to 1 day; possibility of infringement notices being issued	Likelihood: Likely Highest Consequence: Moderate Threat rating: High	Sewer Growth Planning Manager	South East Water	Ongoing, conduct climate rainfall modelling on all assets being renewed or at high risk, implementing upgrades on a risk vs cost basis

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
146	Increased soil erosion leads to asset damage	Possibility of significant contamination to the environment with an enforceable undertaking issued by the Environment Protection Authority Victoria, as well as significant negative media coverage	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High	Sewer Network Reliability Planning Manager	South East Water	Significant increases to sewer monitoring and renewal/replacement program planned for 2023 – 28; specific actions outlined in Sewer Lifecycle Asset Management Plan
151, 171	Soil movement leading to sewer leaks and blockages	Repeated non-compliances at the infringement notice or external audit requirement level	Likelihood: Likely Highest Consequence: Major Threat rating: Extreme	Sewer Network Reliability Planning Manager	South East Water	
153	Increased heat and reduced rainfall increase tree root impacts	Repeated spills with day-scale impacts on immediate areas; unavailability of critical services for up to 1 day	Likelihood: Likely Highest Consequence: Moderate Threat rating: High	Sewer Network Reliability Planning Manager Environment Manager	South East Water	

Risk No#*	Risk	Most significant consequence(s) by 2030	2030 Rating	Risk Owner	Key Stakeholder Organisation/s	
8, 9	Carbon is directly or indirectly priced due to increasing efforts at a global, national or local scale to reduce emissions	Our costs increase to cover this additional cost	Likelihood: Almost Certain Highest Consequence: Moderate Threat rating: Extreme	Environment Manager	South East Water	Development of an internal carbon price for use in project decision making (2022)
26	Insurance costs increase or a gap of coverage occurs due to the increasing likelihood and consequence of extreme events	Our costs increase to cover this additional cost	Likelihood: Rare Highest Consequence: Catastrophic Threat rating: High	Risk assurance and quality manager	South East Water	Ongoing engagement with and monitoring of local and international insurance markets

*Risk numbers as listed in the Climate Adapt Combined Risk Register.

Appendix C: Climate Scenario Analysis Guide

Conducting scenario analysis on physical risks

Worked example

We recommend starting with **RCP 8.5** as this is typically where the largest amount of change is realised. Furthermore we recommend commencing with the impacts at 2090 (Long-Term) again this is where we typically expect the greatest change, however if you are analysing an asset that is not likely to exist in 2090 e.g. a treatment plant, then it would make sense to conduct the analysis at 2050. Once you have completed the analysis at RCP 8.5 at 2090, you can complete the analysis on the remaining time horizons for RCP 8.5 (2030 and 2050) and also for the other scenario (RCP 4.5, that has less prominent physical impacts than RCP 8.5).

Example Analysis – Increase in average temperatures impacting distribution pipe material

1. What is the predicted change under the scenario?

Under RCP 8.5 at 2090, there will be an expected increase in average temperature of 4.44°C compared to historic levels (1986 – 2005).

Has the asset previously been affected by the climate variable?

Yes, when the external and internal temperatures have differed in the past, it has caused bending and cracking of distribution pipes.

What was the outcome?

The pipes were required to be replaced, and that area of pipeline was out of operation until maintenance was completed to fix the issue.

2. Are there currently any controls in place to prevent this occurring?

Yes, the South East Water network is increasingly using plastic pipes (e.g. PVC or PE pipes) that react less to temperature differentials and have a longer product life span. **Controls should be noted in the Risk Register**.

If yes, what is the effectiveness of the control/s?

The controls are partially effective, as this risk is still relevant for older pipelines made of less robust materials. **Control effectiveness should be listed in the Risk Register**.

3. What are the consequences and likelihood ratings for this risk?

Please use the consequences and likelihood tables within the risk register to complete this section

RCP 8.5 – We understand that pipes can bend and crack due to temperature differences between the internal and external temperatures. If we assumed that there are currently maintenance issues and damage to pipelines for this issue happening at least once a year, it is expected that this would become more frequent by 2090. Therefore the likelihood of this risk would be **'Almost Certain'**.

To conduct the consequence analysis we have to understand the impact of a section of pipe bending and cracking.

Read through the consequence table located within the risk register and see which rating best fits the risk

Can SEW still provide their critical service?

Not if the area relies on that part of the pipe network.

How many people will be affected?

Those in the area serviced by that area of pipeline.

How long would it take to rectify the issue?

The pipe can be replaced or repaired within the same day.

What is the financial cost of the impact and can it be quantified?

The cost of the pipe repair and replacement likely could be partially quantified using standard repair costs for pipes, with the total volume annually being estimated (not calculated). It is expected it would fall in the Insignificant category of <$0.6m.

Based on the above responses, the risk would fit with a **'Moderate'** Consequence rating under the Service category, being 'Unavailability of critical services or systems for up to 1 day'. **The Risk Category title of 'Service' should be noted in the Risk Register**.

Using the Risk Matrix to determine the overall risk we can see that an **'Almost Certain'** likelihood combined with a **'Moderate'** consequence result in an **'Extreme'** risk rating in the Risk Register for RCP 8.5 at 2090.

Note: Not all data is available in the Power BI Dashboard.

Always refer to the Risk Register for the location of the relevant data.

Change expected under RCP 8.5 2050 (Baseline 1986 – 2005)	Change expected under RCP 8.5 2090 (Baseline 1986 – 2005)	Location of Data
+1.93 C (Max temp ARI 20) +57% in days above 35 (from 7.2 to 11.5) +200% in days above 40 degrees (0.6 – 1.8 days)	+3.92 C (Max temp ARI 20) +155% in days above 35 (from 7.2 to 18.4) +567% increase in days above 40 degrees (0.6 – 4)	1. Return intervals and days above data are located in the Climate Summary Data Excel

Likelihood Table

Rating	Likelihood Description	%
Almost Certain (5)	Event ***will occur***, almost certainly, at least once every year	>98%
Likely (4)	Event is ***likely to occur*** (once every 1 to 2 years)	50 – 98%
Possible (3)	Event ***may occur*** (between once every 2 to 5 years)	20 – 49%
Unlikely (2)	Event is ***not likely to occur*** (between once every 5 to 20 years)	5 – 19%
Rare (1)	Event ***will only occur*** in exceptional circumstances (less than once every 20 years)	<5%

Conducting scenario analysis on transition risks

Worked example (carbon price)

As a metropolitan water utility, transition risks at South East Water are experienced differently to those in the private sector, or in government. As covered in the risk assessment workshops, transition risks will be identified and discussed predominantly with Corporate Risk RRMs. Where relevant, and for emissions intensive parts of the business (e.g. Water Treatment), transition risks will also be discussed in the workshops.

Our recommended approach for undertaking transition risk scenario analysis is as follows:

1. What is the predicted change under the scenario?

2. How would that affect the asset or business offering?

3. If South East Water is expecting to see an increase in either capital or operational expenditure with the increase in costs from a carbon price, could these costs be passed on?

4. Taking into considerations the potential controls at South East Water's disposal, and the potential ability to limit the associated impacts of the identified transition risk, what is the overall consequence and likelihood rating for this risk under RCP 2.6 and RCP 4.5 under the selected time horizon?

Carbon Price under RCP 4.5 at 2030	Carbon Price under RCP 2.6 at 2030	Carbon Price under RCP 4.5 at 2050	Carbon Price under RCP 2.6 at 2050	Carbon Price under RCP 4.5 at 2090	Carbon Price under RCP 2.6 at 2090
$35 per tone C02-e	**$100** per tone C02-e	**$35** per tone C02-e	**$105** per tone C02-e	**$35** per tone C02-e	**$105** per tone C02-e

Example Analysis – carbon price impact on PVC pipe costs

1. What is the predicted change under the scenario?

Under RCP 2.6, there will be an expected carbon price of $100 per tonne of CO2-e at 2050.

2. How would that affect the Asset? (for example, the cost of installing pipelines?)

Firstly it is assumed that South East Water's PVC produces will pass the full extent of the carbon price to customers. The emissions intensity of PVC currently is estimated around 3.4 kgs of CO2-e per kg of PVC. Assuming a PVC pipe diameter of 400mm, the weight of the pipe is expected to be 24kg per metre of pipe. Using these values, the increased cost can be calculated by multiplying the emissions intensity by the weight of the pipe: 3.4 x 24 = 81.6 kgs of CO2-e per metre of PVC pipe. Under RCP 2.6, we assume a carbon price of at least $100 per tonne of CO2-e, or $0.1 per kg of CO2-e. This will see each metre of pipe will cost an additional $8.16, and each kilometre of pipe costing the business an additional $8160 in capital expenditure from a carbon price alone.

3. Could South East Water pass this additional cost on to its' customers?

South East Water's ability to pass on these costs will be limited through the role of the Essential Services Commission in setting water prices in Victoria. If South East Water is unable to pass on the increase costs from emissions pricing to customers, the organisation will either need to pay the additional costs for the material, or search for a substitute product that is less emissions intensive (and therefore more cost effective in the scenario).

4. What are the consequence and likelihood ratings for this risk?

Using the estimates of carbon prices provided, the total financial consequence for this risk across these time horizons is listed below. Note this example is illustrative only, and assumes that a quarter of the 24,000 km of South East Water's pipeline network is upgraded once every 20 years.

RCP 2.6 – Under this assumption, a carbon price of $100 at 2030, or $105 at 2050 and 2090 would see the cost of around $48mil, which results in a **'Catastrophic'** consequence category, with the **'Rare'** likelihood rating of replacement once every 20 years or more. This would result in a **'High'** overall risk rating.

RCP 4.5 – Under a carbon price of $35 per tonne of CO2-e in 2030, 2050 and 2090; the overall additional cost of a carbon price would be around $17mil, resulting in a **'Major'** consequence rating and the **'Rare'** likelihood rating, leaving the risk across each scenario and time horizon to be rated as **'Moderate'** overall.

Note: this risk is assessed on the financial scale, but quantification of this risk is only **'Partial'** due to the significant reliance on assumptions in quantification.

Appendix D: Dataset, parameter and resolution information

Climate Dataset	Representative Concentration Pathways	Parameters	Resolution
Victorian Climate Projections 2019 (CSIRO: Access 1.0 Climate Model)	4.5 and 8.5	Temperature Rainfall Wind speed Solar radiation Relative humidity Pan evaporation Evaporation	5km grid Annual Seasonal
Sea level rise (including storm tide inundation)	4.5 and 8.5	Annual Return Intervals 2, 5, 10, 50, 100, 200, 300	5-metre grid
Drought	4.5 and 8.5	Standardised Precipitation-Evapotranspiration Index (SPEI) probability of: • moderate and higher drought • extreme drought	5km grid
Bushfire	4.5 and 8.5	McArthur's Forest Fire Danger Index (FFDI)	5km grid
Pluvial flooding	4.5 and 8.5	Annual Return Intervals 20, 50, 100, 200, 500	30-metre grid
Fluvial flooding	4.5 and 8.5	Annual Return Intervals 20, 50, 100, 200, 500	30-metre grid

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