GOVERNMENT OF WESTERN AUSTRALIA

Department of **Water and Environmental Regulation**

Department of **Treasury**

Climate change risk management guide (interim)

Practical guidance for the Western Australian public sector to assess and manage climate change risks

Contents

Acknowledgment

The content in this document has been partly or wholly reproduced from the *Climate risk ready NSW guide – Practical guidance for the NSW Government sector to assess and manage climate change risks*, published by the State of New South Wales through the Department of Planning, Industry and Environment, March 2021.

The *Climate risk ready NSW guide* is available at: https://climatechange.environment.nsw.gov.au/adapting-to-climate-change/climate-risk-ready-nsw

Preface

Western Australia is experiencing the impact of climate change through increased average and maximum temperatures, sea level rise, time spent in drought, and more extreme weather events. In the south-west, the prolonged period of drying will continue, affecting primary industries, water security and natural ecosystems. These changes will potentially have broad impacts across our communities, industries and ecosystems.

Climate risks are risks associated with the physical and economic impacts of natural hazards and a changing climate. These can be physical or transition risks and may be direct (such as damage to buildings and infrastructure) or indirect (such as disruption to supply chains and markets).

The public sector can help manage the economic and social impacts of climate risks by, for example, taking action to avoid or reduce disruptions to public services, protect government assets, and support adaptation within the community. Enhancing our resilience to climate change goes hand-in-hand with the WA Government's objective to reach net zero emissions by 2050, as outlined in the Western Australian Climate Policy.

The Department of Water and Environmental Regulation is working with WA Treasury to develop a Climate Risk Framework (the framework) to monitor, assess and report on implications of climate change on the state's finances, infrastructure, physical assets and service delivery.

This interim *Climate change risk management guide* (the guide) will support public sector agencies to conduct a first-pass climate risk assessment of their physical climate risks, including identification of treatment options to enhance resilience. This guidance will enable the public sector to begin to consider climate risk consistent with the framework's long-term objectives.

The guide has been adapted from the 'Climate risk ready NSW guide – Practical guidance for the NSW Government sector to assess and manage climate change risks' developed by the NSW Government through the Department of Planning, Industry and Environment. The WA Government wishes to thank the NSW Government for its collaboration and assistance.

Introduction

The climate in Western Australia is already changing, with increasing frequency and intensity of extreme weather events and long-term changes to weather patterns.

The rise in Australia's average temperatures has accelerated in recent decades (see Figure 1). Current temperatures are about 1.4˚C higher than they were in the 1950s (BoM 2020), with further warming expected.

Impacts from climate change will be felt differently across WA and are likely to result in risks to our natural resources, health and wellbeing, and economic prosperity.

It is estimated that unchecked climate change will reduce the size of the Australian economy by 6.3 per cent by 2070, and lead to a net reduction of 880,000 jobs (Deloitte Access Economics 2020). Further modelling by a global group of 66 central banks, including the Reserve Bank of Australia, warns that global domestic product could fall by 25 per cent by 2100 if no action is taken (NGFS 2020). Disadvantaged groups, and those who do not have the financial capacity, social resources and necessary information to respond, will be particularly vulnerable – as will individuals and businesses in regions where the physical impacts are expected to be particularly severe.

Alternatively, limiting warming to 1.5˚C and investing in climate adaptation measures is estimated to grow Australia's economy by $680 billion in present-day terms and add more than 250,000 jobs by 2070 (DAE 2020).

Climate change has the potential to affect how government plans and delivers the critical services and infrastructure the community depends on. Climate change will exacerbate existing risks and create new systemic risks and opportunities for government.

The reliance of the WA community on government assets and services is often emphasised during times of crisis, such as when critical networks are damaged or disrupted by extreme weather events.

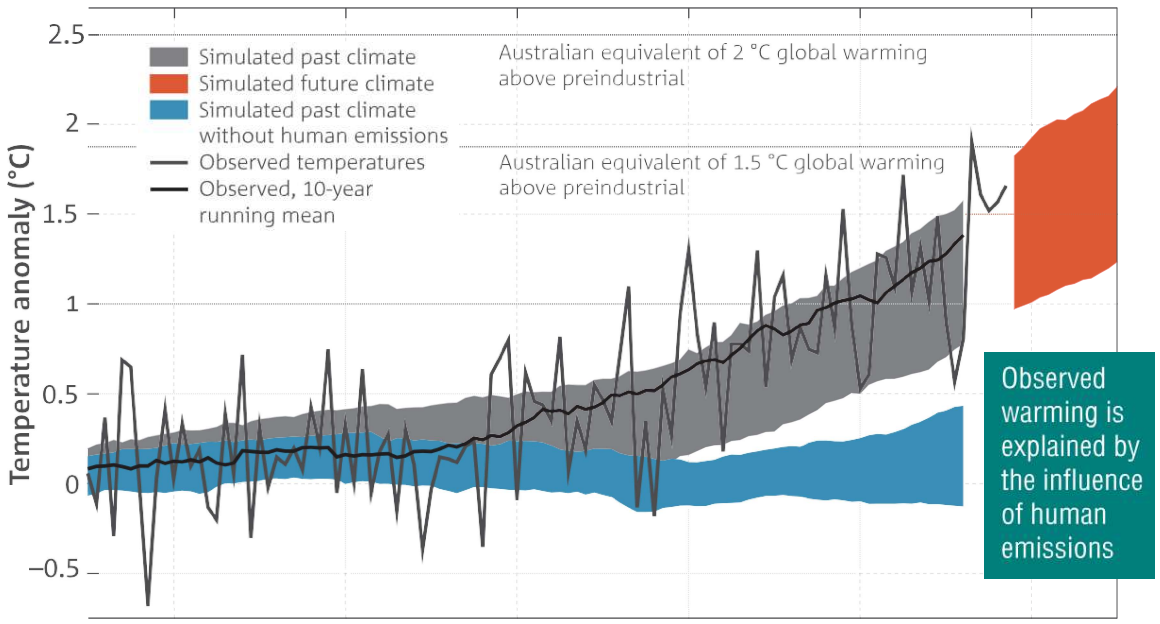


Figure 1: Observed and simulated temperature anomalies for Australia, with and without the effect of human activities

(Australian Government Climate Change Authority 2020)

The WA Public Sector Commission states that effective risk management is one of the foundations of good governance in the public sector. *Treasurer's Instruction 825 Risk Management* requires all agencies to develop suitable risk management policies and practices for all risks, including emerging risks such as climate change.

This guide will support public sector agencies to conduct first-pass climate risk assessments of their physical climate risks, including identification of treatment options to enhance resilience. It is acknowledged that some agencies and government trading enterprises (GTEs) plan to undertake, or already have undertaken, more detailed climate risk assessments.

> It is estimated that unchecked climate change will reduce the size of the Australian economy by 6.3 per cent by 2070, and lead to a net reduction of 880,000 jobs.
>
> (Deloitte Access Economics 2020)

Global emission targets: the ParisAgreement

The Paris Agreement is a global climate agreement that provides a framework for all countries to act on climate change. It was reached by 197 countries as part of the United Nations Framework Convention on Climate Change (UNFCCC) 21st Conference of the Parties (COP21) in Paris on 12 December 2015. The Paris Agreement includes a goal to limit the increase in global temperatures to well below 2˚C and pursue efforts to limit the rise to 1.5˚C.

National leadership and economy-wide policy is critical to delivering our international commitments under the Paris Agreement. The WA Government is, however, not waiting for national action, and is taking steps to lay the foundations of a low-carbon transition and adjust to unavoidable climate change.

What is climate change risk?

Climate change risk refers to the potential negative or positive impacts of natural hazards and climate under the influence of rising global greenhouse gas emissions (Figure 2).

Impacts can be event-driven (acute shocks) or longer-term shifts (chronic stresses) in climate patterns. There are three types of climate risk: physical, transition and liability (Bank of England 2020).

This guide focuses on completing a first-pass assessment of physical risks only.

Physical risks result from the direct impacts from rising aggregate global temperatures (CSIRO 2016). Examples include damage or disruption to assets or infrastructure, supply chain impacts, or health impacts.

Physical risks can be determined based on past and current experiences of natural hazards, climate change projections and identification of relevant climate variables.

Transition risks or opportunities may result from the move to a lower-carbon economy. Examples include changes in market demand, reputational risks or legal risks associated with regulatory change to limit greenhouse gas emissions. **Not in scope for first-pass assessments proposed in this guide.**

Liability risks are those associated with people or businesses seeking compensation for losses they may have suffered resulting from climate change, including as a result of physical and transition risks (Bank of England 2020). **Not in scope for first-pass assessments proposed in this guide.**

Risk is defined as 'the effect of uncertainty on objectives, noting that effect is a deviation from the expected and may be positive and/or negative'.

Climate resilience is the ability to anticipate, prepare for, respond and adapt to acute and chronic climate change, so as to continue delivery of services and assets, and meet community expectations.

Adaptation refers to actions undertaken to manage or reduce the adverse consequences of climate change, as well as to harness any benefits or opportunities.
This may include transitional or transformational action.

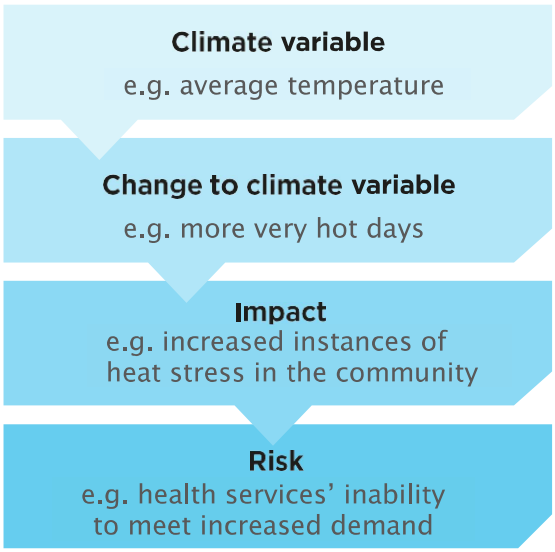


Figure 2: Links between climate change and risk (AGO 2006)

Climate vs weather

Weather is the mix of events that happen each day in the Earth's atmosphere. There is only one atmosphere, but weather varies in different parts of the world and changes over minutes, hours, days and weeks.

Weather refers to short-term changes in the atmosphere, while climate describes what the weather is like over a long period of time in a specific area.

Adaptation or mitigation?

The severity of climate change impacts in the medium to long term depends on how fast global greenhouse gas emissions can be reduced. Greenhouse gases already built up in the atmosphere will result in some unavoidable short-term warming. Adaptation will help manage potential climate risks resulting from current and projected warming.

Climate change adaptation refers to the process of making decisions and taking actions to manage or reduce the adverse consequences of climate change, as well as to harness any benefits or opportunities.

Climate change mitigation includes actions we take globally, nationally and individually to limit changes caused in the global climate by human activities. Mitigation activities reduce greenhouse gas emissions and/or remove greenhouse gases from the atmosphere.

In some instances, action to adapt (address climate change risks) may also achieve climate change mitigation outcomes. Figure 3 illustrates the difference between mitigation actions and adaptation actions and the overlap between the two.

This guide outlines the approach to complete a first-pass climate change risk assessment and identify adaptation responses.

Guidance for emissions mitigation planning is not included.

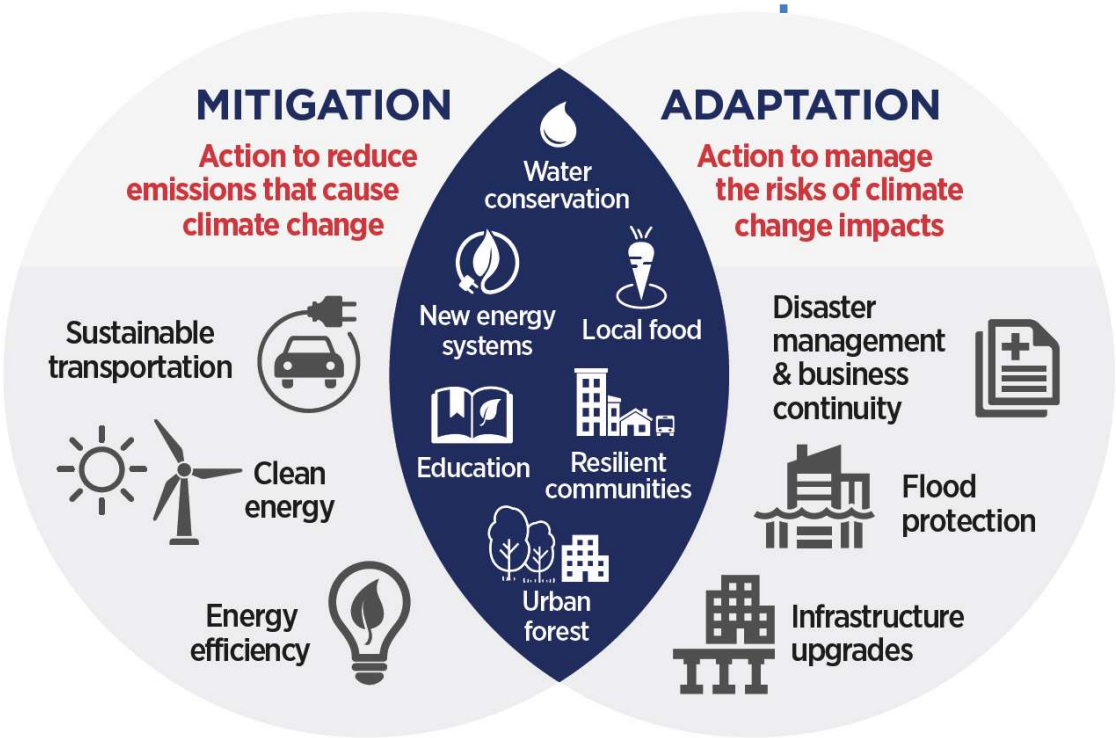


Figure 3: Examples of climate change mitigation and adaptation actions and complementary approaches

International and national climate risk context

The Reserve Bank of Australia, the Australian Prudential Regulation Authority and the Australian Securities and Investments Commission have recognised climate change as a material economic risk to the Australian economy. The ratings agencies Moody's and S&P are increasingly considering climate risk in their credit rating assessments of state governments.

This increasing attention has in part been catalysed by the Task Force on Climate-related Financial Disclosures (TCFD). The TCFD was established by the global Financial Stability Board in December 2015. The TCFD seeks to help manage the exposure of the financial system to climate-related risks through more informed investment decision-making and supporting targets set out in the Paris Agreement to limit global warming this century to well below 2°C.

Its 2017 recommendations provide a framework to guide the disclosure of climate-related financial risks to investors, regulators and governments (TCFD 2017). Figure 4 outlines the types of climate-related financial risks and opportunities for an agency.

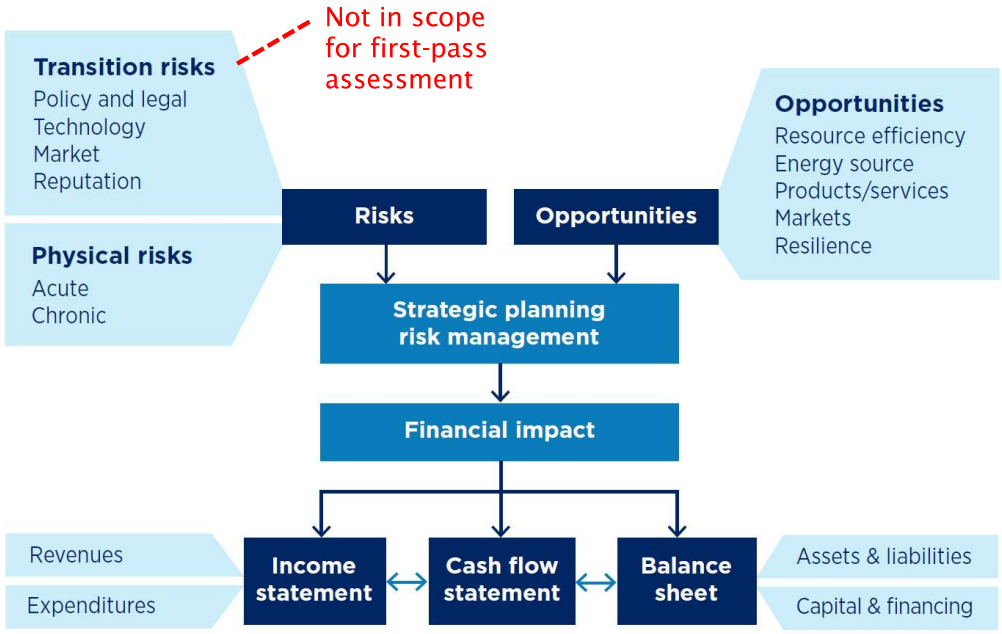


Figure 4: Climate-related financial risks, opportunities, and their financial impact

(TCFD 2017)

There is wide and continued uptake of the TCFD recommendations around the world. Global benchmarks such as the Carbon Disclosure Project and Global Real Estate Sustainability Benchmark are increasingly aligning to TCFD recommendations. The Australian Government's Senate inquiry into carbon risk disclosure also recommended that government commit to implementing the TCFD recommendations (Senate Economic References Committee 2017).

Unique aspects of climate risk management

Your first-pass climate change risk assessment will be qualitative, as you will need to make several assumptions about what a plausible future climate may look like, and how this may influence the likelihood and consequence of potential risks.

Potential challenges of managing climate change risks include:

- uncertainty about the precise nature and timing of climatic changes, particularly at regional and local scales
- uncertainty about societal, economic and technological changes that may influence global emissions over time
- long-term horizons that may not align with other planning timeframes
- dispersed governance of the functions and roles that can help governments effectively adapt, and of the systems that may be impacted by climate
- capacity for transitional or transformational adaptation.

These challenges reinforce the need for an adaptive management approach that uses evidence as it becomes available to maximise risk management and adaptation outcomes over time.

Leading practice in climate risk management

Climate change risk management is an emerging area of risk management and is evolving in response to increasing extreme events, improved risk management culture, and the expectations of key stakeholders such as investors, insurers, credit rating agencies and communities.

A leading agency will have:

- an executive that understands climate risks to its agency, and which is committed to addressing them
- allocated oversight of climate risk to a central, ongoing role (a climate risk officer with clear accountability for addressing climate risk)
- a risk management process that explicitly identifies climate risks
- integrated consideration of climate risk in existing risk management, monitoring and reporting systems
- a continuous improvement process in place to periodically review management of climate risks
- appropriate resourcing for knowledge and capability building over time.

Flooding of the Great Northern Highway in 2011.
Source: DWER

Case study

Climate Health WA Inquiry: Understanding climate risks in the health sector

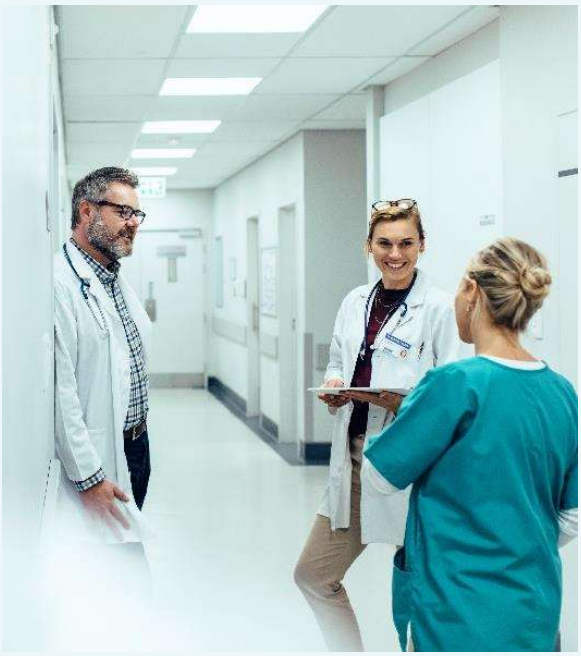
In 2020 the Western Australian Government released the Climate Health WA Inquiry and endorsed its recommendations. The Chief Health Officer commissioned the inquiry to review the current planning and response capacity of the health system in relation to the health impacts of climate change, and make recommendations for improvement with respect to climate change mitigation and public health adaptation strategies. It was the first statutory inquiry anywhere in the world focused on the health impacts of climate change.

Climate change can affect human health in a number of ways, such as through increased injury, death and mental health impacts from extreme weather events; heat-related illness; respiratory distress from bushfire smoke; mosquito-borne disease; and reduced water and food quality and security. The inquiry found climate risk was both strategic and operational.

For example, the inquiry uncovered evidence that climate change was changing the liveable range of mosquitos and in some cases exacerbating the risk of the viruses they transmit. It recommended the Department of Health strengthen adaptation in the specific areas of extreme weather events, heatwave, mosquito control and air pollution to effectively manage those risks.

The inquiry was modelled on a parliamentary inquiry, and featured a robust consultation process of multiple stages including a call for written submissions, public forums, targeted engagement and formal hearings. It sought information from the WA community, and Australian and international experts to obtain the best science, data and evidence to inform its key findings and associated recommendations.

The recommendations set a blueprint for strengthening the WA health system's capability to adapt to climate change and better protect the health of the community over the next 10 years. This included establishing a Sustainable Development Unit to help implement the recommendations, and terms of reference for undertaking both a climate change vulnerability assessment and a *Climate change adaptation plan* for the health sector.



Source: Shutterstock

Why this guide matters

Delivering government priorities and objectives

From school classrooms, health centres and police stations to transport, water and energy infrastructure, the WA Government has an opportunity to better prepare for future disruptions from climate change and to build resilience. Climate risks may affect the government's ability to meet statutory mandates and/or its reputation as a reliable provider of services. Figure 5 illustrates examples of potential climate impacts and risks to delivering on government objectives.

Applying this guidance will help your agency to:

- **protect core functions** – understand how physical climate risks may impact core strategic objectives and operations
- **prioritise responses to climate change risk** – highlight areas that warrant further investigation or investment
- **seize opportunities** – increase understanding and capacity to respond to climate-related opportunities
- **improve agency-level oversight of climate change risks** – embed climate risk management in existing frameworks and procedures
- **adapt and build climate resilience** – inform decisions about risk treatments to be implemented over time.

Figure 5: WA Government strategic objectives and potential climate impacts and risks

	Department of Primary Industries and Regional Development	Department of Health	Department of Water and Environmental Regulation	Main Roads
Agency objective	We develop and protect WA's agriculture and food sector and aquatic resources, and build vibrant regions with strong economies.	We help people stay healthy and provide access to timely, high quality, patient-centred health care.	We protect, manage and regulate the state's environment and water resources.	We provide a world-class, safe, reliable and sustainable road-based transport system.
Climate risk and impact	Declining growing season rainfall in the South West Land Division is driving changes to cropping practices and soil management. By 2050, growers could face shorter growing seasons and even greater variation in annual yields.	Heatwaves of greater frequency, duration and intensity are increasing heat-related health issues and morbidity, placing greater pressure on health services. Heat-related deaths are expected to double over the next 40 years.	Reduced rainfall is affecting water demand and allocation. Rainfall has reduced faster than changes to groundwater use, and our once-healthy system is under strain.	Sea level rise across WA is expected to impact on 9,000 km of roadways, resulting in $11.3 billion in damages.

Using this guide

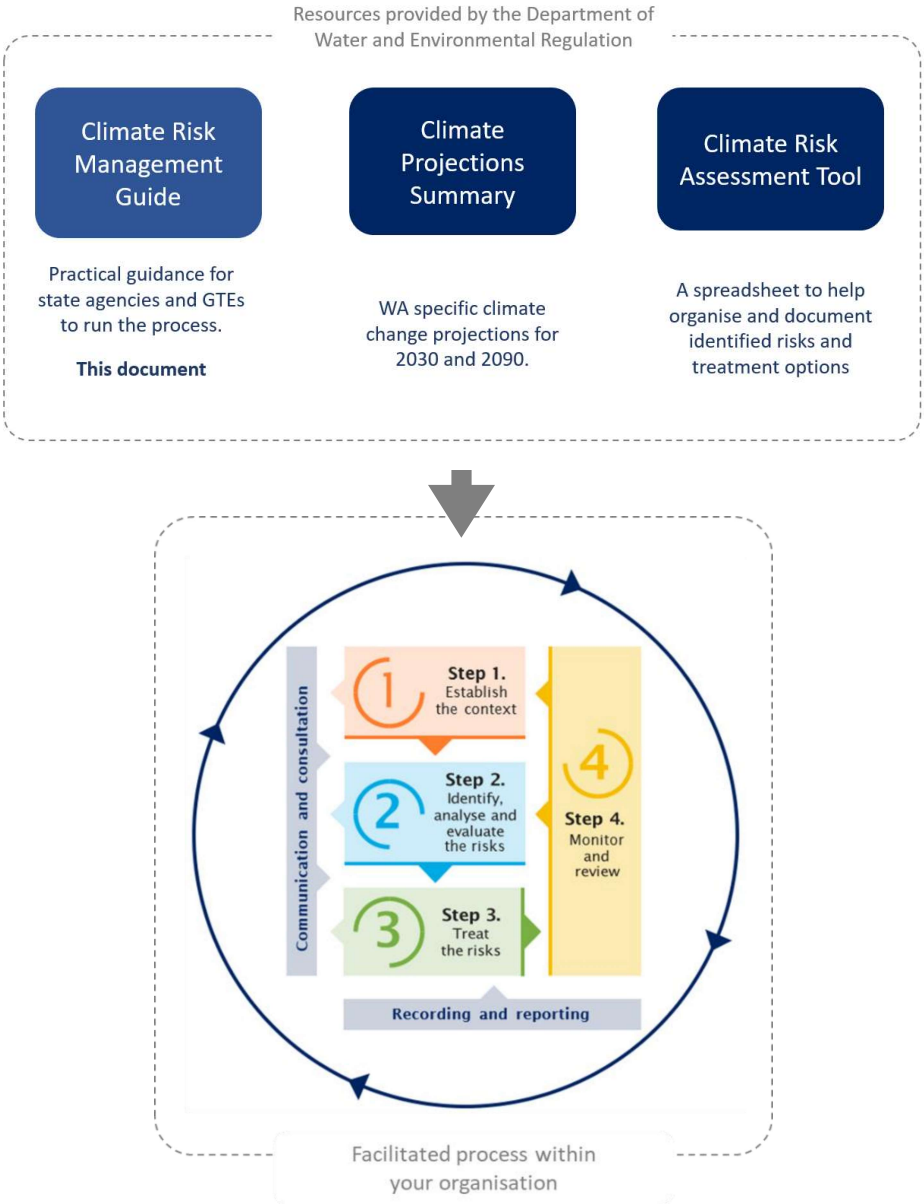
This guide outlines foundational activities and a four-step process to prepare a first-pass climate change risk assessment for your agency.

To support your assessment the guide should be used alongside the WA climate projections summary and the Climate Risk Assessment Tool. Figure 6 describes how these resources complement and support the risk assessment process.

Table 1 (page 15) summarises the first-pass assessment process including key actions, indicative timeframes, outputs, and resources to support your assessment.

The risk management approach aligns with the general process and considerations in *ISO 31000:2108 – Risk management guidelines* and *ISO 1409 – Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment*.

Figure 6: Resources to support a climate risk assessment



Features of a first-pass climate change assessment

Scope

Your first-pass climate change risk assessment will:

- identify physical climate risks that have the potential to impact on your agency's ability to meet its strategic objectives using the intermediate and high-emissions scenarios detailed below
- identify and prioritise adaptation options (risk treatments)
- be a qualitative assessment only
- not include program and project-level risk assessments as this will extend the timeframe and complexity of your assessment
- not identify options for reducing emissions.

Timeframe and resourcing

- A first-pass assessment should take between **6 and 12 months** to complete.
- Agencies should use internal resources to embed learning. Climate risk assessments should be incorporated into agency risk management policy and processes.

Consultation

- The risk assessment team should involve the executive, executive directors and senior managers, as well as other internal stakeholders (where appropriate).
- There is no requirement for external consultation (e.g. the public, contractors).

Emissions scenarios

- **RCP 4.5 – Intermediate-emissions scenario**: strong global action to reduce emissions towards the end of the century.
- **RCP 8.5 – High-emissions scenario**: little global action to reduce greenhouse gas emissions (business as usual).

See the supporting resources (below) for more information on Representative Concentration Pathways (RCP) and climate change projections.

Supporting resources

Refer to the following resources to support your assessment:

- **The guide** (this document) – practical steps to create a first-pass climate risk assessment and adaptation plan.
- **Climate Risk Assessment Tool** (Excel, provided separately) – a template for documenting climate change risk and treatment options.
- **WA climate projections: A summary to support climate risk assessments** (provided separately).

Table 1: Climate risk assessment and management process

Step	Indicative timeframe	Outputs
Step 1: Establish the context Establish an authorising environment and resources for a first-pass climate change risk assessment		
High-level prioritisation of agency objectives that are particularly exposed and warrant a first-pass assessment	2 weeks	Prioritised focus areas for assessment
Establish the reason for a climate change risk assessment and secure approvals	3 weeks (if required)	Briefing paper to secure executive sponsor
Identify stakeholders and establish an assessment team	2 weeks	List of stakeholders and assessment team members
Refine scope of the climate risk assessment	2 weeks	Agreed climate risk assessment scope
Step 2: Identify, analyse and evaluate the risks Establish a plausible climate future and document priority climate change risks		
Understand past and recent climate hazards and trends	3 weeks	List of climate variables relevant to your context. This can be condensed into the next step and may require less time.
Consult climate projections in the summary provided	2 weeks	Understanding of projected climate change impacts
Identify risks and opportunities	3 weeks	List of climate change risk statements
Analyse and evaluate risks	3 weeks	Priority climate risks with agreed risk ratings
Step 3: Treat the risks Develop an adaptation plan to treat priority climate change risks		
Identify and prioritise adaptation actions	3 weeks	Adaptation plan to address priority climate risks
Develop and begin implementing an adaptation plan	4 weeks	
Step 4: Monitor and review Monitor implementation of adaptation plans, climate change impacts and embed reviews in existing procedures and systems		
Develop a monitoring and evaluation plan	2 weeks	Plan to track adaptation implementation, and monitor climate risks
Integrate monitoring, review and learning into existing systems	4 weeks	Updated risk register

Step 1: Establish the context

Establish an authorising environment, establish the risk assessment team and determine the scope

Key messages

- Building an authorising environment is a foundational step to complete before you begin a climate risk assessment.

Actions and outputs

Actions	Indicative timeframe	Outputs
Establish the reason for your first-pass climate risk assessment	3 weeks **(if required)**	· Briefing paper to secure an executive sponsor for a first-pass climate change risk assessment
Identify stakeholders and establish an assessment team	2 weeks	· List of stakeholders and assessment team members
Determine the scope of the climate risk assessment	2 weeks	· An agreed climate risk assessment scope

Recommended roles and responsibilities

Executive	Risk assessment lead	Assessment team
Sponsors a climate risk assessment Communicates the importance of addressing climate risk in the agency Identifies a risk assessment lead	Leads engagement with decision-makers Establishes the agency's climate risk context Endorses the scope of the climate risk assessment	Develops the scope of the climate risk assessment Supports communication with decision-makers

Establish the reason for a climate change risk assessment and secure approvals

Climate change risk assessments may be triggered or driven by a range of internal or external policies, processes, or events. Understanding the driver for assessment will help determine its scope, who should be involved, and the level of detail required.

The PESTLE (political, economic, socio-cultural, technological, legal, environmental) model is a common approach to scan the external environment for potential drivers and trends that will impact your agency.

Common reasons for conducting climate risk assessments include recent impacts from extreme weather events, increased realisation of the benefits of considering climate change in decision-making, or a change to government or market regulation. Figure 7 provides examples of triggers or drivers for a climate change risk assessment.

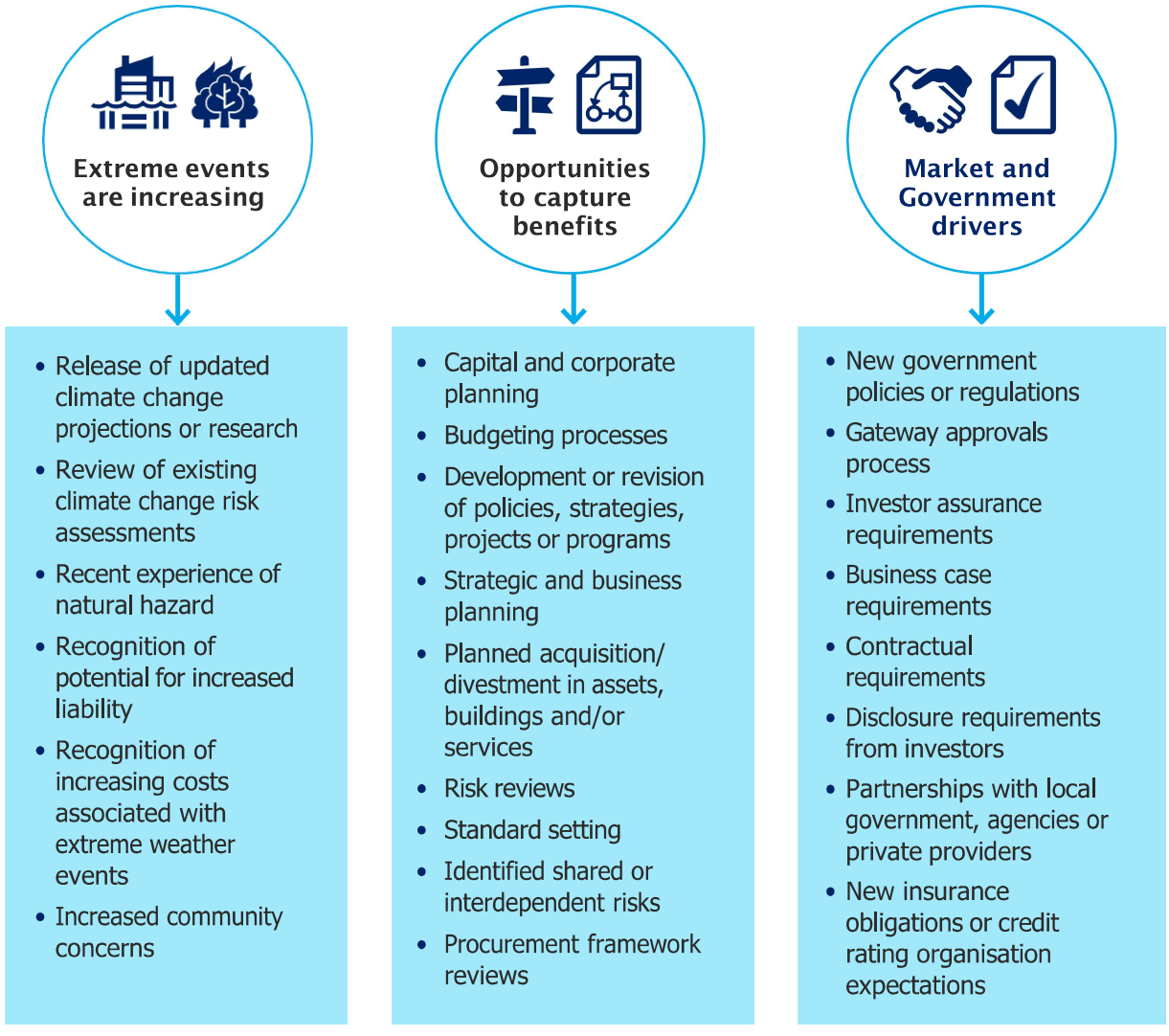


Figure 7: Potential reasons for undertaking a climate change risk assessment

Identify stakeholders and establish a climate risk assessment team

Best practice risk assessment and management is an inclusive and collaborative process. This is particularly true for climate risks because they:

- are systemic in nature, so benefit from diverse perspectives
- may have compounding effects across an agency (e.g. across multiple climate variables)
- may present challenges for standard risk management practices
- may not be well understood by decision-makers.

When identifying the most relevant stakeholders, it is useful to consider the diversity of perspectives and experience, representativeness, relevant expertise, their ability to influence the process, and their proximity to potential risks.

At a minimum, the following groups will likely need to be identified:

- executive/leadership team to sponsor the assessment
- staff who have influence over potential impacts and implementation of adaptation actions, including resourcing and funding
- staff or stakeholders who will be responsible for the implementation of adaptation actions
- stakeholders who are most likely to be affected by the risks.

In leading practice agencies, external stakeholders will also be engaged in the assessment and management process to enable effective adaptation. Step 3 covers the attributes of best practice climate change adaptation in more detail.

Staff will also need to be identified to form an assessment team. Members should represent core functions responsible for achieving strategic objectives.

The assessment team will need:

- an executive sponsor
- a project manager or lead to drive the process and document outcomes
- representatives from different operational areas to participate in the assessment and validate findings
- resources to undertake risk assessment activities such as workshops.

An internally run assessment will help agencies build on existing internal knowledge and develop new expertise, which will be vital as climate impacts change. Staff with a sound knowledge of the local area, environmental conditions, assets and operations, and risk assessment methodology are best suited to this project.

Roles that may be represented include risk and governance, planning and policy, asset management, operations and maintenance, community services, finance and IT managers, community engagement specialists, indigenous and Traditional Owner engagement staff, sustainability and environmental management, emergency management, legal, and frontline staff in customer service or safety.

The assessment team can be involved in a range of activities ranging from data provision and interpretation to identifying and evaluating risks. They will help build commitment to the process from executive and general staff. The assessment team should be involved in updating and agreeing on a risk assessment matrix that is suitable for evaluating the likelihood and consequence of climate risks.

Further guidance...

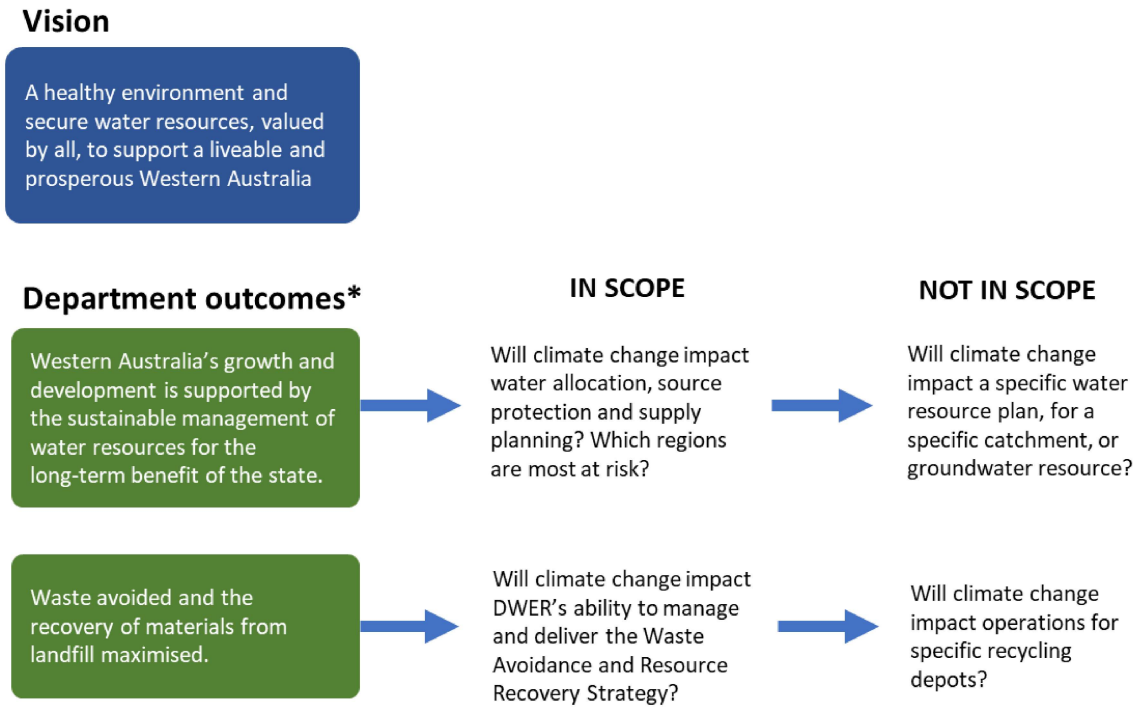
Resources on best practice stakeholder engagement can be found in the International Association for Public Participation Australasia 2015 Quality Assurance Standard for Community and Stakeholder Engagement (IAP22015).

Determine the scope of the first-pass climate change risk assessment

To determine the scope of the first-pass climate risk assessment, the risk assessment team should work with their executive and senior managers to determine how granular the assessment of an agency's strategic objective should be. Each agency will have unique strategic objectives and considerations to take into account.

Figure 8 illustrates example questions the executive and assessment team might pose to refine scope, using the Department of Water and Environmental Regulation as an example. Note that first-pass assessments should assess risk for broad types of assets and programs, and service delivery functions, but not identify risks for specific assets, programs or projects.

Figure 8: Scoping a first-pass climate risk assessment



*Above outcomes appear in the department's annual report 2019–20

At the end of Step 1 you will have:

- your first-pass climate risk assessment and adaptation planning process
- established your agency's context for undertaking a climate risk assessment and secured executive level support to progress
- formed a risk assessment team to lead the risk assessment process and identified stakeholders across a range of functions to involve in the process
- determined and secured endorsement of the scope of your climate risk assessment.

A scaled approach to climate change risk assessment

The climate risk process may be adapted to suit requirements at different scales of an agency (adapted from Tonmoy et al. 2019):

- **Agency** – a high-level (or first-pass) assessment undertaken to understand how climate change may impact agency objectives. This should identify delivery areas of the agency that are particularly exposed and warrant a more detailed risk assessment.
- **Program (not in scope for first-pass assessment)** – a more focused risk assessment of climate change risks to a program, division or service that aligns with the ISO 31000.
- **Project (not in scope for first pass assessment)** – a risk assessment for a specific project or asset (new or existing), required due to its high value, criticality, life span, or legislative requirements, and that aligns with ISO 31000.

The process may be applied to support common government functions to build climate resilience into decision-making, such as:

- strategic, business and workforce planning
- delivery of existing assets, infrastructure,and services
- planning new infrastructure or services.

Table 2: Climate change risk assessment levels

Aspect of climate change risk assessment process	Agency level	Program level (not in scope)	Project level (not in scope)
Scope of assessment	Impacts to strategic objectives	May be focused on specific natural hazards or risk categories.	Specific project or asset. Interdependent risks may be identified.
Technical capacity required	Lowest	Moderate	Highest
Adaptation planning	Implementation driven through central business processes or delegated to appropriate risk owners. Economic evaluation of options unlikely to be required.	Implementation driven through divisional or programmatic management processes. Economic evaluation of options may be required.	Likely to include incorporating assessment findings into specifications, detailed designs and management plans. Economic evaluation of options likely to be required.
Monitoring and review	Monitoring driven through existing agency-level risk management frameworks and processes (interim).	Monitoring driven by business planning, risk management or program governance.	Monitoring driven through project management processes, legislative approvals, or operations and maintenance.

Step 2: Identify, analyse and evaluate the risks

Establish a plausible climate future and document priority climate change risks

Key messages

- A climate change risk assessment includes consideration of both risks and opportunities posed by a changing climate.
- When assessing climate risks, information about plausible future climates and climate trends must be consulted rather than relying on historical climate and weather data. The WA climate projections summary has been provided to help agencies with their assessment of future climates.
- Involvement of stakeholders to validate and prioritise identified risks is crucial to developing a realistic and well-informed view of priority climate risks to the organisation.

Actions and outputs

Actions	Indicative timeframe	Outputs	Key resources
Understand past and recent climate hazards and trends (if required)	3 weeks (if required)	· A list of climate variables relevant to your context	
Consult relevant climate projections	2 weeks	· An understanding of projected climate change impacts	WA climate projections summary (provided separately)
Identify risks and opportunities	3 weeks	· A list of climate change risk statements	Climate Risk Assessment Tool (Appendix B)
Analyse and evaluate risks	3 weeks	· Priority climate risks with agreed risk ratings	

Recommended roles and responsibilities

Executive	Risk assessment lead	Assessment team
Engages in risk assessment where relevant and encourages participation from staff Endorses or approves prioritised risks	Reviews and endorses risk assessment outputs Communicates assessment outcomes to decision-makers	Leads delivery of risk assessment and workshops Documents risk assessment outcomes

Understand past and recent hazards and trends

Before constructing a picture of a plausible future climate, you will build an understanding of how past and current natural hazards and climate trends affect your agency. This step will assist in selecting the most relevant climate variables for your climate risk assessment.

Some common climate variables include:

- precipitation
- temperature (average daily minimum and maximum)
- wind speed
- humidity
- frost days
- soil moisture
- storm frequency and intensity
- drought weather
- evaporation.

Useful information to consult to build an understanding of current risk exposure, sensitivity and adaptive capacity may include:

- Bureau of Meteorology's Climate Data Online portal
- agency data (reports, spatial data) that details impacts to assets or services in years pass
- local and indigenous knowledge
- warnings and updates provided by local government authorities
- climate modelling for geographic areas e.g. flood modelling, bushfire hazard mapping, and drainage designs.

Projections vs predictions

Projections of future climate change are not like weather forecasts. Short-term weather forecasts are definitive predictions based on observations. On the other hand, projections of climate change model how the climate system may respond, and evolve, to plausible scenarios in the future. Projections are not intended to give accurate predictions of future climate change, because this change is dependent on:

- future human and natural drivers of change
- models of the climate system, and
- the existence of internal climate variability.

Nonetheless, as greenhouse gas concentrations rise, we expect to see future changes to the climate system that are greater than those already observed. Complex computer models can be used to understand future climate change and characterise outcomes and uncertainties under specific climate forcing scenarios.

Source: Collins et al. (2013).

Consult relevant climate projections

Looking at climate change projections is one of the core activities that distinguish your climate change risk assessment from a standard risk assessment process.

It is recommended that WA Government agencies consult the WA climate projections summary (provided separately). This is based on the Climate Change in Australia projections produced by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology (BoM).

This document summarises the changes in climate for a range of variables likely to occur in the coming decades across WA's three natural resource management (NRM) regions:

- **South Western Flatlands** – covers the Northern Agricultural, Wheatbelt South-Coast, South-West and Perth-Peel regions.
- **Monsoonal North** – covers the Kimberley.
- **Rangelands** – stretches from Shark Bay to the Pilbara, across to the Northern Territory border in the east, and down to the Norseman and Nullarbor coast in the south.

Emissions scenarios

Most climate change projections are currently based on a range of greenhouse gas scenarios called Representative Concentration Pathways (RCPs), developed by the Intergovernmental Panel on Climate Change.

Each RCP provides a possible emissions trajectory over time (generally up to 2100). Figure 9 depicts the four RCPs and projected climate impacts at 2100. The summary outlines projections for three RCPs:

- **RCP 8.5 (high)** – little global action to reduce greenhouse gas emissions, similar to business as usual.
- **RCP 4.5 (intermediate) –** strong global action to reduce emissions towards the end of this century.
- **RCP 2.6 (low) –** ambitious global action to reduce emissions in line with the Paris Agreement to keep global warming below 2˚C above pre-industrial temperatures.

You should use RCP 4.5 and RCP 8.5 for your first-pass assessment.

Note that the IPCC has released a new suite of global emission scenarios called Shared Socioeconomic Pathways (SSPs). When climate projections based on the SSPs become available, DWER will update advice.

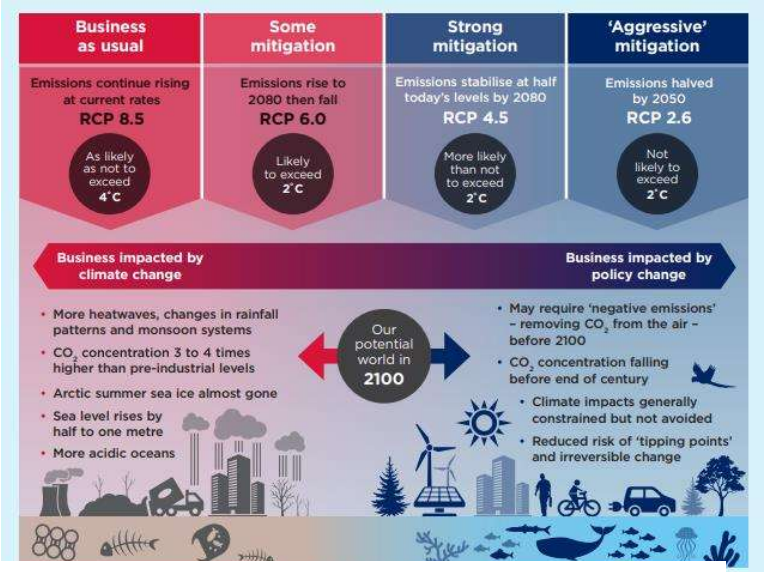


Figure 9: Representative Concentration Pathways

Identify risks and opportunities

Identifying climate risks comprises identifying the source of the risk, the event/s that could trigger the risk, and potential impacts to your agency. Risks should be documented in a way that is transparent and easy for others to understand, even if they were not involved in the first-pass risk assessment process.

All assumptions underlying the assessment should be stated. This is particularly important so that information underlying highly aggregated risks (i.e. at the agency level) is transparent.

Identification of climate change risks should consider:

- **direct risks** such as damage or disruption to assets, health impacts to the community and/or staff
- **direct opportunities** that can directly benefit the agency
- **indirect risks or opportunities**, where there are secondary consequences of the initial risk such as impacts to supply chains or customers
- **interdependencies**, where infrastructure rely on each other for continued service provision.

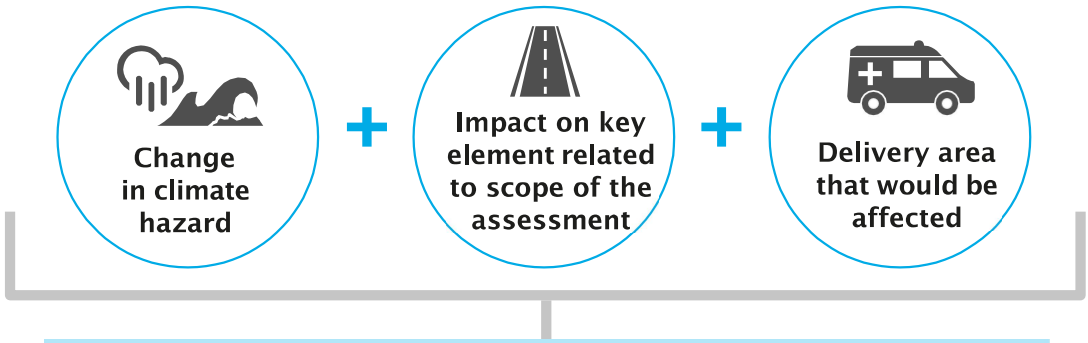
To streamline the assessment process, pre-identified risks may be provided to stakeholders at a climate risk assessment workshop for them to validate and expand on.

Techniques identify climate risks include:

- desktop reviews of potential climate change impacts to your sector
- group methods, such as brainstorming sessions or commissioned reviews
- risk assessment workshops
- checklists or questionnaires
- individual interviews
- review of audit findings.

Develop climate change risk statements

Climate risk statements contain key information about relevant climate variables and their potential impacts, to describe a potential risk. A proposed structure for these statements is outlined in Figure 10. The Climate Risk Assessment Tool in Appendix B provides example climate change risk statements.



Example climate risk statements:

'Increased flooding and inundation + causing damage to coastal road infrastructure + preventing community access to healthcare services'

'Increase in average maximum daily temperature + resulting in increased energy and water demand across sites + increasing annual running costs'

'Decrease in mean rainfall during growing seasons + resulting in lower crop yields + reducing regional productivity'

Figure 10: Developing climate risk statements

Analyse and evaluate risks

The Climate Risk Assessment Tool in Appendix B, or a similar tool, can be used to analyse the likelihood and consequence of your identified risks.

Analysis can be undertaken in a workshop with diverse stakeholders to:

- validate information about climate hazards
- review climate risk statements
- validate the assigned likelihood and consequence ratings applied to each risk
- add relevant new risks
- help prioritise climate hazards and risks.

The workshop should involve the stakeholders identified in Step 1.

At this stage it is not uncommon to find that weather-related risks have already been identified by the agency under existing risk categories (such as work health and safety, or compliance); however, the impacts of climate change may not yet have been considered.

Using the Climate Risk Assessment Tool

The Climate Risk Assessment Tool (Appendix B) provides a template to analyse climate risks and to support ongoing identification of risk treatments and implementation of adaptation actions. It can be used where standard risk registers are not suitable.

The tool enables the rating of risks across future time horizons based on the Climate Change in Australia projections. Example risks and adaptation actions are provided to assist users to complete first-pass risk identification and adaptation planning.

For each risk you have identified you will need to:

- use your risk matrix to identify the consequence(s) – the impact, if the event occurs, on your agency's objectives
- use your risk matrix to identify the likelihood – the chance of the event happening
- identify controls already in place or included in approved plans to prevent the event from occurring or limit its possible impact
- assess whether these controls are adequate
- update the risk rating of each risk to take into account existing controls.

Risk assessment criteria can be customised to align with the agency's own risk assessment criteria. Guidance is provided in the tool on how to work through the climate change risk assessment process.

The ISO 14091 – *Adaptation to climate change* suggests that an independent review of the climate risk assessment and may be helpful to validate findings or evaluate the most salient features of the risk assessment.

Priority risks identified at the workshop will form the basis of a climate change adaptation plan (or risk treatment plan, see Step 3). The assessment team may conduct a first-pass prioritisation before the workshop, for participants to validate.

The following factors may be used to prioritise climate risks:

- **tolerance** – the agency's toleration of climate risks
- **risk rating** – giving greater priority toextreme or high risks
- **qualitative assessment** – prioritising risks according to:
  - *materiality*, e.g. risks that have a significant impact on delivery of critical services; this may include lower rated risks
  - *scalability*, e.g. risks that affect multiple areas of the agency
  - *geographic exposure*, e.g. locations subject to a large number of risks
  - *strategic importance*, e.g. risks that may have a lower rating but impact key areas
- **climate variable** – grouping risks by a specific climate variable or hazard
- **industry trends** – sectoral or socio-economic trends that may influence risks.

An example of priority physical risks grouped by climate variable is provided in Table 3. Confidence ratings may be attributed to priority risk statements to make the level of uncertainty clear to decision-makers.

Table 3: Example shortlist of priority climate change risks

Climate variable	Priority risk statements
 **Greater frequency and intensity of rainfall and storms**	Service disruptions due to damage and flooding by rainfall and storm events.
 **Sea level rise and tidal intrusion**	Operational disruptions, increased duration of repair and maintenance activities due to permanent sea level rise and/or cyclical tidal intrusion.
	Reduced land for future capacity and development due to permanent sea level rise and/or cyclical tidal intrusion.
 **Higher temperatures and more severe heatwaves**	Increased health services demand due to heat exposure.
	Operational disruption due to power supply black outs and brown outs from to increased energy demand during heatwaves.

At the end of Step 2 you will have:

- Built a knowledge base and understanding of a plausible climate future and the potential climate risks that may affect your organisation.
- Consulted with internal stakeholders to develop a list of priority risks with agreed risk ratings (based on consequence and likelihood criteria) that require further management action.

Step 3: Identify and plan risk treatments

Develop an adaptation plan to treat priority climate change risks

Key messages

- Developing actions to treat priority climate risks forms the basis of an adaptation plan.
- Developing adaptation pathways supports implementation over time and can facilitate the most efficient use of resources.

Actions and outputs

Actions	Indicative timeframe	Outputs
Identify and prioritise adaptation actions	3 weeks	• An adaptation plan to enhance resilience to climate risks
Develop and implement an adaptation plan	4 weeks	

Recommended roles and responsibilities

Executive	Risk assessment lead	Assessment team
Commits resources to an adaptation plan. Supports engagement with stakeholders about treatment of shared and interdependent risks.	Oversees development and implementation of the adaptation plan. Leads integration of climate risk into existing risk frameworks.	Leads development of the adaptation plan and economic appraisal of options where relevant. Engages stakeholders in the development of priority adaptation actions.

Identify and prioritise adaptation actions

In this step you will develop adaptation actions in response to the priority climate risks selected in Step 2: Identify, analyse and evaluate the risks.

Identify adaptation actions

This step is best undertaken collaboratively with risk owners to avoid duplication or misalignment of adaptation efforts.

Adaptation actions should be selected to reduce the likelihood and/or consequences of priority risks, noting that it may not be possible to eliminate all risk relating to your agency.

To build an adaptation plan you will need to:

- reflect on risk controls and measures that are already in place
- devise new actions or revise existing actions, with stakeholders and risk owners.

To address them you should hold a second workshop with the same stakeholders involved in Step 2 to identify existing controls for priority risks. It is important to be transparent and inclusive, so value judgements applied to adaptation decisions are clear and accepted by stakeholders.

Types of adaptation actions

Adaptation actions may range from incremental to transformational, from simple improvements to an agency's adaptive capacity to major infrastructure projects that require significant lead time for planning and design. Commonly used categories of adaptation actions include:

- **no/low regrets or win/win options** are low-risk responses that deliver economic benefits and should be implemented as a priority
- **accommodate** the risk by including provisions that reduce the consequence of impacts
- **retreat**; for example, by relocating assets and people to safe areas
- **defend** existing and new structures against climate change affected hazards using largely structural measures
- **co-exist or adapt** through a combination of innovative measures including planning (Sinay & Carter 2020).

Case study

Investing in the climate resilience of Perth's water supply

The Water Corporation's overarching challenge is to supply water to a rapidly expanding population in a drier climate, while reducing impacts on the environment. Reduced rainfall and changes in rainfall timing since the 1970s has reduced runoff into our dams by up to 80 per cent. The impact of a changing climate has dramatically reduced the role of surface water (dams) in our drinking water supplies.

In response to declining surface water supplies, the Water Corporation has developed strategies to reduce water consumption, recycle more wastewater and develop new sources to supplement existing supplies. The *Water Forever 50-year plan* (2009) and *Water Forever: Whatever the weather* (2013) publications outlined Water Corporation's approach to reduce water demand (water efficiency) and develop new supply options to increase the resilience of Perth's water supply.

To identify new supply options, the Water Corporation undertook complex modelling of Perth's future water demand against several plausible climate scenarios. This assessment identified the need for climate-independent water sources, including wastewater recycling and desalination. Since 2006, two desalination plants have commenced supplying Perth's Integrated Water Supply Scheme, and now make up 45 per cent of our water supply.

- The Perth Seawater Desalination Plant at Kwinana produces approximately 15 per cent of Perth's water supply.
- The Southern Seawater Desalination Plant at Binningup produces approximately 30 per cent of Perth's water supply.

After production at Binningup began in 2011, the Water Corporation purchased energy from a wind farm and solar farm near Geraldton. The wind and solar farms were developed on the back of a long-term energy purchase agreement associated with the Southern Seawater Desalination Plant.

Southern Seawater Desalination Plant
Source: Water Corporation

The Water Corporation has identified that the most cost-effective option for Perth's next water source is another desalination plant. Planning for this plant is underway, and in September 2021 the government announced it was setting aside $1.4 billion to help fund Perth's next desalination plant, which would also be powered by renewable energy.

When developing specific adaptation actions you should consider:

- the agency's risk tolerance
- the potential resources available
- existing controls and initiatives that may be leveraged
- the capacity for adaptive management as conditions change over time
- being equitable, in that they do not place a disproportionate share of costs or risk on a particular group
- being sustainable by building local capacity to support long-term resilience
- being specific, measurable, achievable, realistic and timely (SMART).

The longer the lead time for action, the more important it is to identify management thresholds and triggers for action. These thresholds and triggers should be included in annual implementation reviews.

Prioritise adaptation actions

Prioritising potential adaptation actions enables effective allocation of resources to those risks requiring the most urgent management. In selecting the most appropriate adaptation actions, or combination of actions, the potential costs and resource requirements should be balanced against likely benefits. This will include consideration of financial and non-financial costs and benefits. A high-level cost–benefit analysis approach is recommended for assessing and comparing adaption options.

Identifying adaptation themes

Grouping actions into themes may help address multiple risks and secure greater co-benefits from adaptation. Themes may be based on climate variables or hazards, a commitment by leadership, strategic planning, operations and assets, or interdependent systems.

Enhancing governance (or building internal capacity/ leadership) around climate risk management may be a fundamental theme to support effective adaptation. Redesigning governance systems to be more collaborative, flexible, integrated, and able to deal with redundancies and complexity is essential to build resilience.

Develop and implement an adaptation plan

An adaptation plan provides a transparent approach to addressing climate risks over time. It will include steps that may be embedded in agency or divisional adaptation strategies as well. Before commencing the plan, seek endorsement or approval of priority climate risks and proposed adaptation responses.

An adaptation plan will include at a minimum:

- a rationale for the actions/risk treatments selected and the residual risk
- designation of risk owners, accountabilities and responsibilities
- steps for implementation over time including milestones
- management thresholds and triggers for action to enable flexible management over time
- required budget and resources, including opportunities to leverage existing or secure new funding
- a process for monitoring and evaluation of implementation
- performance measures that are SMART.

When developing the plan, consider potential roadblocks for implementation, potential gaps in capacity to deliver, and the role of stakeholders or partners in implementation. Allocated resources will build momentum and show commitment. Consider the potential for cost-sharing when treating shared or interdependent risks.

Further considerations when developing your adaptation plan may include:

- additional feasibility or technical studies that may berequired
- securing regulatory or legislative approvals
- project-specific risk management planning
- establishing project governance
- development of operational and maintenance plans.

Best practices in climate change adaptation planning

- Planning is underpinned by climate change risk assessment
- Climate change adaptation actions have been identified in master planning/ development plans/ strategic planning
- Adaptation actions are identified for short, medium and long-term planning horizons
- A corporate policy or strategy on climate change adaptation has been adopted (separate to climate change mitigation)
- Collaboration occurs with external stakeholders to validate risks and identify adaptation actions

Case study

Coastal erosion hotpots report

Rising sea levels, and increased frequency and intensity of storms along Western Australia's coast, are likely to exacerbate coastal hazards including flooding and coastal erosion.

In August 2019 the *Assessment of coastal erosion hotspots in Western Australia* report was released. The report evaluated the scale and extent of coastal erosion in WA, identifying 55 areas along the coast where erosion could cause short-term impacts. It discussed longer-term policy solutions for areas with accelerated coastal change and put an additional 31 locations on a watchlist for future consideration.

To facilitate a strategic approach to coastal erosion management efforts, it developed a framework to compare the relative importance of managing erosion for each hotspot. The framework considered the number and monetary value of public assets subject to erosion, coupled with potential loss of recreational uses and private or public leasehold property.

Using the framework, a total of 21 of the 55 hotspots were found to have management importance within the next 25 years. Of these, Port Beach and South Thompson Beach have high and pressing management importance by 2024, with another 12 hotspots on the brink of becoming high, including Broome Town Beach, Ledge Point, Floreat Beach, Rockingham Town Beach, Mandurah's northern beaches and Koombana Bay (Bunbury).

The report included a broad evaluation of coastal management options to inform future funding considerations and priorities for the coastal zone. The estimated cost for managing the 55 locations was up to $110 million between 2019 and 2024, with additional funding required in the long term.

The government's response to the report has included:

- Expanded investment to support adapting to coastal erosion, with the 2021–22 State Budget allocating an additional $18.5 million over five years to the CoastWA program. This brings total funding to $33.5 million to fight erosion and protect WA's coastline.
- The Department of Planning, Lands and Heritage chairing the intergovernmental Coastal Hazard Working Group, which has assessed the national status of coastal hazards and current adaptation responses. The working group is preparing recommendations for an improved national coordinated approach to the issue, for consideration at the Meeting of Environment Ministers intergovernmental forum.

Erosion of sand dunes at Myalup Beach
Source: Shire of Harvey

Adaptation pathways

Adaptation pathways are an effective way for an agency to document agreed thresholds and triggers for management across a suite of adaptation options. They support a management approach that is flexible enough to ensure risk exposure is being managed while avoiding path dependency and locked-in responses.

Pathway planning is a useful approach to guide adaptive management. They help address the inherent uncertainty in planning for, and responding to, climate change. Clear responsibilities and procedures for overseeing, managing and monitoring climate risk are required for this approach to be effective. The approach has been successfully applied in adaptation planning for infrastructure and water management projects, and broader cross-sector adaptation planning.

Pathway planning:

- enables investment in adaptation to be prioritised and staggered. Trigger points for decisions can be used along a time continuum to revisit decisions or actions (as shown in Figure 11)
- facilitates clear communication of risk and proposed adaptation approaches to stakeholders
- enables integrated risk management across adaptation themes
- helps prevent being 'locked in' to actions that may not be the best solutions for managing uncertainty or a long-term problem.

Identifying management triggers and thresholds

Management thresholds and triggers are identified limits at which an unacceptable level of change to a key indicator occurs. For example, if water levels in a river are below a specified level for a certain period this may result in unacceptable threats to a local fishery, or to the river's ecological health. Alternatively, a management threshold may be reached when an increase in the frequency and scope of repairs to telecommunications assets results in unacceptable disruptions to customers, or prohibitive costs to the agency.

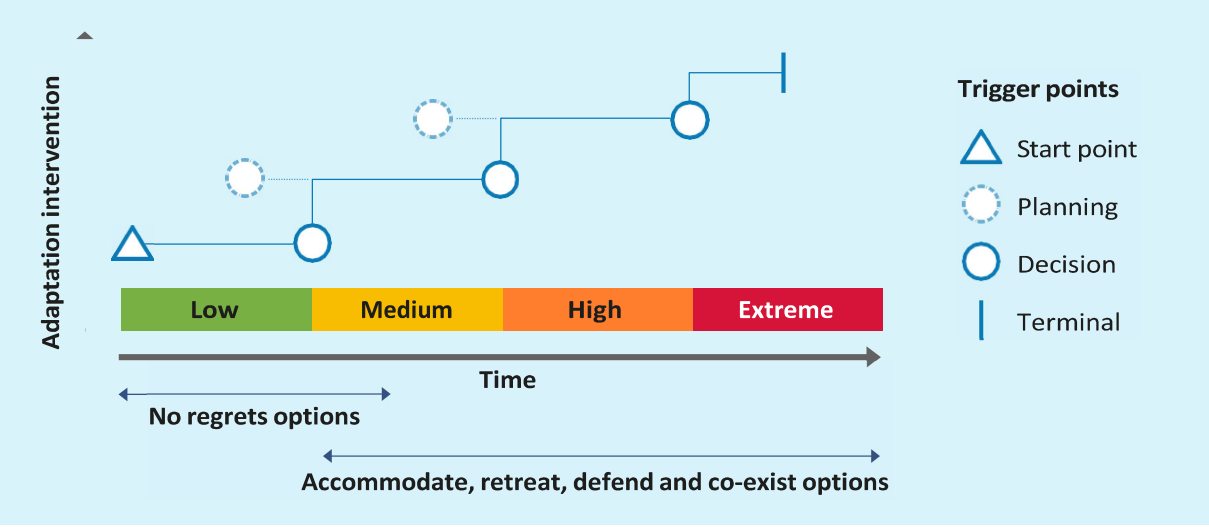


Figure 11: Adaptation pathways include management trigger points along a time and risk continuum (reproduced and adapted from Jacobs et al. 2018 and Haasnoot et al. 2013)

At the end of Step 3 you will have:

- Identified the most important actions to start taking to treat your priority climate risks, and triggers for action over time.
- Developed and communicated an adaptation plan with risk owners and key stakeholders in your agency.
- Undertaken economic appraisal of adaptation options, and other relevant studies, including consideration of required resources.

Step 4: Monitor and review

Monitor implementation of adaptation plans, climate change risks and embed reviews in existing procedures and systems

Key messages

- The nature of climate change requires a strong emphasis on embedding monitoring and evaluation as a continuous and flexible part of the risk management process.
- Implementation of adaptation plans should be reviewed regularly.
- Monitoring adaptation actions should be embedded in existing relevant frameworks and processes where possible.

Actions and outputs

Actions	Indicative timeframe	Outputs
Develop a monitoring and evaluation plan	2 weeks	• A plan to track adaptation implementation, and monitor climate risks
Integrate monitoring, review and learning into existing systems	4 weeks	• An updated risk register
Consider sharing the outcome of your first-pass climate change risk assessment with Department of Water and Environment Regulation and the Department of Treasury This will help inform development of the Climate Risk Framework. Assessment outcomes will not be disclosed without further consultation with your agency	1 week	• Communication to DWER and Treasury

Recommended roles and responsibilities

Executive	Risk assessment lead	Assessment team
Approves action to be taken when management triggers or thresholds are reached Uses adaptation reviews and priority risk monitoring to inform decisions about climate risk management	Monitors and reports on adaptation progress and climate risks and escalates action when required Oversees maintenance of monitoring and evaluation procedures	Develops monitoring and evaluation plans, and establishes baselines where appropriate

Develop a monitoring and evaluation plan

Monitoring and evaluating climate change adaptation and risk management practices is necessary to support a flexible response and reduce the risk of inefficient use of resources. This is particularly true for adaptation, giving the inherent uncertainty of responding to climate change, and the complex and long-term nature of managing climate risks.

Monitoring and evaluation can help achieve different objectives, depending on the scale of climate risk assessment conducted and the objectives of the agency. These include:

- to assess progress of adaptation actions
- to track risk exposure at agency or program level, or provide input into agency risk and financial risk reporting
- to identify and integrate new knowledge about climate change impacts and climate projections as they arise
- to track management thresholds and triggers
- to inform improvements and realignment of action in response to changing context or impacts
- to provide progress updates to stakeholders or adaptation delivery partners
- to inform reporting to meet legislative or regulatory obligations.

Monitoring and evaluation activities should be embedded in organisational processes. It is recommended that a risk assessment lead is allocated to maintain focus on priority climate risks over time.

As described in Step 3, adaptation pathways may be a useful way to represent when adaptation steps are required to occur. These pathways may form the basis of a monitoring and evaluation plan to monitor progress and identify when management triggers have been reached.

Monitoring and evaluation activities should be embedded and ideally a risk assessment lead will be allocated to maintain focus on priority climate risks over time.

A monitoring and evaluation plan should consider the following components at a minimum:

- **time period** – an agreed period for ongoing monitoring
- **lifecycle** – an agreed decision lifecycle for adaptation interventions
- **responsibility** for data collection, reviews and reports
- clear articulation of long-term and intermediate **outcomes**
- **performance** indicators and management triggers
- **metrics** – agreed measures that will indicate change, and baselines where appropriate
- **targets** that will demonstrate success
- **review or trigger points** to guide changes as new knowledge is gained.

It may be necessary to establish baseline conditions to ensure targets are realistic and achievable, and that progress can be tracked over time to help tell a story of how adaptation actions helped build resilience or achieve their ultimate goal.

Dealing with uncertainty

Developing a theory of change may be useful to clearly articulate how change, such as adaptation progress, is expected to happen over time. This will build on an adaptation pathway by documenting assumptions that underpin your anticipated path to success. For example, there may be assumptions about how climate change impacts may develop, or how community or business stakeholders may respond to interventions.

A theory of change will typically document elements such as:

- **long-term and intermediate outcomes** – the changes that are expected to occur in the short, medium or long-term as a result of your work activities (Funnell and Rogers 2011)
- **benefit(s)** – the measurable improvement resulting from an outcome perceived as an advantage by one or more stakeholders
- **outputs –** the physical goods, services or products that will be produced through project activities, and will help result in change
- **assumptions –** the beliefs or premise that underlie your theory of how change will occur (preferably based on some prior knowledge or evidence).

For each outcome outlined in a theory of change, performance measures and indicators should be identified to measure ultimate impact. In some instances, proxy indicators may be needed to demonstrate indirect change, and process indicators may be useful to measure the success of actions over long periods of time (where outcomes cannot yet be measured). SMART targets may also be included.

Integrate monitoring, review and learning into existing systems

Reviewing progress and implementing learning is a fundamental aspect of adaptive management. Monitoring and reviews of adaptation plans should occur annually and be integrated with existing frameworks or systems such as business continuity, asset management, and program governance. At an agency level, this may include strategic and business planning and outcomes reporting requirements, including those aligned to the WA Government's outcome budgeting commitments and policies.

Reviews of climate risk management practices may be undertaken less frequently, in line with the frequency of the agency's risk framework reviews. This may include a review of how the agency is using climate change projections, datasets or assumptions, or how information about recent climate impacts is being captured.

Increasingly, agencies may consider aligning their monitoring and evaluation to the recommendations of the TFCD, to inform public transparency. Figure 12 outlines core elements of climate-related financial disclosures as recommended under the TCFD framework.

Governance

The organisation's governance around climate change risks and opportunities

Strategy

The actual and potential impacts of climate-related risks and opportunities on the organisation's business, strategy, and financial planning

Risk management

The process used by the organisation to identify, assess, and manage climate- related risks

Metrics and targets

The metrics and targets used to assess and manage relevant climate-related risks and opportunities

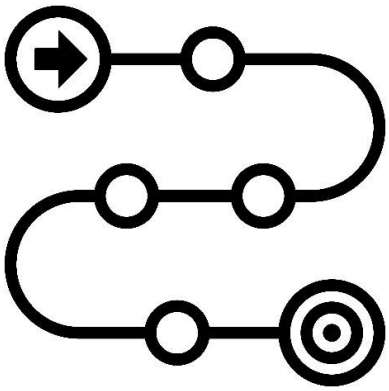
Figure 12: Core elements of financial disclosures (TCFD 2017)

When reviewing progress, the roles and responsibilities for implementation may have changed and may sit with contractors. In this case you may wish to clarify their roles in supporting adaptation at a strategic or operational level. As an example, Sydney Metro has identified specific climate adaptation actions it remains responsible for, irrespective of the stage of design or construction of the Sydney Metro component. This ensures central oversight of material climate risks across the project.

Digital platforms may also be used to efficiently track progress and collate data. It may be possible to consult existing monitoring programs to track performance measures and indicators; for example, air quality, water levels, vegetation cover, and socioeconomic patterns. These may be sources you already consulted in Step 1 of the Guide.

At the end of Step 4 you will have:

- Developed a monitoring and evaluation plan that draws on adaptation action plans and adaptation pathways, and outlines performance measures and indicators that can be monitored over time
- Allocated responsibility to an internal lead or risk assessment lead to monitor and report on climatic changes over time
- Identified where monitoring and evaluation can be operationalised through use of existing procedures and systems
- Established regular reporting cycles and a group or governance with oversight of implementation progress.



Glossary

Acute climate change risk	Event-driven physical risk, including increased severity of extreme weather events such as heatwaves, floods or storms (TCFD 2017).
Adaptation	Actions undertaken to manage or reduce the adverse consequences of climate change, as well as to harness any benefits or opportunities (AdaptNSW n.d.a).
Adaptive capacity	The sum of attributes that an organisation has that enables them to successfully manage risks and maximise opportunities from climate change. Attributes include resources, skills, knowledge, leadership and adaptive management maturity (ClimateADAPT n.d.).
Chronic climate change risks	Risks resulting from longer-term and cumulative changes in weather patterns, and climate-related trends. Chronic risks can amplify acute risks (event-based risks) and can relate to changes to the average of a climate variable over time.
Climate	The average weather that a location experiences over many years, even thousands of years. Key variables include temperature, rainfall and wind (CSIRO 2018).
Climate change	Persistent change in the average weather for an extended period of time, typically decades or longer. This change occurs on top of variability from year-to-year (CSIRO 2018).
Climate change risk/Climate risk	The effect of uncertainty on organisational objectives from acute and chronic climatic change. This includes physical, transition and liability risks. Physical risks are associated with direct impacts from rising aggregate global temperatures. Transition risks may result from activities undertaken to adjust towards a lower-carbon economy. Liability risks arise when a person or entity is held responsible for not acting sufficiently on physical or transition risks, causing damage to others (adapted from CSIRO (2016)). The terms climate change risk and climate risk are used interchangeably in this guide.
Climate change scenario	A coherent, plausible but often simplified description of a possible future state of the climate as influenced by climate change. It is not a prediction about the future, but rather it provides a means of understanding the potential impacts of climate change (CSIRO 2016).
Climate forcing	A physical process that affects the climate, specifically through changes to the energy flow in Earth's atmosphere caused by human (e.g. greenhouse gas concentrations) or natural drivers (e.g. solar radiation, volcanic eruptions) (adapted from IPCC 2014). The concept is used in simple climate models.

Climate projection	The response of the climate system over the coming decades to an emissions scenario as simulated by a climate model to obtain a sense of the range of future climate conditions that may emerge, for which we must plan. A true climate prediction or forecast is not currently possible beyond a few months (CSIRO 2018).
Climate-related opportunity	The potential positive impacts for an organisation related to climate change. Efforts to mitigate and adapt to climate change create the potential for organisations to benefit. Benefits may include resource efficiency and cost savings, utilising low emission energy sources, developing new products and services, and building robust supply chains (TCFD 2017).
Climate resilience	The ability to anticipate, prepare for, respond to and adapt to incremental change and sudden disruptions associated with climate change, so as to continue the delivery of products and services and meet customer expectations.
Consequence	Certain or uncertain outcome of an event affecting objectives directly or indirectly. It can be expressed qualitatively or quantitatively. Any consequence can escalate through cascading and cumulative effects (ISO 2018).
Critical infrastructure	The assets, systems and networks required to maintain security, health and safety, as well as social and economic prosperity. These are underpinned by supporting organisations and people (Department of Justice 2018).
Emissions scenario	Emissions scenarios are a tool with which to analyse how driving forces may influence future greenhouse gas emission outcomes and to assess the associated uncertainties. They are used in climate change analysis, including climate modelling and the assessment of impacts, adaptation and mitigation (IPCC 2000).
Interdependency	When multiple critical infrastructures rely on each other for continued service provision, or where interconnections associated with the supply or receipt of a service (e.g. water) on which the receiving sector is reliant and an impact on this supply could be critical (Department of Justice 2018).
Likelihood	The chance that a hazard will cause harm under a given scenario.

Materiality	When a climate change risk is material, it results in significant deviation from the organisation's strategic, financial or non-financial performance outcomes (Natural Capital Coalition 2016).
Mitigation	Climate change mitigation includes actions we take globally, nationally and individually to limit changes caused in the global climate by human activities. Mitigation activities are designed to reduce greenhouse emissions and/or increase the amounts of greenhouse gases removed from the atmosphere by greenhouse sinks (AdaptNSW n.d.,b).
Natural hazards	A natural or human-induced situation or condition that could harm people or damage property or the environment. Natural hazards include heatwaves, flooding and tidal inundation, storms such as east coast lows, landslides and bushfire.
Resilient infrastructure	New and existing physical facilities that support our society (e.g. roads, water pipes, power stations and communication systems) that are able to withstand climate variations over the decades of their use. To be climate resilient, new assets are located, designed, built and operated with the current and future climate in mind, and existing infrastructure and maintenance regimes should incorporate resilience to the impacts of climate change over an asset's lifetime (UK DEFRA 2011).
Risk	The effect of uncertainty on objectives, noting that effect is a deviation from the expected and may be positive and/or negative (ISO 2018).
Risk Assessment Lead	Leads the climate risk assessment team, consults and briefs the executive and ensures risk registers and adaptation plans are updated and embedded.
Risk management framework	The set of components for integrating, designing, implementing, evaluating and improving risk management throughout an organisation.
Risk management process	The systematic application of policies, procedures and practices to the tasks of communication, consultation, establishing the context and assessing, treating, monitoring, reviewing, recording and reporting risk.
Risk treatment	A process to modify risk.
Vulnerability	The extent to which a system or organisation can cope with the negative impacts of climate change, variability and extremes. Vulnerability is a function of risk and adaptive capacity (AGO 2006).
Weather	The atmospheric conditions over defined short periods of time, such as hours or days (AdaptNSW n.d.).

Appendix A: WA climate risk and policy context

The WA Public Sector Commission states that effective risk management is one of the foundations of good governance in the public sector. Treasurer's Instructions issued under the Financial Management Act 2006 require all public sector bodies to institute suitable risk management policies and practices.

The *Treasurer's Instruction 825 Risk Management*, states that the accountable authority of an agency shall ensure that:

1. suitable risk management policies and practices are developed; and

2. risk management policies and practices are periodically assessed and updated to ensure that they are suitable for managing risks inherent in the operations of the agency.

Where possible, agency risk management policies and processes should be consistent with Standards Australia, AS *ISO 31000:2018 Risk management guidelines*, which provides guidance on effective and efficient risk management.

In addition the *Treasurers Instruction 812 Insurance* states:
1. The accountable authority shall ensure there is an appropriate level of insurance cover over all insurable risks of the agency.

2. The accountable authority shall review the insurance arrangements before the renewal of each policy or class of policies.

There has been growing recognition by national financial regulatory authorities of the significance of climate risks for private and public organisations, and the need to ensure climate risks are identified and managed appropriately.

Western Australian Climate Policy and climate risk

The Western Australian Climate Policy sets out the Western Australian Government's plan for a climate-resilient community and a prosperous low-carbon future. It underscores the government's commitment to adapting to climate change and working with all sectors of the economy to achieve net zero emissions by 2050. The policy's vision is:

> *to harness Western Australian's innovation and wealth of natural and mineral resources to achieve net zero emission and ensure a prosperous, resilient future for all Western Australians.*

The Western Australian Climate Policy includes 64 actions to achieve greenhouse gas emission reductions, and identify and manage climate risks. It includes an action to develop and implement a Climate Risk Framework, to monitor, assess and report on the implication of climate change on the state's finances, infrastructure, physical assets and service delivery.

Organisation risk frameworks

Western Australian government agencies and GTEs have risk frameworks that guide their implementation of risk management generally. This interim guidance is designed to complement, and where necessary adjust, an agency's organisational risk framework to better address climate risk considerations, and ensure a consistent climate risk approach across State Government agencies.

Appendix B: Climate Risk Assessment Tool

The **Climate Risk Assessment Tool** is a template to support agencies to complete a first-pass climate risk assessment, identify risk treatments and implement adaptation actions. It can be used where the agency's standard risk registers are not suitable for the purposes of climate risk assessment. See Figure 13 for an excerpt of the tool.

The tool helps users to structure their climate risks. It enables the rating of risks across multiple future time horizons for agencies to consider how they are likely to be affected by climate change in the long-term. These time horizons (near-future to 2030 and far-future to 2090) have been selected based on the Climate Change in Australia projections. Example risks and adaptation actions are given to help users with their first pass of risk identification and adaptation planning.

The tool's risk assessment criteria are given in an editable form to allow users to customise the template with the risk assessment criteria outlined in an agency's existing risk management framework/guidance if desired.

Risk ID	Risk description	Business area/Risk owner	Date last assessed DD/MM/YY	Risk category	Natural hazards (climate related)							
					Sea level rise & coastal floodin	Mean temperature	Heatwaves/extreme heat days	Relative humidity	Bushfires	Extreme rainfall and flooding	Extreme storms (incl wind & h	Droughts
Unique identifier	*Refer to Guidance for advice on developing a climate risk statement, or refer to the Example Risks tab*	*Who is responsible for managing the risk*		*e.g. financial, service delivery, work health and safety*	*e.g. map against natural hazards to help understand how many risks relate to specific natural hazards and/or identify any gaps*							
1	***EXAMPLE*** Increased number of health issues related to heat stress in the workplace due to higher temperatures and increased severity of heatwaves.	Operations	20/09/19			✓	✓	✓				
2	*User input*	*User input*	*DD/MM/YY*									
3	*User input*	*User input*	*DD/MM/YY*									
4	*User input*	*User input*	*DD/MM/YY*									

Figure 13: What success may look like in terms of outcomes and level of stakeholder engagement over time under different maturity levels

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