ALGA
Australian Local Government Association

Adapting Together: Local Government Leadership in a Changing Climate

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THE AUSTRALIAN LOCAL GOVERNMENT ASSOCIATION (ALGA)

ALGA is the national voice of local government, representing 537 councils across the country. In structure it is a federation of state and territory local government associations.

ALGA provides a range of services to its member associations and, through them, local councils throughout Australia. This includes representing local government on national bodies and ministerial councils, policy development to provide a local government perspective on national affairs, information and forums and raising the profile of local government at the national level.

This report was commissioned by the Australian Local Government Association.

ALGA would like to acknowledge the Traditional Owners of Country that all local governments and communities call home. We extend our particular respects to the First Nations leaders who serve on councils or as staff in local governments across Australia. We are grateful for your leadership and insights that enrich our sector.

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President's acknowledgements

Local governments are intrinsically involved in preparing their communities for changing climate, both in their day-to-day work and strategic plans. And yet, there is currently no comprehensive framework that characterises local governments' approaches to climate adaptation action, either in Australia or overseas. ALGA commissioned this report to measure the value of local government work towards adaptation.

I'd like to acknowledge all the local governments that entrusted us with advice and information to build this report. Your input not only made the economic modelling at the centre of this work possible, but also as robust and accurate as it could be. Special thanks the case study councils Moyne Shire Council, Buloke Shire Council, Lockyer Valley Regional Council, Hobart City Council and Darwin City Council.

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Special thanks go to Tia Brullo, Prof. Sarah Boulter, Prof. Jon Barnett, and Elissa Walters at the National Environment Science Program Climate Systems Hub for their generosity in sharing advice and data. You can explore the Australian Adaptation Database freely.

Lastly, ALGA extends its gratitude to all state and territory local government organisations, particularly the climate policy staff and policy directors, who provided invaluable advice and support from the first concept through to finalisation.

With their local knowledge, experience, connections and leadership roles in their communities, local governments play a unique role in climate adaptation. We call for this role to be recognised and supported as we meet the current and future needs of our communities.

Mayor Matt Burnett

President
Australian Local Government Association

Executive summary

Australia's communities must urgently adapt to a changing climate

Even under the most optimistic assumptions for global decarbonisation, Australia's municipalities will face escalating impacts from climate change. This includes more frequent and severe disaster events, as well as more heatwaves and rising sea levels. For example, without investment in adaptation, disaster-related costs to Australia could reach $73 billion by 2060 (Deloitte 2021).

Climate change adaptation is the ongoing process of evolving how we make decisions so that we can cope with the expected impacts of climate change. Adaptation involves incremental changes to improve existing systems and practices, such as integrating climate projections into how an organisation plans and manages its asset base. However, effectively responding to climate change also requires new investment and different ways of thinking to produce more fundamental changes.

Local governments are already under significant financial constraints. Considering local roads alone, the Grattan Institute estimated an additional $1 billion is required annually to maintain current conditions (Terrill, Bradshaw & Jones 2023). The need to undertake proactive climate change adaptation puts additional yet unavoidable strain on councils that are already stretched thin.

Local governments face an inequitable delivery burden. Councils regularly act as a service provider of last resort, addressing market gaps and regulatory failures to ensure that community needs are met. Climate change impacts are likely to make this situation more severe. Stepping up to address unmet needs can blur the line with core local government duties and is not a long-term solution.

Direct investment by other levels of government is required if councils are to build their capacity and deliver comprehensive adaptation programs which meet their communities' needs. Continued reliance on short-term and ad-hoc funding will not sustain Australian climate adaptation.

Local governments are irreplaceable delivery partners in climate adaptation

Australia's local governments play a unique and systemic role in addressing climate-related risks and achieving national climate adaptation objectives. The adaptation required in local communities could not be delivered by any other level of government due to a lack of local presence and knowledge, as well as the absence of necessary skills, systems and experience delivering place-based projects.

Using 219 examples, this report describes the different types of actions that councils are taking to address climate impacts. There are many other activities undertaken as part of core business that contribute to climate risk management but are not specifically identified by councils as 'climate adaptation'. Examples include 'business as usual' management of infrastructure and assets, planning and development, community service delivery, and waste management.

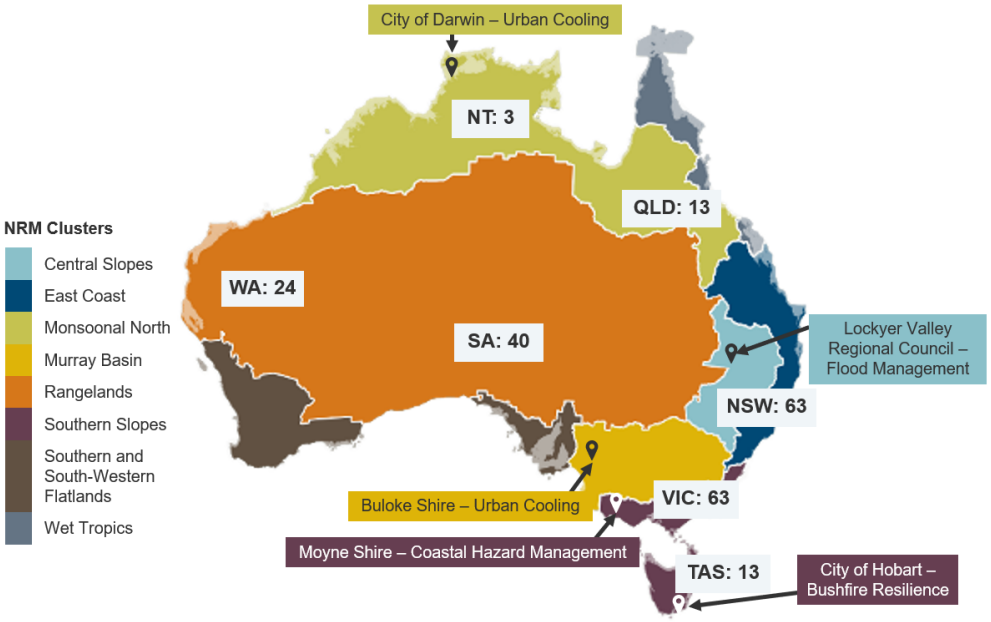


Figure 1 Spread of project examples across states, territories and natural resource management (NRM) clusters. The five specific projects described above were selected as case studies for the economic analysis.

A new framework and categorisation (i.e. typology) unique to Australia has been created to understand council climate adaptation, based on **Risk, Remit and Response**. It offers a practical structure that demonstrates local governments' adaptation expertise, strengths and options for future action. It can also be used as a reference point by the local government sector to plan, organise and describe its adaptation action.

Local governments' unique contribution to supporting healthy, prosperous and sustainable communities as the climate changes

Risks

What are the problems and opportunities driven by a changing climate?

Remit

To what extent can local government directly address the risk or opportunity?

Response

What is the best use of local government strengths and resources to reduce the problems and seize opportunities?

Findings from local government adaptation project examples:

Half the examples focused on one physical driver of risk, such as sea level rise, while the remainder sought to address multiple hazards.

Some actions addressed risks related to the net zero transition, particularly in rural and regional communities being asked to host new renewable energy infrastructure.

Two-thirds of the actions were associated with climate risks shared with other government levels and the private sector.

This emphasises the need for a clear multi-level governance model and associated resources for local governments.

One in five actions were associated with areas where councils have primary control of decision-making.

Categories of action include:

- internal governance and processes, regulatory measures,
- economic and financial measures,
- physical and technological measures, and
- knowledge-based, behavioural and cultural change measures.

Almost half those reviewed were internal governance and processes. Among these, two-thirds were climate risk management and adaptation planning.

Local governments are central to the management of nationally significant climate risks. Local governments play a pivotal role in all 'systems of national importance' identified in Australia's National Climate Risk Assessment (NCRA). **This role is most pronounced in the areas of health and social support, infrastructure, the natural environment, and emergency management.** Councils work across these systems in an integrated manner, meaning their role is more than the sum of their contribution to each system. Councils' role is also significant in rural and regional communities, which have more dispersed populations and often greater exposure to climate-related disasters.

*Table 1 Summary of key local government roles in selected systems of national importance, including example national benefits of local government action**. Note that local government roles are generalised on a national basis, and arrangements differ based on factors such as jurisdiction, location and population size.***

System of national importance	Example of local government contribution (not exhaustive)	Examples of national benefits of local government action
Health and social support system	Providing safe and accessible community facilities where people can connect, seek relief and access services. Providing physical and mental health and wellbeing services, including maternal and child health care, aged care, immunisation programs neighbourhood houses, and community centres.	• Preventative health benefits that reduce demand on Australian Government and state/territory-funded healthcare and other support mechanisms (e.g. Jobseeker). • Reduces underlying community vulnerability to disaster events and supports community connection during recovery.
Infrastructure and built environment	Delivering and managing more than one-third of Australia's public infrastructure.	• Quality local roads and drainage improve flood resilience. • Improved emergency response capacity and fewer requests for support under Disaster Recovery Funding Arrangements (DRFA).
Natural environment	Protecting and enhancing natural and culturally significant spaces to support human and ecological health outcomes.	• Protecting Matters of National Environmental Significance (MNES), supporting resilience in the face of climate stressors. • Supports healthier, more disaster-resilient communities.
Defence and national security	Delivering social and community development programs, hazard mitigation through infrastructure upgrades and planning amendments, and local emergency response and recovery.	• Strong local emergency management reduces demands on Australian Government and Australian Defence Force (ADF). • Social cohesion reduces underlying drivers of violent extremism.

Local government adaptation is an investment in every Australian community, with net economic, social, and environmental benefits

Five detailed case studies were used to model the avoided costs and benefits that adaptation projects provide to the community. Findings from these case studies were then scaled to estimate national economic contribution of local government adaptation. Actions considered in this study covered the areas of urban greening, strategic floodplain retreat, bushfire preparedness programs, and planning controls for future sea level rise. These actions are the result of these case study councils incorporating climate considerations into the core roles and decision making. **Cost-benefit analysis conservatively estimates that projects produce benefits of *at least* $0.8 and $3.1 per $1 of cost.** This modelling **likely underrepresents the value of local government adaptation**, given many benefits such as additional employment, improved productivity and improved mental health could not be quantified.

Local governments are already making significant investments in climate adaptation. A conservative estimate of current Australian local governments' direct expenditure on climate adaptation actions is $400 million per annum or $2 billion to 2030. This $2 billion investment is estimated to benefit local communities by between $2.2 and $4.7 billion.

Increasing Australian Government funding by at least $400 million per year—bringing total local government adaptation funding to $800 million annually—would more than double national benefits. Councils that can plan and deliver adaptation measures over multiple years achieve higher returns, as they can stage projects logically, integrate maintenance, and refine actions based on monitoring results. Ad-hoc, short-term funding risks inefficiency and lower returns.

1. Introduction and approach

Introduction

Local governments across Australia are playing their part in addressing climate change by proactively reduce their greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) emphasises the importance of addressing climate change due to its wide-ranging and potentially severe impacts on society, our natural environment, and the global economy. However, even under the most optimistic assumptions for global decarbonisation efforts, Australia's municipalities will face impacts from more frequent and severe extreme events (e.g. heatwaves, droughts, floods, and storms), as well as changes in long-term average conditions (e.g. rising sea levels and shifts in average rainfall).

In response, councils across Australia are increasingly engaged in **climate change adaptation**, which the IPCC defines as the 'process of adjusting to actual or expected climate change and its effects'. This includes actions focused on their own assets and service delivery, as well as those aimed at building the resilience of the communities they serve.

In 2012, Australia's three levels of government agreed through the former Council of Australian Governments (COAG) on the *Roles and Responsibilities for Climate Change Adaptation in Australia* (COAG 2012). The COAG statement acknowledges that climate change affects public goods and services for which the Australian Government has key responsibilities and/or provides substantial funding, including community health, environmental protection and emergency management. Australia's local governments play key delivery roles in all these areas and as such, their ability to deliver these and other services in the face of a changing climate is of critical national importance.

Purpose of this report

The Australian Local Government Association (ALGA) is the national voice of local government in Australia. ALGA represents Australia's 537 councils through a federated structure of state and territory associations, ensuring that the voices of diverse communities are heard and understood in national decision making.

Operating for more than 80 years, ALGA is a single, credible point of contact to engage with local government, enabling better designed programs and more efficient service delivery across Australia's towns, cities, and regions.

While Australia's local government sector undertakes extensive adaptation action, its highly fragmented nature and being highly context-driven means that efforts and approaches of local governments nationally are not widely understood (OECD 2023), and there is a lack of reliable information on their national economic value. In response, ALGA commissioned Nation Partners and Ricardo to:

- Develop a categorisation (a 'typology') of adaptation actions currently undertaken by Australia's local governments, considering the range of levers available.
- Describe how these existing efforts contribute to national adaptation goals and priorities.
- Quantify the national economic value of existing local government adaptation efforts.
- Quantify the potential national return on investment if local governments were to be provided with consistent year-on-year funding for their adaptation activities. This is intended to address a key

limitation of current funding arrangements, which rely heavily on project-specific grants that do not support the consistent, long-term planning and action required to build resilience to climate change.

What is climate change adaptation?

Climate change adaptation (climate adaptation) is the ongoing process of evolving how we make decisions – such as how we plan, build and live – so that we can cope with the expected impacts of climate change. Examples include:

- Improving the working knowledge of an organisation's staff on climate change, how it could impact on their objectives, and what can be done to reduce the potential impacts.
- Planning cities and communities to be safer from rising sea levels and extreme storms.
- Changing how we manage bushfire risks in hotter, drier conditions.
- Increasing the capacity of drainage and roads to handle projected increases in rainfall intensity.

Adaptation may be **incremental**, involving smaller changes to improve existing systems and practices, such as integrating climate projections into how an organisation plans and manages its asset base.

However, effectively responding to climate change will also require **transformational** adaptation that involves fundamental systemic changes. What this looks like varies across Australia but may include relocating assets and communities away from highly vulnerable locations, establishing new governance structures and engaging in significant cultural change. Transformational approaches are most needed where risks are high, current approaches are no longer viable, and decisions have long-term consequences.

Climate adaptation is also critical for local governments' role in **emergency management**. As climate change increases the severity and intensity of disasters like floods, bushfires, and storms, adaptation helps emergency response and recovery efforts by:

- Reducing the number and severity of emergencies.
- Building communities' underlying resilience and adaptive capacity so they can recover faster.
- Using climate science to better understand and plan for future risks.

Overview of project approach and method

Led by the local government sector, this project was based around the four research questions shown in Figure 2.

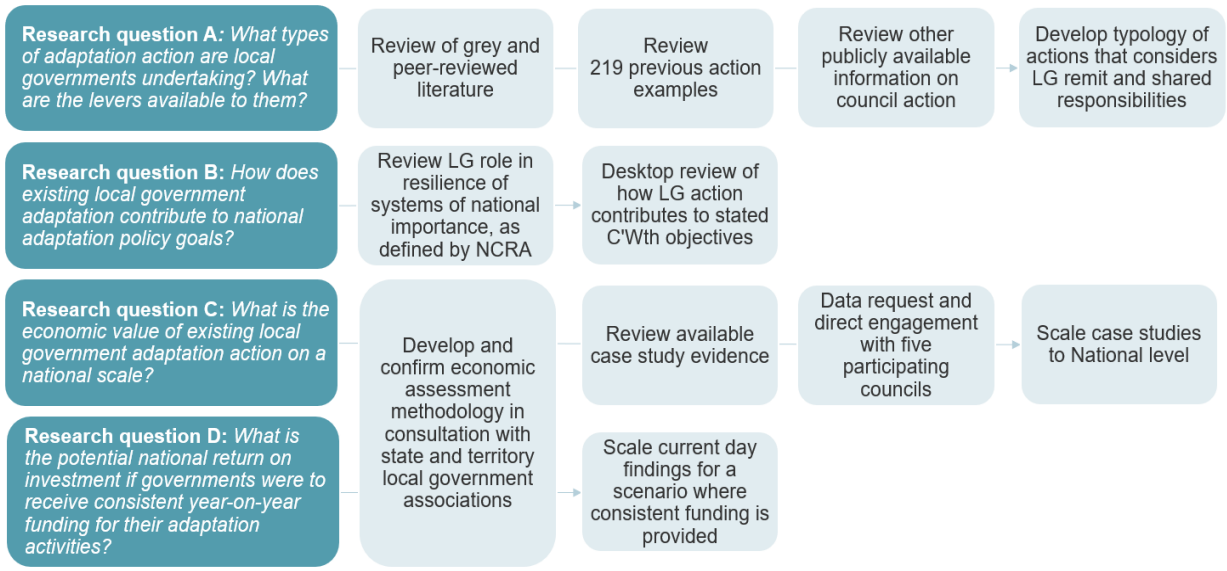


Figure 2 Summary of the project approach

How this research was driven by the local government sector

This project has been led by the local government sector through from scoping to finalisation. ALGA designed the initial concept in partnership with all seven state and territory local government associations, whose representatives provided input and review as part of a Technical Advisory Group (TAG).

A key input to this research was a set of 219 examples of local government climate adaptation projects, sourced from the National Environmental Science Program (NESP) Climate Systems Hub, all state and territory local government associations, ALGA, and the websites of a small sample of local governments. The examples include municipalities spanning all states and the Northern Territory (NT), as well as a mixture of metropolitan, peri-urban and regional areas. The full list of councils where project examples were sourced can be found in Appendix 1.

From these 219 examples, five suitable case study projects were identified for use in the economic analysis. Figure 3 below describes the selection process.

Figure 3 Case study shortlisting process

As shown in Figure 4, by drawing on the knowledge and networks of Australia's local government areas (LGAs), this project reflects a diverse range of local-level adaptation actions underway across Australia. While the examples and case studies do not provide an exhaustive picture of all local government-led adaptation action, they offer a sound basis for assessing the costs and benefits of the sector's efforts across a range of Australia's natural resource management (NRM) areas.[1]

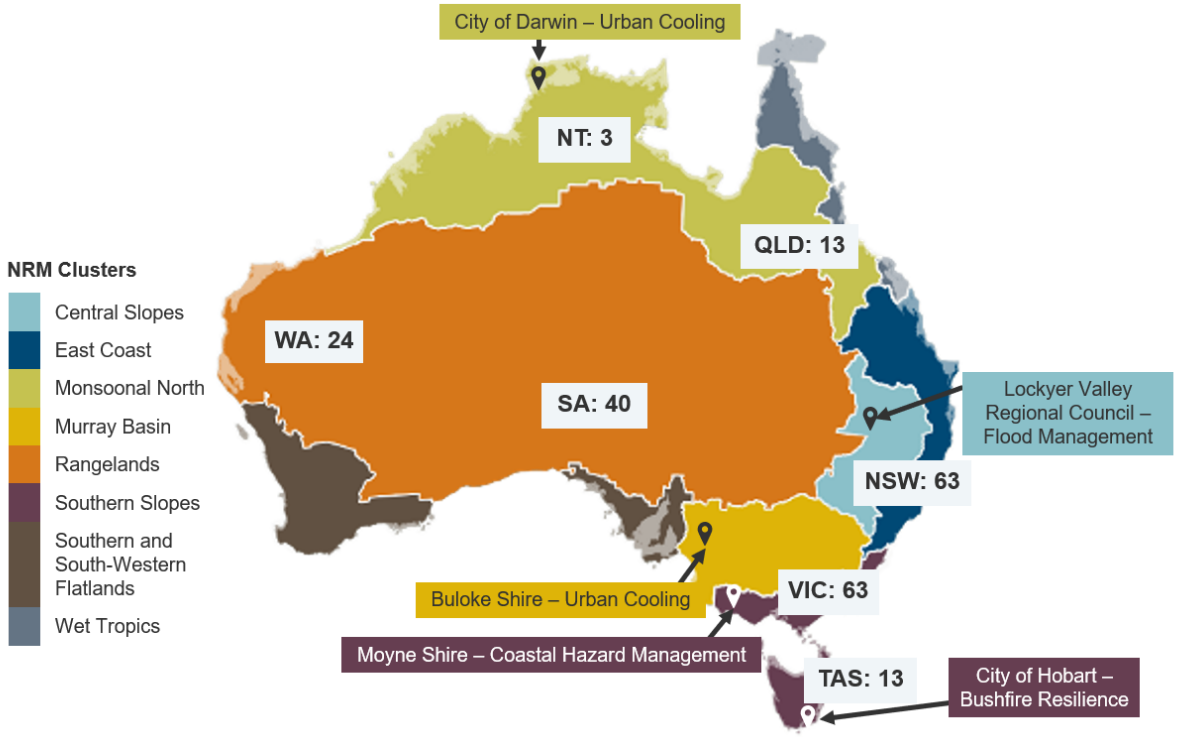


Figure 4 Spread of project examples across states, territories and natural resource management (NRM) clusters. The five specific projects described above were selected as case studies for the economic analysis.

[1] Categorising adaptation actions by NRM cluster can support local governments to identify other municipalities that may be in a different jurisdiction but exposed to similar projected changes in climate. Refer to Appendix 1 for more information on NRM clusters.

Qualitative analysis of policy and actions

To support an improved understanding of local government climate adaptation and its outcomes at the national scale, this project included:

- Review of how local government adaptation is characterised in peer-reviewed and grey literature (such as government, peak body and other organisations' publications), summarised in Appendix 2.
- Reviewing the administrative context for climate adaptation in each jurisdiction. For example, Victorian councils have a legislative responsibility to consider climate change as part of Municipal Health and Wellbeing Plans; in Western Australia, the new *State Public Health Plan for Western Australia 2024-2029* includes a new priority to manage the effects of climate change on people's health.
- Analysis of 219 examples to understand the spread of actions in terms of factors like the hazard(s) being addressed, and how the action sought to reduce risk.
- Working with all state and territory local government associations to establish a typology of current Australian local government approaches to climate adaptation.
- Analysing how local governments contribute to achievement of stated Australian Government adaptation policy priorities, as documented in sources such as the *National Adaptation Plan Issues Paper* (DCCEEW 2024a).
- Developing seven 'system summaries' that describe:
    a. Local government's role in managing risks to the 'systems of national importance' as defined by Australia's *National Climate Risk Assessment First Pass Assessment Report* (Australian Government 2024) (NCRA)
    b. Examples of tangible actions taken by local governments in each system
    c. How the impacts of climate change on local government may have flow-on consequences for nationally significant risks identified in Australia's NCRA.

Economic analysis

This project applied a structured cost-benefit analysis (CBA) framework to evaluate local government adaptation actions for the five case studies shown in Table 2.

The analysis captured a broad range of benefits, including economic benefits (e.g. avoided property damage, reduced emergency costs), social benefits (e.g. improved health, community resilience), and environmental benefits (e.g. avoided air pollution, carbon sequestration). Where possible, benefits and costs were monetised using available data and accepted valuation methods. Where monetisation was not feasible, significant non-monetary values—such as improved wellbeing or cultural benefits—have been qualitatively analysed to ensure a complete understanding of outcomes. Given the inherent uncertainties in predicting future climate risks, costs and benefits, sensitivity analysis was used to test how results change under different assumptions such as varying discount rates.

Table 2 Key features of project case studies used in economic analysis

Case study	NRM region	Location type	Hazard	Type of action
City of Darwin (NT)	Monsoonal North	Metro	Heatwaves, cyclones	Physical and technical
Lockyer Valley Regional Council (Qld)	East Coast	Regional	Riverine flooding	Economic and financial
City of Hobart (Tas)	Southern Slopes	Metro	Bushfire	Knowledge-based, behavioural, and cultural change
Moyne Shire Council (Vic)	Southern Slopes	Regional	Sea level rise	Regulatory
Buloke Shire Council (Vic)	Murray Basin	Regional	Heatwaves, drought	Physical and technical

Using available data on council expenditure, the findings from the five case studies were scaled to estimate the level of investment and benefits of local government adaptation at a national scale. The findings highlight not only the real, measurable impact of actions already underway, but also the potential value of increasing and sustaining funding.

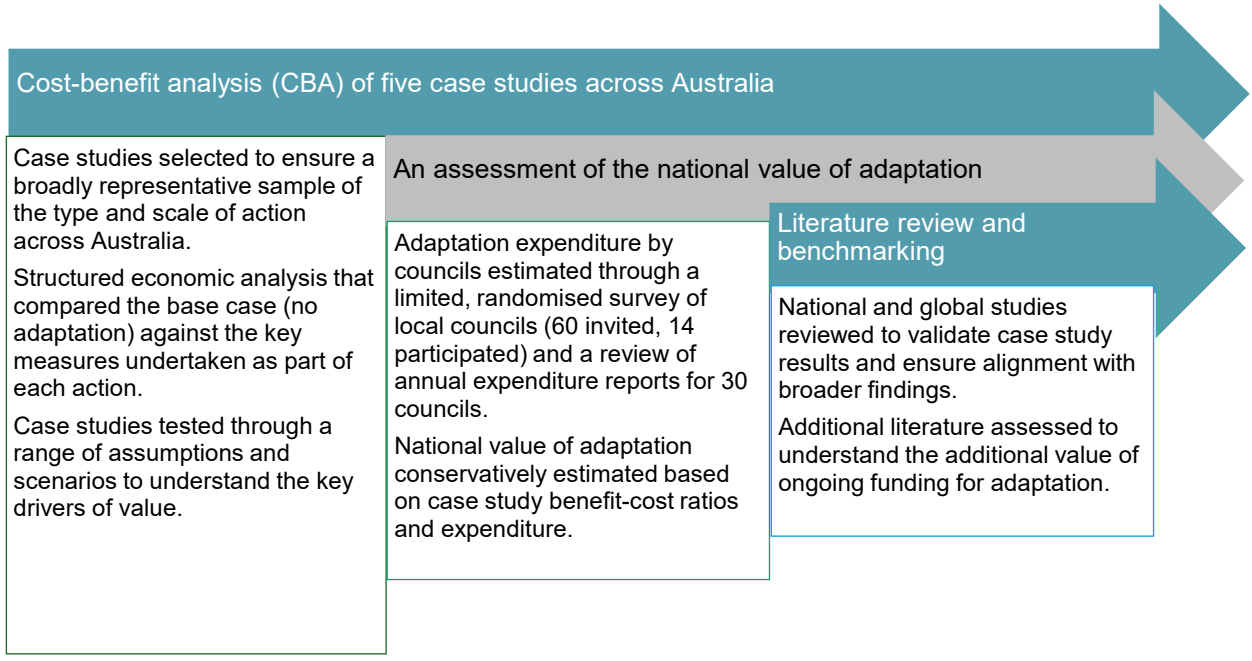


Figure 5 Summary of economic analysis approach

Key limitations and future opportunities

- This study is one contribution to the larger body of research that is needed to understand the current state of climate adaptation in Australia, including at the local level.
- Stakeholder engagement for this project focused primarily on state and territory local government associations and a limited number of councils. In future, there is the opportunity to broaden engagement within the local government sector.
- There are opportunities to draw on the considerable data held by the Australian, state and territory governments to better understand the effectiveness and short-, medium- and long-term community outcomes of local government adaptation work.
- While some climate adaptation measures reviewed for the project may also assist in reducing greenhouse gas emissions (e.g. urban greening), this project has not focused on council emissions reduction efforts.
- In addition to the 219 adaptation project examples, there are many other activities undertaken as part of core business that contribute to climate risk management but are not specifically identified by councils as 'climate adaptation'. Examples include 'business as usual' management of infrastructure and assets, planning and development, community service delivery, and waste management. These core business actions are not fully reflected in this study and its findings.
- Data on the current level of local government expenditure on climate adaptation is not representative of all councils' cumulative spending, as it was generated through a survey of a limited sample of councils for the purposes of this project.
- While the five case studies selected to inform the economic analysis illustrate some key types of adaptation action currently underway across Australia, they are not a complete representation of all actions and are subject to volunteer bias.
- This study provides a current day 'snapshot' of select local government adaptation action. There is significant opportunity to undertake longitudinal data collection and assessment to inform a 'state of local adaptation' that could improve knowledge sharing about activities and outcomes over time.
- First Nations traditional values and knowledges are critical for climate adaptation in Australia. There are opportunities to better understand how local government and Traditional Owner partnerships and collaborations are already advancing climate adaptation and can be better supported nationally.

2. The unique role of local governments in climate change adaptation

Key findings

- With their local knowledge, experience, connections and leadership roles in their communities, local governments play a unique role in climate adaptation – for example, by addressing local drivers of climate vulnerability, mainstreaming adaptation, and driving local investment that supports climate resilience.
- Much of the adaptation required in local communities cannot be delivered by other levels of government due to their lack of local presence and knowledge, as well as the absence of necessary skills, systems and experience delivering place-based projects.
- Local governments experience an inequitable delivery burden due to significant devolution of Australian Government and state/territory government adaptation responsibilities. Councils regularly act as a service provider of last resort, addressing market gaps and regulatory failures to ensure that community needs are met.
- Publicly available information on local government climate adaptation in Australia is fragmented and context-specific, making it difficult to gain a full picture of the current state and distinctive value of locally led adaptation across the nation.
- A new framework unique to Australia has been created to understand council climate adaptation, based on the concepts of *risk, remit* and *response*.
- Two-thirds of the 219 local government actions analysed for this study related to climate risks shared with other government levels and the private sector, requiring a clear multi-level governance model and associated resources for local governments to play their role. Only one in five of the reviewed actions were found to address matters wholly within councils' control.
- In the absence of adequate resourcing, almost half of the actions were low- or no-cost updates to internal governance and processes. Of these, two-thirds focused on development of climate risk assessments and adaptation plans.

Adaptation roles and responsibilities

All levels of government—Australian, state/territory and local—have complementary yet differentiated responsibilities in supporting Australia's adaptation to climate change. These roles were formally agreed in the 2012 COAG statement on *Roles and Responsibilities for Climate Change Adaptation in Australia*.

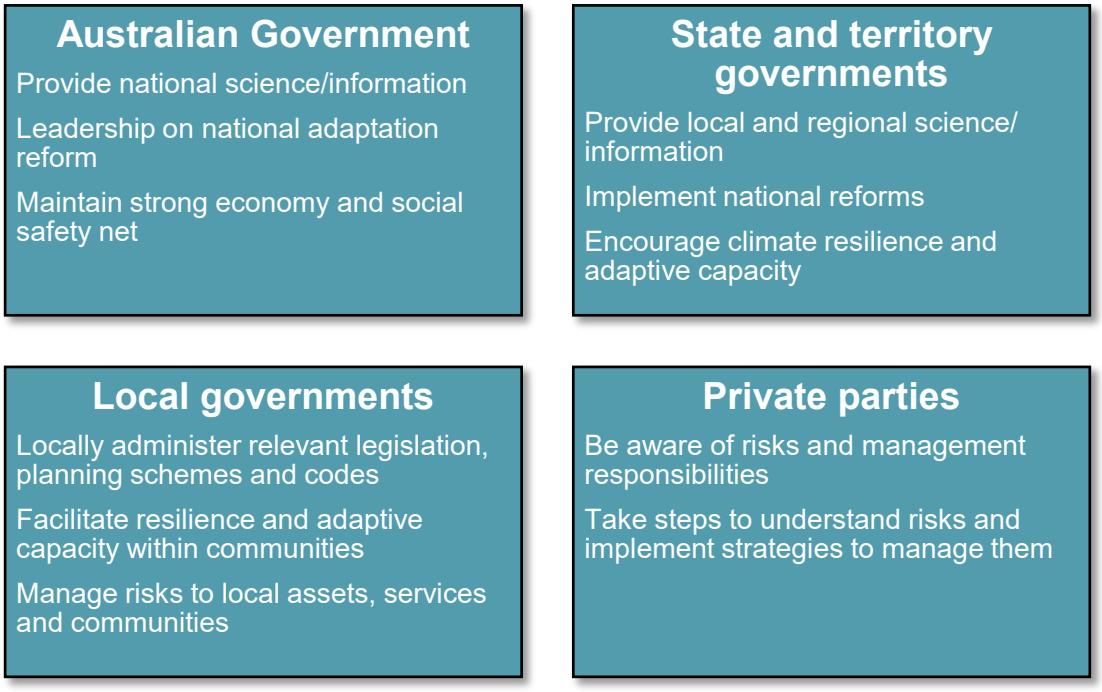


Figure 6 Summary of adaptation responsibilities in the COAG agreement (not exhaustive)

The *Independent Review of Commonwealth Disaster Funding* (the Colvin Review) found that most local governments have a strong desire to play a leading role in disaster management; however, they often have inadequate capacity and capability to play this role. This is especially the case in rural and regional communities, which have more dispersed populations and often greater exposure to climate-related disasters (Colvin 2024).

In practice, local governments bear an inequitable delivery burden for climate adaptation. While other levels of government contribute to the 'social safety net' noted in the COAG agreement through structural mechanisms such as welfare payments and public housing, councils play the resource-intensive role of facilitating social cohesion that supports communities to better manage, respond to, and recover from shocks and stresses. Through activities such as providing shared spaces, supporting community-led initiatives, and delivering health and wellbeing programs, local governments play a fundamental role in maintaining the social fabric of communities.

Councils are regularly acting as a service provider of last resort, addressing market gaps and regulatory failures to ensure that risks are not left unchecked and community needs are met. This includes providing essential services and infrastructure where investment is seen as unattractive or unviable, enforcing compliance to ensure local issues do not remain unregulated, and providing a magnified voice for the community to advocate and platform local needs.

Local governments stepping up to address unmet needs can blur the line with their core duties and is not a long-term solution. Councils are already under significant strain from climate-fuelled disasters, with 15 municipalities having sought and received Australian Government assistance for disaster recovery at least 25 times since 2006/07 (Climate Council 2024). This funding rarely, if ever, covers the full cost of

recovery, leading to compounding and cascading impacts that overwhelm the local community and council's coping capacity.

How Australian local governments are adapting to climate change

While resource constraints make it difficult for many local governments to implement ambitious and effective adaptation, they hold powerful levers, including land use planning, delivering emergency management services, and operating of critical community services and facilities. These strengths enable councils to deliver—both individually and in partnership with other municipalities—many important place-based measures that help prepare communities, businesses, the natural environment and built infrastructure for changes to the local climate.

However, the disparate nature of climate adaptation and the lack of a consistent approach to documenting projects means it is challenging to gain a full picture of the current state of local government efforts in this space. Looking at sources such as council plans, websites, grant platforms and case study databases (Victorian Government 2020; Local Government NSW 2025), it can also be difficult to distinguish between planned and implemented actions or identify the results of adaptation efforts.

Figure 7 presents a new typology that characterises Australian local government approaches to climate adaptation. The typology aims to support local adaptation in three main ways:

- Offering a practical structure that demonstrates local governments' adaptation expertise, strengths and options for future action.
- Demonstrating that most adaptation relies on effective partnerships, supporting the case for further collaboration and support from other levels of government to address shared risks in the national interest.
- Providing a framework that can be used as a reference point by the local government sector to understand, plan, organise and describe its adaptation action.

Findings from the literature review that informed the design of this typology can be found in Appendix 3.

Local governments' unique contribution to supporting healthy, prosperous and sustainable communities as the climate changes

Risks

What are the problems and opportunities driven by a changing climate?

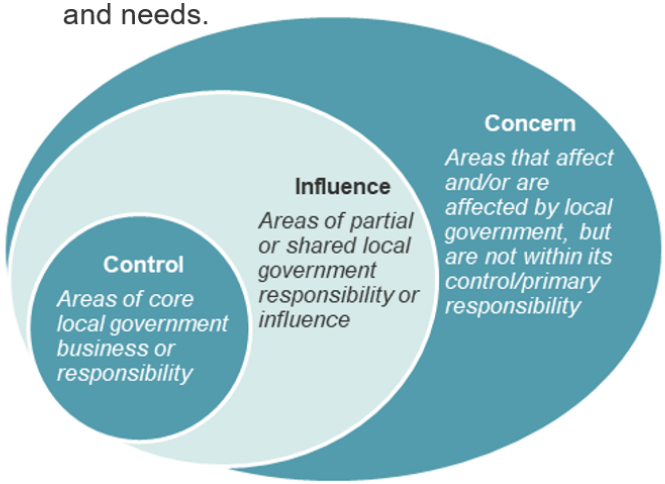
Influenced by:

- **Climate hazards** – acute (e.g. floods, bushfires) and chronic (e.g. sea level rise, changing rainfall patterns).
- **Exposure** – when things we value are in places that could be affected by hazards (e.g. assets in a flood zone).
- **Vulnerability** – factors that can cause things we value to be impacted differently and disproportionately (e.g. low income, existing health conditions).

Remit

To what extent can local government directly address the risk or opportunity?

The issues falling in spheres of control, influence or concern, as driven by statutory obligations, intergovernmental agreements, and the community's vision and needs.



Response

What is the best use of local government strengths and resources to reduce the problems and seize opportunities?

The diverse **actions** that local governments take to respond to climate risks and opportunities, in support of their communities.

Categories in the typology include:

- Internal governance and processes
- Regulatory measures
- Economic and financial measures
- Physical and technological measures
- Knowledge-based, behavioural and cultural change measures.

Figure 7 A typology of adaptation action in Australia's local government sector; Source: Authors, with reference to the IPCC framework for climate risk and Stephen Covey's (1989) 'spheres of influence' concept.

Breaking down the ‘Response’ element, Table 3 outlines a comprehensive set of categories and sub-categories of adaptation action that local governments can take, including practical examples for each sub-category.

Table 3 ‘Response’ categories, sub-categories and illustrative examples

Category of adaptation action	Sub-category of adaptation action	Examples (not exhaustive)
Internal governance, and processes	Council-wide enterprise/organisational risk management processes and activities	• Council-wide enterprise/organisation risk register • Risk assessment and management procedure
	Dedicated climate risk management and adaptation planning *(climate risk planning does not always influence organisation-wide risk management and strategy, and is therefore distinguished)*	• Council-wide or department-specific climate risk assessment process and report • Council-wide climate change adaptation strategy
	Public reporting, disclosures and transparency measures	• Published disclosure report on climate change risks identified and managed by council • Published mapping of council assets exposed to climate-related hazards
	Integrating climate change imperatives into council strategies, plans, business processes and service delivery	• Inclusion of climate adaptation measures statutory obligations such as integrated planning and reporting • Including climate change in Municipal Health and Wellbeing Plans (VIC)
	Internal institutional capacity building and resourcing	• Climate change adaptation-focused training program for council staff • Budget and staffing allocation to lead/implement adaptation initiatives
	Asset management processes and activities	Integrating climate change projections into asset management strategy and planning
Regulatory measures	Land use planning controls	• Local environmental plans • Development control plans
	Building permitting and enforcement	• Building approval processes • Certification and compliance processes
	Local laws	• General local laws • Licensing
Economic and financial measures	Strategic economic development planning and measures	• Economic development plan • Green infrastructure innovation program or hub for local businesses
	Financing and incentive instruments	• Loan to local businesses for resilience upgrades • Facility for repayment of resilient building loans through rates
	Insurance (public and private) and risk sharing instruments	• Building and infrastructure insurance • Public-private partnerships

Category of adaptation action	Sub-category of adaptation action	Examples (not exhaustive)
Physical and technological measures	'Grey' physical infrastructure measures	'Grey' measures typically include traditional, human-made infrastructure solutions, e.g. roads, bridges and subsurface drainage systems.
	'Green' physical infrastructure measures	'Green' measures are often also called 'nature-based solutions' and involve natural or semi-natural systems that provide environmental benefits (e.g. parks, green roofs, urban forests, and ecosystem functions and services).
	'Blue' physical infrastructure measures	'Blue' measures may also be referred to as nature-based solutions, but they specifically relate to water-related infrastructure (e.g. lakes, wetlands, and sustainable urban drainage systems).
	Technological measures	• Early warning system for extreme weather events • Sensors to monitor exposure of key community infrastructure to hazards and inform adaptation needs
Knowledge-based, behavioural and cultural change measures	Leading by example, including through innovation and practice	• Local pilot or trial programs for adaptation • Commitments to initiate or support adaptation action in ways that are different from peer councils
	Advocacy and lobbying	Advocacy partnerships across councils to pool resources and expand reach/relevance
	Community strengthening and capacity building	• Community resilience-building programs • Climate-focused training programs for council volunteers with existing council initiatives
	Enabling and supporting community-led adaptation action	Provision of funds or in-kind resources to allow communities to meet, deliver events, etc.
	Studies and research programs to identify adaptation needs and priorities	• Feasibility studies • Surveys and town hall events to elicit community input
	Educational programs and targeted information provision	• Community engagement for policy and program design, development and delivery • Local school-based climate change education sessions • Information campaigns targeting local groups • Changes to program design or delivery to encourage different community/stakeholder behaviours • Elucidating and incorporating collective social, environmental, and economic values into program design.
	Behavioural change programs	
	Cultural change programs	

First Nations values and knowledges and local government adaptation

Australia's First Peoples have been working in Australia's environment for tens of thousands of years. The values, ways of thinking and knowledges of Traditional Owners are deeply rooted in Country and connected with community. There is significant benefit to be gained from partnerships between local governments and Traditional Owners to not only create benefit for Aboriginal and Torres Strait Islander peoples, but to inform good adaptation benefitting Country, community, and regional economies.

Aboriginal and Torres Strait Islander peoples suffer disproportionately from the impacts of climate change. As stated in the Colvin Review (p.4), 'First Nations communities are often most at risk from the rapid onset of a hazardous weather event, but it is through them we learn that vulnerability is a product of our reaction to disasters; a consequence of the systems, structures and policies that we have created.' First Nations communities are forging their own culturally sensitive approaches to manage impacts (Lyons et al. 2020). A range of communities are also seizing opportunities from the transition to a low emissions economy by 'participating in, benefitting from, responding to, and shaping clean energy projects' (First Nations Clean Energy Network 2024).

The relationships between Traditional Owners, communities and local governments are independent and unique. As a signatory to the Closing the Gap Agreement, ALGA's role is to champion partnerships that have delivered mutual benefit for both Traditional Owners and local governments.

Example in lights

Wiluna community bush walk, Shire of Wiluna and the Tarlka Matuwa Piarku Aboriginal Corporation (WA)

As part of the Goldfields Esperance urban greening program, a bushwalk will be developed by the Wiluna community. The Martu Bush Walk will support the vision of the Martu people which is to ensure Martu law and culture is practiced, and Country is healthy. This collaboration seeks to bolster economic, environmental and social resilience while improving community health, shade and biodiversity through restoring local native vegetation through the town and in areas of significance for the Martu people. It is supported by funding obtained by the broader Goldfields Esperance Voluntary Regional Organisation of Councils.

Insights from past local government actions

The 219 project examples[2] addressed a range of climate-related hazards. Almost half focused on addressing one physical driver of risk, such as sea level rise, while the remainder sought to address multiple hazards concurrently, such as extreme heat and bushfires. Hazards addressed in the project examples included:

- Flooding
- Sea level rise and coastal erosion
- Bushfire
- Extreme heat and heatwaves
- Extreme winds and storms (including large hail)
- Changes in average rainfall and drought
- Changes in average temperatures
- Erosion and landslips
- Cyclones.

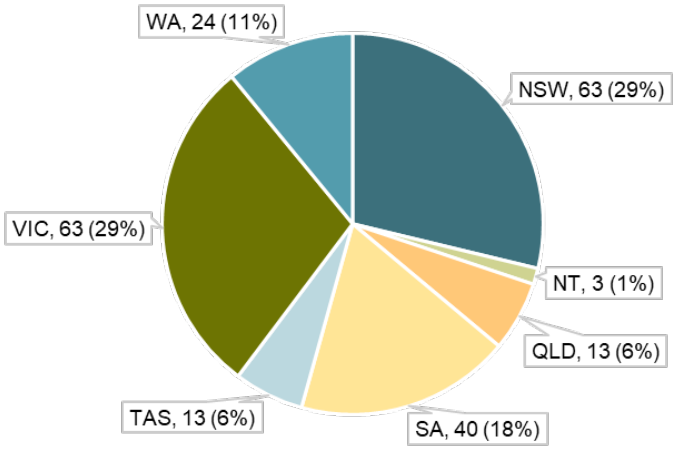


Figure 8 Summary by jurisdiction of adaptation project examples included in review

A range of secondary and tertiary impacts lie at the intersection of these hazards. For example, several of the actions had a focus on controlling communicable diseases, which is a pressing issue that is exacerbated by climate change but may not always be identified by councils as a climate change risk.

Many climate change impacts are often far reaching and cross jurisdictional boundaries, meaning that multiple actors often share the responsibility for their management. Local governments' available 'spheres of influence'[3] over climate risks depend on their remit to manage local activities, services, assets and landscapes, which are often also partially led, managed or shaped by other actors.

[2] Sources for examples included the Climate Systems Hub NESP Database, all state and territory local government organisations, ALGA, and a small sample of local government websites.

[3] This project built on Stephen Covey's (1989) concept of three 'circles' or 'spheres' of influence—control, influence and concern—that can be used to clarify and define an individual or entity's extent of control and their roles/responsibilities.

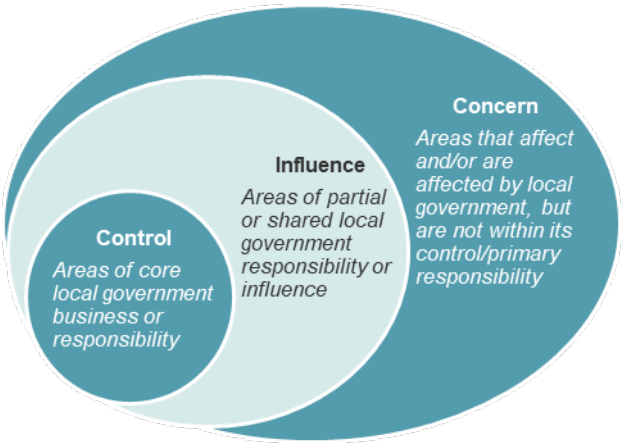


Figure 9 Local government spheres of influence

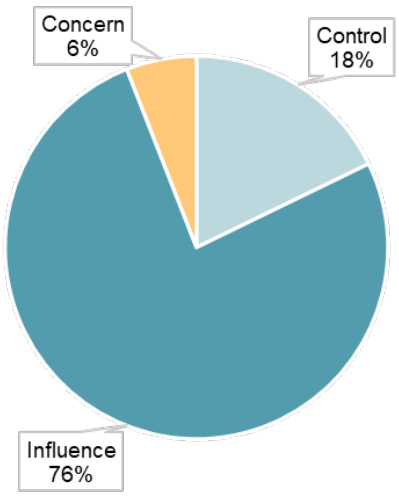


Figure 10 Summary of project examples reviewed categorised by sphere of influence

Local governments mostly share their remit for managing local climate-related risks with other actors and must therefore navigate having only partial responsibility for devising and delivering potential solutions (Figure 10). More than three-quarters of the project examples reviewed were actions over which councils had 'influence' (i.e. partial or shared responsibility). Roughly one in five of the reviewed actions were in areas that sit within councils' areas of primary 'control' (i.e. areas of core local government activity, such as council owned and managed infrastructure).

This spread of actions points to the fundamental need to partner and exchange support and resources with other actors.

Only around 6% of the project examples were judged to be in the 'concern' sphere (i.e. areas that affect or are affected by local government, but are not within its control or primary responsibility). This reflects councils' critical and substantial role in most local climate adaptation actions.

Project examples were also assessed against the categories and sub-categories of action in the typology. Almost half were internal governance and processes, and among these, two-thirds of projects were focused on dedicated climate risk management and adaptation planning activities.

The City of Onkaparinga case study below, which centres on an organisation-wide physical and transition risk assessment, is similar to many of the projects reviewed. Such assessments are typically led by an environmental or sustainability function within a council; however, they give rise to adaptation needs that span a range of different teams and service offerings. A key challenge is agreeing how responsibility for adaptation can be appropriately shared across the organisation, and where possible, tangible actions delivered through existing structures such as budgeting and strategic asset management.

Examples in lights

Climate change risk assessment and climate response plan, City of Onkaparinga (SA)
Internal governance and processes – dedicated climate risk management and adaptation planning

The City of Onkaparinga undertook a dedicated climate change risk assessment to identify climate-related gaps in the council's strategic and governance structures. In addition, the assessment identified physical and transition risks that could impact service delivery, asset management and operations. The risk assessment culminated in the development of the *Climate Change Response Plan 2022-2027*, which outlines actions to manage climate-related risks across the municipality.

Sustainability Action Plan Review, City of Launceston (TAS)
Internal governance and processes – dedicated climate risk management and adaptation planning

The City of Launceston completes annual reporting on the implementation progress of its *Sustainability Action Plan 2022–2030*, which includes commitments on adaptation and resilience. The review comments on the cost, progress and status of 21 adaptation and resilience actions, which range from working with local Tasmanian Aboriginal people to understand culturally significant sites and their protection needs, to reviewing land use planning in levee protected areas. It identifies target years and priorities for continuing work.

Among the 62 project examples of physical infrastructure measures, there was an equal split between 'grey' physical infrastructure (such as road surface and building upgrades) and either 'green' or 'blue' physical infrastructure measures (such as tree planting, revegetation and 'eco reefs').

Knowledge-based behavioural and cultural change measures made up almost a quarter of all project examples, with a primary focus on delivering community education programs and targeted information provision.

Regulatory measures (such as integrating climate change into land use planning or permitting) and economic and financial measures (such as loans, repayment facilities through rates, or public-private partnerships) were the least common adaptation types identified. This finding may reflect inherent limitations of the spread of project examples selected for review and does not necessarily indicate that local governments are less inclined to use these adaptation approaches.

How local government adaptation supports national objectives

The Colvin Review notes that the proximity of council to communities 'provides them with the necessary insights and authority to administer disaster-related programs' (Colvin 2024, p.52). This extends to climate adaptation, which requires many of the same capabilities and helps to mitigate the burden of disasters on communities. In many cases, the adaptation required in local communities cannot be delivered by other levels of government due to their lack of local presence and knowledge, as well as the absence of necessary skills, systems and experience delivering place-based projects.

Local governments have unique role to play in areas closely aligned with the three objectives proposed by the Australian Government (DCCEEW 2024a) for a future National Adaptation Plan:

- Establish support for people and communities in disproportionately vulnerable situations

- Mainstream adaptation action
- Drive a substantial uplift in private sector investment.

Addressing local vulnerabilities

The impacts of climate change are not uniformly experienced across populations. Groups that are often more susceptible to climate impacts, such as older people, people living in particularly exposed or remote areas, and people with lower financial resources, are more likely to be sensitive to impacts and less able to respond or recover (IPCC 2021). Local governments play an integral role in reducing community vulnerability as they have an on-the-ground understanding of community needs. In addition to directly implementing measures that address drivers of vulnerability, they act as connectors within a community, facilitating networks and collaboration arrangements to create coalitions of businesses, community groups and residents. This includes working with Traditional Owners in locally and culturally appropriate ways.

Local mainstreaming of adaptation

Local governments have a role to play in helping to make climate adaptation standard practice through mechanisms such as:

- **Embedding adaptation in asset management and infrastructure**, including revising asset management processes and policies to ensure climate change impacts are being considered when planning for and designing new infrastructure. Six of the 219 project examples analysed for this study were within this sub-category.
- **Integrating consideration of climate change imperatives into council strategies, plans, business processes and service delivery**, such as considering possible different futures based on different levels of warming in strategic planning processes. 18 of the 219 project examples were within this sub-category.
- **Increasing community awareness and capability to recognise and respond to climate impacts**, including through education programs and targeted information provision. 16 of the 219 project examples reviewed were this type of adaptation action.

Enabling local investment that supports climate resilient outcomes

Additionally, local governments facilitate and accelerate private sector investment in climate adaptation by acting as enablers, regulators and/or co-investors (OECD 2023). This includes using public investment to de-risk private adaptation, such as offering financial incentives or rebates to retrofit buildings to achieve higher levels of climate resilience. It may also include using public infrastructure upgrades, such as development of cool green spaces, to catalyse private development in surrounding areas.

3. How local governments manage nationally significant climate risks

Key findings

- The success of councils in managing local climate risk has a defining influence on how well Australia meets its climate adaptation objectives at the national scale.
- The local government sector plays an important role in all 'systems of national importance' identified in Australia's National Climate Risk Assessment. This role is most pronounced in the areas of health and social support, infrastructure, the natural environment, and emergency management.
- For example, in the health and social support system, councils provide physical and mental health and wellbeing services – such as maternal and child health care, aged care, immunisation programs neighbourhood houses and community centres. This creates preventative health benefits for Australians that reduce demand on Australian Government and state/territory-funded healthcare and other support mechanisms, while reducing community vulnerability to disasters.
- Despite local governments' adaptation leadership role, their capacity to respond to nationally significant climate risks is already under severe pressure. Without more predictable sources of funding and support from other levels of government, the sector will be increasingly constrained and unable to adapt effectively.

Australia's *National Climate Risk Assessment First Pass Assessment Report* (Australian Government 2024) (NCRA) describes a range of nationally significant risks across eight 'systems of national importance'. The first pass report is currently being augmented by a deeper assessment of these risks that, when released, will provide the evidence base to inform Australian Government climate adaptation efforts.

As the closest level of government to the public, local governments play a pivotal role in managing many of the nationally significant risks highlighted in the NCRA. By addressing risks at the local level, councils help to avoid or reduce the escalation of risks to a national scale that would require more significant intervention by the Australian Government.

Local governments' capacity to continue responding to nationally significant climate risks will be increasingly constrained by the projected impacts of climate change and the resulting financial and physical impacts. Without continued investment in adaptation at the local government scale, the magnitude of potential impacts from climate-related risks will increase the need for direct intervention by other levels of government. This highlights the importance of recognising and supporting local government adaptation action in current and future national adaptation policy.

System summaries

To underscore the varying role of local governments in successful adaptation across the eight systems of national importance in the NCRA, the following pages comprise seven 'system summaries' that describe:

- Local government's role in managing risks to each system
- Examples of tangible actions taken by local governments in each system – this reflects the 'Response' element of the typology defined above

- How the impacts of climate change on local government may have flow-on consequences for nationally significant risks identified in the NCRA.

In recognition of the diversity of climate risk interpretations and experiences among First Nations peoples, a summary has not been produced for the 'First Nations values and knowledges' system. Further discussion on the overall role of First Nations perspectives in local government adaptation is discussed earlier in this report (see *First Nations values and knowledges and local government adaptation*).

*Table 4 Summary of key local government roles in each system of national importance, including example national benefits of local government action. **Note that local government roles are generalised on a national basis**, and arrangements differ based on factors such as jurisdiction, location and population size; for example, NT local governments do not undertake land use planning.*

System of national importance	Role of local governments (not exhaustive)	National benefits of local government action (examples)
Health and social support system	Providing safe and accessible community facilities where people can connect, seek relief and access services. Providing physical and mental health and wellbeing services, including maternal and child health care, aged care, immunisation programs neighbourhood houses, and community centres.	• Preventative health benefits that reduce demand on Australian Government and state/territory-funded healthcare and other support mechanisms (e.g. Jobseeker). • Reduces underlying community vulnerability to disaster events and supports community connection during recovery.
Infrastructure and built environment	Delivering and managing more than one-third of Australia's public infrastructure.	• Quality local roads and drainage improve flood resilience. • Improved emergency response capacity and fewer requests for support under Disaster Recovery Funding Arrangements (DRFA).
Natural environment	Protecting and enhancing natural and culturally significant spaces to support human and ecological health outcomes.	• Protecting Matters of National Environmental Significance (MNES), supporting resilience in the face of climate stressors. • Supports healthier, more disaster-resilient communities.
Defence and national security	Delivering social and community development programs, hazard mitigation through infrastructure upgrades and planning amendments, and local emergency response and recovery.	• Strong local emergency management reduces demands on Australian Government and Australian Defence Force (ADF). • Social cohesion reduces underlying drivers of violent extremism.
Economy, trade and finance	Fostering local economic activity including through provision of grants, benefits and incentives to increase communities' financial capacity to cope with impacts.	• Support resilient local businesses and their contribution to GDP and economic growth. • Fostering industry and community collaboration to seize opportunities associated with transition to a low emissions economy.
Primary industries and food	Managing infrastructure that supports the primary industries and food system	• Improved economic contribution from agricultural exports.

System of national importance	Role of local governments (not exhaustive)	National benefits of local government action (examples)
	and supporting economic development in primary producing communities.	• Better mental and physical wellbeing outcomes.
Regional and remote communities	Bridging the gap between isolated communities and key services and infrastructure.	• Improved regional economic output and resilience to extreme events. • Service provision where market failure occurs, such as for skills and training, childcare, aged care, healthcare and resource recovery facilities. • *In regions hosting the energy transition:* brokering constructive legacy associated with renewable energy, between communities, landholders, regulators, private sector and others.

System summary: Health and social support

As defined in the NCRA, '*the health and social support system refers to population health and wellbeing, as well as the provision, availability, and access to health, wellbeing and social services. This system includes services that encompass healthcare, public and preventative health, aged care, disability services, housing support, employment and financial wellbeing and their supporting infrastructure.*' (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to (Department of Health and Aged Care 2025):

- Partial funding of hospitals under the National Health Reform Agreement and other Australian Government contributions
- Managing Australia's universal public health insurance scheme (Medicare)
- Regulating private health insurance
- Funding and regulating residential aged care
- Providing social security payments, including Jobseeker and the Disability Support Pension
- Administering the National Disability Insurance Scheme (NDIS).

Local government's contributions in managing risks to the health and wellbeing of Australians

Local governments have a deep understanding of how local health and wellbeing outcomes can be affected by climate-related hazards. Their understanding of the social, cultural, economic and environmental context is critical for identifying the most effective local interventions, reducing strain on the primary health system and improving people's health.

Local governments manage risks to health and wellbeing of their communities through a range of services and targeted programs aimed at reducing the vulnerability of the community to impact and/or enhancing their capacity to cope with natural hazards and a changing climate.

Table 5 Examples of local government's contributions in the health and social support system

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Providing health and wellbeing services, delivered within and outside of local government owned facilities, including: • Maternal and child health programs • Immunisation programs • Emergency relief and support programs • Environmental health services • Targeted health and social support programs with Indigenous communities • Connection to resources and services that are not provided directly by local government, including mental health programs.	Helps to reduce vulnerability to a range of climate-related risks and supports adaptive capacity across the community by: • Enhancing resilience to a range of climate-driven or climate-exacerbated health impacts, such as immunisation against vector-borne diseases. • Providing physical and mental resources to support communities before, during and after an emergency. • Supporting vulnerable community members, such as mothers, children and aged care recipients, to stay healthy and make climate-resilient choices.
Providing infrastructure to support health service delivery and preventative health outcomes, including: • Aged care and disability facilities • Neighbourhood houses • Community centres and libraries • Playgrounds • Sporting facilities • Walking and cycling infrastructure • Safe housing.	These facilities and enabling infrastructure support the community to adapt to climate change by: • Reducing health-related determinants of climate vulnerability (e.g. obesity). • Providing spaces for community to congregate, both during and outside of emergency periods and as heat refuges. • Providing safe housing and shelter for vulnerable populations, including for evacuation purposes.

Examples in lights

Climate Safe Rooms, City of Geelong (Vic)
Physical and technological measures – grey physical infrastructure

To help protect selected vulnerable households from the impacts of temperature extremes, the Climate Safe Rooms project retrofitted one room in each house to remain comfortable during both summer and winter. The project focused on 16 people identified as most at risk of serious illness or death and provided insulation, draught proofing, and energy efficient air-conditioning offset by small solar systems. The project reduced the exposure of individuals most at risk in the community from the health impacts associated with a changing climate.

Tackling Mosquitos Together, Northern Rivers councils (Tweed Shire, Ballina Shire, Byron Shire, Clarence Valley, Kyogle, Lismore City, Richmond Valley Councils) (NSW)
Knowledge-based, behavioural and cultural change measures – behavioural change program

Climate change is projected to bring more frequent and intense hot and wet periods. Communities can expect to face increased risk of vector-borne diseases, such as Ross River Fever and Barmah Forest Virus. Northern Rivers councils developed a behavioural change program to reduce residents' risk from mosquito carrying illnesses. The program provided guidance and workshops to encourage residents to reduce backyard mosquito breeding and improve personal protection behaviours.

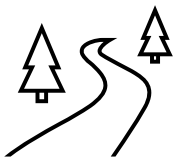
How the impacts of climate change on local government activity threaten Australia's health and social support system

The NCRA identifies a range of nationally significant risks for the health and social support system, including those related to service delivery and workforce, communicable diseases, health infrastructure, and individuals and communities at risk.

Table 6 provides an example of how one nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

Table 6 Flow of climate change impacts at the local level through to the national scale – health and social support system

Selected nationally significant risk (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Service delivery and workforce: Risks to delivery of health and social support services and the health workforce that are caused by increased demand, cost and disruptions	• Damage to roads caused by extreme events (e.g. bushfire, flood) preventing delivery of, or access to, council services. • Increasing cost of goods, such as medicine, due to supply chain impacts from climate-related events.	• Disruption to council's delivery of in-home services (e.g. maternal and child health visits). • Inability of council staff to access workplace to provide services. • Increased costs to deliver immunisation programs. • Increased demand on council services following extreme events.	• Poorer national health outcomes due to disruptions in delivery of preventative and curative healthcare services. • Increased demand for health services funded by other levels of government. • Burn-out of local government workforce, placing increased pressure on other workforces and services.



System summary: Infrastructure and built environment

As defined in the NCRA, '*the infrastructure and built environment system refers to the intricate networks of human-made structures across Australia. This includes physical buildings, green and blue spaces, and their supporting infrastructure such as transport, water, and energy systems*.' (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to:

- Planning, prioritising and investing in nationally significant infrastructure projects, particularly major transport infrastructure, including interstate and nationally significant road, rail and freight networks, and airports
- Economic regulation of key energy systems and markets, including wholesale gas and electricity

- Managing risks to national security associated with infrastructure defined as 'critical' under the *Security of Critical Infrastructure Act 2018* (SOCI Act)
- Providing telecommunication and digital infrastructure, including the National Broadband Network (NBN).

As the climate changes, the infrastructure and built environment system is projected to come under significant stress.

Local government's contributions in managing risks to infrastructure and built environment

Local governments play a pivotal role in managing and maintaining approximately one third of all public infrastructure across Australia, while local roads make up 77% of the national network by length (ALGA 2024). These assets contribute to the liveability and desirability of many areas, while also providing the enabling infrastructure to support the health, wellbeing and economic prosperity of communities. Some local government infrastructure is defined as 'critical' under the SOCI Act, including regional airports and sewerage (Australian National Security 2024).

Table 7 Examples of local government's contributions in the infrastructure and built environment system

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Delivery and maintenance of assets and infrastructure, including: • Roads • Bridges • Footpaths • Drains • Parks and play equipment • Recreational centres and other community facilities, including libraries (see Health and social support system summary) • Green and blue infrastructure, such as reserves and waterways.	Can support the community to adapt to climate change by: • Providing infrastructure that is resilient to impacts from extreme weather and can remain operational during and following a disaster event. • Providing safe spaces for community to congregate both during and outside of emergency periods and as heat refuges. • Actively managing and maintaining assets, such as clearing stormwater drains, to mitigate potential impacts from heavy rainfall events. • Using nature-based solutions that offer improved resilience outcomes compared to engineered measures, such as mangroves for coastal protection.
Planning and regulation of assets and infrastructure for both council owned and operated infrastructure, and private and commercial infrastructure, including: • Urban planning and future growth planning • Preparing and administering planning schemes • Issuing planning and building permits • Enforcing legislation and regulations, such as building codes.	Can help to reduce vulnerability to a range of climate-related risks and build adaptive capacity to cope with impacts of extreme weather by: • Preventing development in inappropriate areas, such as flood zones. • Ensuring appropriate preventative measures are in place to reduce impact from extreme events, such as bushfire clearance area around homes. • Committing to the delivery of community infrastructure that is resilient to extreme events such as high heat and power outages. • Reducing exposure to risks that drive insurance costs for local communities, noting that this

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
	requires insurers to reflect risk mitigation in premiums.

Examples in lights

Safeguarding Communication Infrastructure Against Extreme Heat, Albury City Council (NSW)
Physical and technological measures – grey physical infrastructure measure

To protect telecommunication infrastructure against the impacts of extreme heat events, Albury City Council upgraded cabinet casings at several remote IT transmission stations. These upgrades have enhanced the resilience of Council's microwave transmitters to heat, ensuring reliability of internet and phone connection at 22 critical sites, including at the Emergency Management Centre and water filtration plant. When ambient temperatures inside the cabinets reach 38°C, internal cooling fans are activated to protect the equipment from overheating.

Grantham Re-location, Lockyer Valley Regional Council (Qld)
Physical and technological measures – grey physical infrastructure measure

Following a devastating flood in January 2011, which killed 12 people and destroyed 100 homes, the township of Grantham was relocated to higher ground. Previously built on a floodplain, residents were offered the opportunity to relocate to areas outside of the floodplain to reduce exposure to future flooding events. With Australian Government and Queensland Government funding, Lockyer Valley Regional Council purchased a 378-hectare plot of land on a hill from a local property owner which could provide 120 blocks of land. A 'land swap' was offered, with participating residents handing over flood affected land to the Council in exchange for a block of land on the newly purchased higher land.

How the impacts of climate change on local government activity threaten Australia's infrastructure and built environment system

Local governments are already financially constrained in providing and servicing public infrastructure, with current council budgets insufficient to keep pace with required maintenance and repair works. Considering local roads alone, the Grattan Institute estimated an additional $1 billion is required annually to maintain current conditions (Terrill, Bradshaw & Jones 2023). Mechanisms to seek additional funding—such as state and Australian Government grant programs—are inadequate for addressing the shortfall, inefficient, and can be cumbersome to navigate.

In this context, there is currently limited capacity to 'build back better' after disasters. The lack of financial capacity for effective maintenance and betterment means local infrastructure is vulnerable to repeated impacts as the frequency and severity of extreme climate events intensifies.

Table 8 provides an example of how a nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

Table 8 Flow of climate change impacts at the local level through to the national scale – infrastructure and built environment system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Building liveability: Risks to buildings and building liveability that reduce building life expectancy and increase maintenance and running costs	• Reduced life expectance (e.g. accelerated weather) and running costs (e.g. higher heating demands of council assets and infrastructure. • Damage to, or loss of, private residences due to an extreme event (e.g. bushfire, flood). • Higher rates of heat-related morbidity in poorly sealed and ventilated private residences.	• Inability to use certain council assets and infrastructure. • Increased demand on council services, including provision of temporary accommodation for community members. • Increased administrative burden on councils in applying for disaster recovery funding to support community members rebuild. • Poorer community health outcomes affect social cohesion and increase demand for council support.	• Poorer national health outcomes. • Increased demand for Australian Government -funded healthcare support. • Increased need for Australian Government investment to support facility maintenance and upgrades.

System summary: Natural environment

As defined in the NCRA, '*the natural environment system refers to Australia's ecosystems, biodiversity, and natural processes. This system includes the ocean around Australia (covering the Exclusive Economic Zone and sub-Antarctic islands), coastal areas and shorelines, as well as the natural environment that is not part of urban or agricultural zones (with some overlap), such as national parks, rangelands, grasslands, forests and bushlands, and other natural landscapes.*' (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to:

- Management of Commonwealth land, waters and marine areas.
- Matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (DCCEEW 2025).
- Upholding international treaties and agreements (such as the Ramsar Convention on Wetlands of International Importance and the Paris Agreement on Climate Change).
- Implementing biosecurity controls to address threats from pest plants, animals and diseases.
- Cooperation with states and territories on regulation of key issues subject to national environmental protection measures (NEPMs).

As the natural environment underpins each system of national importance, any threat to this system jeopardises the security and sustainability of all other systems.

Local government's contributions in managing risks to the natural environment

Local governments are a major spender on environmental protection, including through investments in waste management, biodiversity, water management and biosecurity (ALGA 2024). Local governments also have the capacity to influence local communities around environmental stewardship through levers such as land use planning, local laws and urban forest strategies. However, many councils do not have adequate financial or resourcing capacity to proactively use these levers and instead must focus on basic compliance with legislation and standards.

Table 9 Examples of local government's contributions in the natural environment system.

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Management, maintenance and protection of natural environment, including: • Parks and open spaces • Trees • Roadside weed and pest control • Water catchments, including creeks and riverbanks • Coastal and foreshore management • Driving innovation through trials of highly localised approaches to environmental protection in a changing climate, such as pilots for resilient tree species and reefs.	• Reducing the urban heat island effect by providing natural cooling areas, protecting the public during heatwaves. • Supporting the maintenance and/or enhancement of biodiversity to build ecological resilience to climate stressors. • Reducing impacts from heavy rainfall events by providing naturally absorbent surfaces to limit flash flooding.
Regulation of the natural environment to ensure conservation and/or protection, including through: • Urban planning and future growth planning • Preparing and administering planning schemes • Issuing planning and building permits	Can reduce community exposure to a range of climate-related risks and build adaptive capacity to cope with the impacts of extreme weather by: • Preventing development in areas of environmental significance or importance, or where there is likely contamination which could risk public safety. • Implementing protection zones/buffers to ensure properties are set back from coastal areas to protect from erosion and sea level rise. • Enforcing sustainable land management practices that protect ecosystem services.
Engaging with Traditional Owners to enhance community and council approaches to caring for Country.	Supporting First Nations peoples and living Traditional Knowledge as a strength for local adaptation.

Examples in lights

Canopy Resilience – Green Streets in Sutherland
Sutherland Shire Council (NSW)
Physical and technological measures – green physical infrastructure measure

Sutherland Shire Council has implemented a Green Streets Program focused on replenishing tree canopies across private and public spaces within the municipality. The program replaces trees that have been removed on private and public property due to development and provides planting in areas that have not been previously planted. Since 2013, the Program has planted nearly 14,000 trees, significantly enhancing the canopy cover of the municipality. This has helped to reduce the urban heat island effect and provided substantially more habitat for local and native wildlife.

Dell Eco Reef
City of Greater Geelong (Vic)
Physical and technological measures – blue physical infrastructure measure

To mitigate the impacts of coastal erosion from sea level rise and extreme storm events, the City of Greater Geelong has invested in concrete wave break modules to reduce the impact from unfettered waves. The modules are placed in the shoreline and serve as an artificial reef, breaking up the intensity of the wave. The modules have also enabled growth and additional habitat for marine organisms. This has provided additional recreational benefits for beachgoers allowing them to snorkel and observe wildlife at high tide.

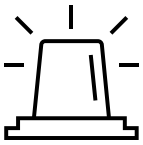
How the impacts of climate change on local government activity threaten Australia's natural environment system

Climate change threatens the intrinsic value of nature and the ecosystem services that underpin Australia's society, wellbeing, cultural identity and economy. Climate change is having—and will continue to have—tangible impacts on the natural environment. This includes through rising temperatures affecting seasonal events like species breeding and migration, saltwater intrusion into freshwater systems from rising sea levels, and warmer ocean temperatures stressing marine ecosystems and coral reefs.

Table 10 describes how a selected nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risk were to occur, and details potential implications for the system at a national level.

Table 10 Flow of climate change impacts at the local level through to the national scale – natural environment system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Use and management of natural places: Risks to access, use and management of natural places from fire season and hot days, as well as damage to roads, built infrastructure and coastal developments	• Degradation of natural environment due to changes in climate conditions. • Loss of council-managed access routes to natural spaces due to an extreme event (e.g. bushfire, storm).	• Inability of councils undertake conservation and/or preservation work. • Increased investment in maintenance and management budgets for natural environment spaces. • Increased need to expand capacity of management and maintenance teams.	• Chronic degradation of ecosystem services that underpin Australia's society, economy, cultural identity, and wellbeing. • Poorer health outcomes due to reduced access to or loss of natural environment. • Damage to Australia's reputation as an eco-tourism destination.



System summary: Defence and national security

As defined in the NCRA, '*the defence and national security system refers to the structures and functions dedicated to safeguarding Australia's domestic stability and international interests, including disaster readiness and risk reduction. This system includes all emergency management services, workforce and volunteers, defence operations and their workforce, particularly with respect to the role of military in disaster response or geopolitical tensions arising from extreme events.*' (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to:

- Raising and maintaining the Australian Defence Force, including the Australian Army, Royal Australian Air Force and Royal Australian Navy (ADF 2024).
- Protecting national security, including through counter-terrorism operations, maintaining national cyber security and border security (Australian National Security 2024).
- Emergency management activities, playing a coordinating role that complements the primary role of state, territory and local governments in emergency preparedness and response (NEMA 2023).

Climate change could have significant impacts on Australia's ability to ensure national security. More frequent natural disasters may overwhelm the capacity of the Australian Government to respond and distract from other defence objectives and may also increase regional instability through resource competition and mass migration (Australian Government 2023).

Local government's contributions in managing risks to defence and national security

The role of local government in managing risks to defence and national security is primarily through emergency management. This includes through supporting communities to prepare for, respond to and recover from disaster events, and increasing the resilience of critical infrastructure under its management,

such as roads and water systems. Local government social and community development efforts also play an underappreciated role in countering against threats to national security, such as organised crime and violent extremism.

Table 11 Examples of local government's contributions in the defence and national security system.

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Delivering emergency management activities: • Preparation of community disaster plans • Rapid provision of staff to support response and recovery activities • Administering local grants and financial support for disaster-affected residents, such as rates concessions • Supporting on-the-ground delivery of Australian Government emergency management priorities • Accessing funding for, and implementing, recovery and reconstruction projects.	Enhances a community's ability to cope with impacts by: • Increasing community awareness of potential hazards and impacts, and risk mitigation strategies. • Providing safe spaces for community members to seek shelter or refuge from disaster events. • Long-term stewardship of disaster recovery, reconstruction and betterment initiatives, which may take decades to fully implement.
Maintaining local infrastructure important to disaster resilience, including local roads, water, drainage, coastal defences, and waste facilities.	• Reduces the likelihood and severity of extreme event impacts, such as flooding resulting for inadequate drainage infrastructure. • Reduces potential disruptions to services and supporting infrastructure during and following disaster events.
Delivery of social and community development programs, facilities and events, such as festivals, clubs and libraries.	Council efforts to foster local community activities and connectivity help to: • Mitigate sources of antisocial behaviour that can lead to threats to national security. • Establish informal networks than can be drawn on for support when faced with a climate-related shock.

Example in lights

South Australia Climate Ready Communities
Various councils, supported by Australian Red Cross
Knowledge-based, behavioural and cultural change measures – educational programs and targeted information provision

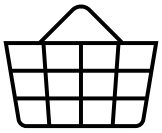
Australian Red Cross, in partnership with councils across SA, is coordinating the Climate Ready Communities Program to empower people to understand the risks they currently face, the way these are changing, and what they can do to build their resilience. It has developed a guide to support communities to have their own conversation about how the things they value could be affected by climate change, and what they can do to continue to thrive. The program trains community champions on how to plan and deliver activities and events in their communities, and the opportunity to get involved in the Red Cross's emergency response and preparedness activities.

How the impacts of climate change on local government activity threaten Australia's defence and national security system

Table 12 provides an example of how a nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

Table 12 Flow of climate change impacts at the local level through to the national scale – defence and national security system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Disaster response and recovery: Risks to domestic disaster response and recovery assistance from the competing need to respond to multiple natural hazard events, resulting in concurrency pressures and overwhelming the Government's capacity to respond effectively	• Increasing need for local governments to step up on disaster response due widespread concurrent demands on state, territory and Australian government resources • Local government emergency response capacity overwhelmed by the extent and/or severity of an acute event • Poorer health outcomes in the community due to slow or inadequate support from government	• Increased local government expenditure on emergency management, undermining capacity to spend in other areas • Reduced community trust in local government to prepare for, and respond to, disasters and climate change • Damage to critical infrastructure	• Increase in amount of Australian Government funding required to sustain emergency response at state, territory and local levels • Poorer health outcomes across Australia • Increased need for Defence Force support in emergency events at local level, detracting from national defence objectives



System summary: Economy, trade and finance

As defined in the NCRA, '*the economy, trade and finance system' refers to Australia's interconnected insurance and investment markets, import and export markets, the distribution of goods and services, and the institutional arrangements that govern them. This includes the institutional arrangements governing economic activities and trade networks across scales.*' (DCCEEW 2024b)

In terms of the economy, trade and finance system, the Australian Government is responsible for activities including, but not limited to:

- Economic management including setting fiscal policy (budgeting, taxation and spending)
- Overseeing economic growth, inflation control, employment, and national debt
- Collecting taxes and providing revenue to state, territory and local governments
- Negotiating trade agreements and foreign investment.

Climate change could have significant impacts on Australia's economy, trade and financial system. More frequent and extreme weather events could disrupt key revenue generating industries including agriculture, tourism and infrastructure, creating economic viability and higher costs. Trade may also be affected by shifting global demand for low-emissions products and changing supply chain risks.

Local government's contributions in managing risks to economy, trade and finance

Councils know what local targeted investments and support mechanisms will enable communities to grow and prosper, in support of Australia's broader economy, trade and finance system. Compared to the Australian Government, local governments provide a more practical and place-based focus to economic growth, planning, infrastructure, procurement, jobs, and financial management.

Table 13 Examples of local government's contributions in the economy, trade and finance system.

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Supporting local economic development and productivity, including through: • Tourism planning and attraction of investment • Offering grants and incentives • Business mentoring • Establishing local procurement channels through which local governments source work • Creating connections between local industry and other partners, such as research and academic institutions • Investing in local infrastructure that underpins the liveability and desirability of townships as places of employment and economic activity • Provision of locally relevant training and skills • Brokering agreements and securing social licence for new infrastructure (e.g. renewable energy).	• Providing opportunities to generate income which can reduce the financial vulnerability of residents and increase adaptive capacity to respond to climate impacts. • Strengthening connections between different parts of the local community which can support better outcomes during and following an extreme event. • Ensuring that new infrastructure and industries which arise from decarbonising the economy align with local expectations, minimising potential adverse consequences for social cohesion and community resilience (Dyer 2023).
Financial management of local government rates, including: • Collection of rates, fees and charges from residents • Budgeting and planning expenditure.	• Investing in climate-resilient infrastructure to reduce impacts from extreme climate events • Invest in programs to support community members build personal resilience to climate change.

Examples in lights

Solar Savers, City of Darebin (Vic)
Economic and financial measures – financing and incentive instruments

To increase the adaptive capacity of community members to heatwaves, the City of Darebin introduced a financing model that used council rates to help low-income households access solar energy. The program supported the delivery of 434 solar systems across 22 councils, reducing annual electricity costs by an average of $260 per household. An independent evaluation of the program underscored the value of solar in enabling cost-effective cooling during heatwaves, highlighted councils' success in drawing private investment through bank partnerships and pointed to the advantages of a shared services model in reducing both risk and resource burden for participating councils.

Principles for successful renewable energy development,[4] Hay Shire Council (NSW)
Economic and financial measures – strategic economic development planning

Located within the South-West Renewable Energy Zone (SWREZ), the community of Hay faces opportunities and challenges from the low carbon transition. In response, the Hay Shire Council developed this set of principles to help ensure that future renewable energy development delivers long-term benefits for the community. It aims to support fair, transparent and community-focused decision making by providing a framework for negotiating with developers and assessing proposals. The principles focus on protecting local values, enhancing liveability, ensuring economic and social returns, and aligning with community priorities.

How the impacts of climate change on local government activity threaten Australia's economy, trade and finance system

The NCRA identifies a range of nationally significant risks for the economy, trade and finance system, including those related to governments' finances and capacities, individual and household budgets, and production and consumption of goods and services.

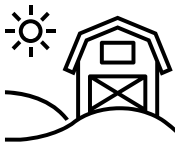
Of most relevance to the Australian Government is the potential for climate change impacts to overwhelm the already constrained financial capacity of local governments, requiring greater investment and intervention from other levels.

Table 14 provides an example of how this nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

[4] Note: This case study is provided to illustrate a specific type of adaptation action but was not included in the dataset of 219 project examples reviewed for this study as analysis had been completed in an earlier phase.

Table 14 Flow of climate change impacts at the local level through to the national scale – economy, trade and finance system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Governments' finances and capacities: Risks to governments' finances and capacities that decrease revenue, increase expenditure and increase demands for government involvement	• Increased local government expenditure and reduced revenue during and following an extreme event (e.g. bushfire, flood, cyclone) • Reduced property value in residential areas due to increased exposure to chronic events (e.g. sea level rise)	• Decreased revenue from residents due to reduced taxes, charges and levies • Increased local government expenditure on disaster recovery efforts resulting in less funding for other activities, services, infrastructure • Increased demand for local government financial assistance from residents due to constrained personal finances	• Increased funding from other levels of government required to sustain local governments • Decreased revenue at national level • Reprioritisation of Australian Government spending due to competing priorities, such as funding emergency recovery and response at local level



System summary: Primary industries and food

As defined in the NCRA, '*the primary industries and food system refers to land, marine, and estuarine commercial activities dedicated to producing food, fibre, wood, fuel, and other products. This system includes agriculture, aqua and mariculture, fisheries, and forestry sectors, spanning large-scale and smallholder operations, both commercial and non-commercial, covering the entire chain from extraction to consumer.*' (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to (DAFF 2024):

- Managing international trade agreements, export certifications, and biosecurity for exports
- Management of biosecurity at borders and regulating the import and export of agricultural products
- Providing financial assistance, drought and disaster relief and recovery funding for primary producers.

Local government's contributions in managing risks to the primary industries and food system

As the closest level of government to primary producing communities, local governments play an important role in providing education, supporting best practice land management, maintaining infrastructure that producers rely on such as roads, and distributing grants and funding received from other levels of government. Councils also play an important role in zoning, which can be used to reduce exposure of farms to hazards such as bushfires and flooding.

Table 15 Examples of local government's contributions in the primary industries and food system.

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Management and maintenance of assets that support the primary industries and food system, including: • Transport routes, including local and main roads • Bridges • Catchment areas, drainage.	• Ensuring transport and supply chain routes are resilient to the impacts from climate change to limit the number and extent of disruptions. • Collaborating with water corporations and catchment managers to ensure resilient, diverse and reliable supplies of water to protect against periods of dryness and drought.
Economic development in primary producing communities, including through: • Business support programs, such as grants and networking opportunities • Market development, such as supporting farmers markets and food festivals • Facilitating collaboration and innovation between industry groups, research organisations and government agencies.	Can increase the adaptive capacity of the community to changing climatic conditions by: • Providing opportunities and access to information, techniques and collaborators working in climate-resilient farming. • Providing financial support to help farmers, growers and producers increase resilience to climate impacts and/or recover following disaster events.

Example in lights

Mapping Sydney's foodsheds, Wollondilly Shire Council (NSW)
Knowledge-based, behavioural and cultural change measures – advocacy and lobbying

Local food production within the Sydney basin delivers a range of benefits and plays a key role in strengthening the city's resilience. However, increasing competition for fertile land the growing impacts of climate change pose risks to the future availability of fresh, locally grown food. To address this, Wollondilly Shire Council undertook a comprehensive mapping exercise of existing and potential food production areas, creating an evidence base to inform future policies and drive innovation that supports the long-term viability of agriculture in the region.

How the impacts of climate change on local government activity threaten Australia's primary industries and food systems

Local government plays a significant role in promoting the economic security and viability of primary industries and food, and providing support to the community members working in these sectors. These existing strengths are expected to become increasingly important in future, with climate change expected to affect the viability of significant tracts of farmland, increase incidences of crop and stock losses, and change what can be produced within some regions of Australia.

Table 16 provides an example of how one nationally significant risk identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

Table 16 Flow of climate change impacts at the local level through to the national scale – primary industries and food system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level?	Consequences for council operations	National impact from degraded level of council operations
Health and wellbeing: Risks to physical and mental health of primary producers and their communities that may cause financial and emotional stress	• Climate pressures make primary production more difficult. • Disruption to farm productivity and incomes. • Demographic changes as people leave farming communities.	• Greater demand and pressure on council-provided physical and mental health services. • Increased pressure for council to provide financial support to primary producers, such as rate concessions. • Local skills shortages affecting council service delivery.	• Diminished national income from exports. • Increase need for Australian Government and state/territory government investment in health and wellbeing programs, due to increased demand and reduced local government capacity. • Adverse impact on national identity, of which Australia's primary producers play an important role.

System summary: Regional and remote communities

As defined in the NCRA, '*the regional and remote communities' system refers to all (natural, social, economic, and built) aspects of communities in Australia that are beyond major urban centres. This system includes regional centres, towns, remote communities, mining settlements, small islands and external territories.'* (DCCEEW 2024b)

In this system, the Australian Government is responsible for activities including, but not limited to:

- Funding grant programs and major infrastructure works (DITRDCA 2024)
- Delivering and/or funding remote national services such as Royal Flying Doctor Service
- Leading policy and funding for First Nations programs in health, housing, education and land rights (NIAA 2024)
- Providing disaster response and recovery funding.

Local government's contributions in managing risks to regional and remote communities

The role of local government in managing risks is arguably more pronounced in regional and remote communities, where populations are more dispersed, exposure to hazards like bushfire is often higher, and there is less access to resources and services than in urban centres (Colvin 2024). Local government

is often the first to respond in times of crisis, both for acute events such as bushfires and floods, and for the slow-moving impact of chronic changes on local infrastructure and economies.

Table 17 Examples of local government's contributions in the regional and remote communities system.

What are the main local government responsibilities in this system?	How does local government build climate resilience in this system?
Management and maintenance of assets and services that support regional and remote communities, including: • Maintaining local roads and bridges that connect isolated communities and supply chains • Operating community health hubs in areas with limited other service offerings • Funding regional airports to enable access to community.	• Supports the resilience of transport and supply chain routes (road and air) to ensure isolated communities are not cut-off during or following extreme events which could exacerbate poor health outcomes. • Ensuring that facilities are resilient to impacts and can operate as intended to delivery critical services, such as health care.
Supporting emergency management preparedness and recovery in regional and remote communities, through: • On-ground support, such as tree pruning and conducting controlled burns • Providing educational and awareness-raising programs for community members in how to prepare for extreme events, such as bushfires and floods • Delivery of emergency relief activities, such as providing temporary shelter and food during and following extreme events.	Can increase the adaptive capacity of people in regional and remote communities by: • Reducing exposure to hazards through preventive and proactive actions • Reducing the potential impacts from an extreme climate event by equipping residents with tools and knowledge of how to prepare and respond.

Examples in lights

Filling the tanks, Nambucca Valley Council (NSW)
Physical and technological measures – grey physical infrastructure measures

To strengthen community resilience in the face of bushfires and drought, Nambucca Valley Council established a water refill station in the regional town of Bowraville on the Mid North Coast of New South Wales. Designed to support both residents and emergency services, the station offers a dependable local water source, reducing the need for long-distance travel during emergencies. The station features a pay-as-you-go system to ensure flexible access while enabling council oversight, including the ability to provide free water during critical times.

Planning for a climate resilient airport, Cobar Shire Council (NSW)
Internal governance and processes – integrating climate change imperatives into council strategies, plans, business processes and services

Cobar Shire Council integrated climate change considerations into a 20-year development strategy for Cobar Regional Airport through a master planning process. The plan outlines climate-responsive strategies to ensure the resilience of critical airport operations and infrastructure. It includes a revised airport layout designed to minimise environmental risks and improve usability for the many stakeholders who rely on the facility, including the Royal Flying Doctors Service and access for the local mining industry.

How the impacts of climate change on local government activity threaten Australia's regional and remote communities

The NCRA identifies a range of nationally significant risks for regional and remote communities, including those related to community cohesion, emergency services and recovery, and pressures on local governance. Table 18 describes one of these nationally significant risks identified in the NCRA may play out at a local level. It also describes the flow-on implications for local government activities and responsibilities if the risks were to occur, and details potential implications for the system at a national level.

Table 18 Flow of climate change impacts at the local level through to the national scale – regional and remote communities system

Selected nationally significant risks (NCRA)	How could this risk play out at the local level? →	Consequences for council operations	National impact from degraded level of council operations
Community cohesion and resilience: Risks to community cohesion and resilience through exacerbated outmigration, environmental degradation, decreased liveability, and increased inequality and conflict	• Reduced liveability of regional and remote communities due to more frequent and intense extreme events (e.g. flood, bushfire, cyclone, drought). • Increased migration away from regional and remote communities. • Higher crime rates and degraded social fabric.	• Loss of rate-paying community members due to outmigration, placing pressures on service delivery. • Loss of skilled workforce to deliver key services such as healthcare and education, which could place greater demands on the role councils play. • Increasingly challenging to govern.	• Increased need for Australian government investment in regional and remote areas to stimulate growth and opportunities. • Loss of people living in regional and remote areas. • Increased levels of violent extremism driven by lower social cohesion and more disenfranchised rural and regional communities.

4. The national economic value of local government adaptation action

Key findings

- Analysis of five new case studies shows that direct investment in climate adaptation activities produces high returns for local communities of *at least* $0.80 to $3.10 for every $1 invested. This is even before accounting for employment benefits, improved productivity and other benefits that could not be quantified.
- These five new case studies from across Australia demonstrate that adaptation actions such as urban greening, strategic floodplain retreat, bushfire preparedness programs, and planning controls for future sea level rise deliver substantial avoided costs, improve community resilience, and support better environmental outcomes.
- A conservative estimate of current Australian local governments' direct expenditure on climate adaptation actions is at least $400 million per annum or $2 billion to 2030. This $2 billion investment is estimated to benefit local communities of between at least $2.2 and $4.7 billion.
- Large adaptation projects are afforded through by once-off funding grants. Short-term reactive funding is not sufficient to address the effects of climate change. Councils need consistent, ongoing funding to plan, sequence and implement effective adaptation strategies, such as urban greening, heatwave response, floodplain management and community education. These measures only work when built upon over time.
- Additional secure ongoing funding from the Australian Government would enable better planning, build capability and target the most pressing risks. Every dollar would deliver stronger returns through greater efficiencies, compounding benefits and reduced future costs.

Findings on the value of local government adaptation from five new case studies across Australia

This assessment includes five new case studies on the value of local government adaptation across Australia. The case studies represent a range of action types, metro and regional locations, climate hazards, and geographical areas (see Appendix 3).

This economic analysis was designed to demonstrate the national value of local government adaptation. It assessed the total value of local government adaptation through detailed case studies and national expenditure estimates.

The findings highlight not only the real, measurable impact of actions already underway, but also the potential value of increasing and sustaining funding. They show how local adaptation can reduce risks, lower long-term costs, and deliver greater benefits, especially for Australia's most vulnerable communities.

For each case study the costs and benefits of a specific climate adaptation investment were identified. These were quantified where possible to provide an understanding of the net benefits of investment. For each case study a high confidence range of values is provided, reflecting uncertainty over the future

impacts of climate change as well as other sensitivities and assumptions[5]. The findings from the five case studies are summarised in Table 19.

Table 19 Summary of findings from economic analysis of adaptation investments

Case study	Typology	Dollar benefits per dollar of cost	Key public benefits[1]
City of Darwin – Urban Cooling	Physical and technological measures	$1.1 - $3.1 benefit per $1 cost	⊕ 🌿 🏃
Lockyer Valley Regional Council – Flood Management	Economic and financial measures	$0.8 - $1.3 benefit per $1 cost	🏠 ⊕ 🚨
City of Hobart - Bushfire Resilience	Knowledge-based, behavioural and cultural change measures	$1.3 - $2.9 benefit per $1 cost	⊕ 🏠 🚨 🌿
Moyne Shire Council – Coastal Hazard Management	Regulatory measures	$1.2 – $2.9 benefit per $1 cost	⊕ 🏠 🚨
Buloke Shire Council – Urban Cooling	Physical and technological measures	$1.0 - $1.6 benefit per $1 cost	⊕ 🌿

1. Notes: ⊕ health and wellbeing 🌿 ecosystem services 🏃 recreation and amenity 🏠 avoided property damage 🚨 avoided emergency response costs

[5] For all case studies the analysis used a 30 year appraisal period except the City of Hobart case study, which was constrained to 10 years due to a current lack of ongoing funding.

City of Darwin – Urban Cooling

Greening Darwin Strategy

The City's 2030 *Greening Darwin Strategy* includes actions to increase tree canopy coverage across heat-vulnerable and cyclone-prone areas. The strategy and planned tree planting program provides opportunities for the City to plant cyclone-resilient, climate-appropriate tree species along active transport routes, adjacent recreational infrastructure and in suburbs with low canopy cover and high vulnerability to heat. Tree planting activities are supported by an ongoing collaborative partnership with CSIRO through the Darwin Living Lab.

Type of action	**Relevant hazards**
Physical and technological	Heatwaves, cyclones

Outcomes and benefits quantified in this case study

Reductions in local temperatures in priority areas	Improved thermal comfort and reduced heatwave impacts	Reduced energy demand for cooling	Improved stormwater management	Increased carbon sequestration	Reduced air pollution	Enhanced aesthetic and recreational value of public spaces

Key findings

For every **$1** spent on tree planting in Darwin, the local community will receive between **$1.1 and $3.1** in benefits, of which:

- **94%** will be due to reduced fatality and healthcare costs associated with heatwaves affecting vulnerable populations
- **2%** will be due to improved amenity and recreational benefits for local residents
- **4%** will be due to additional ecosystem services such as carbon sequestration, avoided energy costs and reduced air pollution.

Other **non-quantified benefits** include biodiversity values, avoided damage to infrastructure from more resilient tree planting, avoided loss of worker productivity during high temperatures, and a range of other flow-on economic and social benefits associated with disruption due to extreme events. Quantified ecosystem service benefits such as air pollution reduction and carbon sequestration only represent a small proportion of the total value represented by tree planting activities; however, these can increase significantly under higher future carbon and energy price scenarios.

Broader insights for this type of local adaptation

The program demonstrates the value of improved adaptation planning and decision-making:

- Planting trees in the most vulnerable suburbs significantly reduces fatalities and healthcare costs, compared to planting in less vulnerable suburbs, nearly doubling the benefit per tree planted.
- Planting more cyclone-resilient trees can reduce future tree planting and management costs by avoiding damage to trees in a cyclone event, as well as delivering other benefits.
- Managing urban tree canopy is a major ongoing investment, requiring local knowledge and capability. Without this investment areas will face declining tree canopy cover under future climate change, leading to a significant loss of value and increase in risk to the community.

Lockyer Valley Regional Council – Flood management

Voluntary Home Buy-Back Program

After flooding events in 2022, the Australian and Queensland Governments announced a joint initiative to help people living in Queensland recover and become more resilient to future flooding events. The initiative included the Voluntary Home Buy-Back (VHBB) Program. Lockyer Valley took part the in VHBB Program and purchased 24 properties across the Lockyer Valley region that met the Voluntary Home Buy Back assessment criteria. These properties were in highly vulnerable locations that are susceptible to extreme flooding risk. Of the 24 properties purchased, 19 were demolished and five were removed. The buyback program permanently reduced flood risk exposure for participating properties and the wider community. It also enabled the restoration of natural floodplain functions, contributing to broader environmental resilience.

Type of action	**Relevant hazards**
Economic and financial	Flooding

Outcomes and benefits quantified in this case study

Fewer residential properties affected by flood events	Avoided property damage and clean-up costs	Avoided emergency response costs	Avoided fatality and healthcare costs including mental health costs	Avoided loss of social wellbeing and mental health costs due to flood events

Key findings

For every **$1** spent on the Voluntary Home Buy-Back Scheme, the local community are estimated to receive between **$0.8 and $1.3** in quantified benefits, of which:

- **47%** are from avoided residential property damage costs incurred including clean up and emergency response
- **53%** are from avoided fatalities, injuries and metal health costs and social wellbeing impacts.

These are **conservative estimates** of the full range of benefits provided by this program, as they do not include significant other intangible benefits including wellbeing and avoided risks for emergency responders and environmental benefits from reclaimed land. In addition, not all expected impacts of climate change could be accounted for, as climate change scenarios were only incorporated in 1-in-100 year flood events, so the impacts of more frequent events of other sizes were not captured.

Broader insights for this type of local adaptation

The value of this action strongly depends on selecting the right properties for removal. Lockyer Valley's detailed flood mapping was instrumental in this. Without high quality flood mapping to inform the property buybacks, the benefits would likely have been lower as appropriate properties may not have been prioritised.

Lockyer Valley also has effective flood planning and preparation measures in place, with an effective warning system that reduces the risks to lives and wellbeing. In other locations with less effective warning systems, the benefits of a property buyback program may be even higher, as the risks to health and wellbeing are more significant without effective warning systems.

City of Hobart – Bushfire resilience

Sparking Conversations, Igniting Action

The City of Hobart collaborated in the 'Sparking Conversations, Igniting Action – Greater Hobart Resilience Program', which focused on improving community bushfire preparedness through education, household planning support, and targeted vegetation management. The program significantly improved household bushfire preparedness and awareness, reduced the risk of property damage, and supported stronger community networks. It enhanced capacity to respond to and recover from bushfire events, protecting people and infrastructure. The program was delivered in collaboration with Kingborough Council, Clarence City Council and Glenorchy City Council.

Type of action	**Relevant hazards**
Knowledge-based, behavioural, and cultural change	Bushfire

Outcomes and benefits quantified in this case study

Reduced bushfire risk to residential and commercial properties	Reduced fatalities and injuries during bushfire events	Avoided emergency response costs	Avoided property damage	Avoided environmental damages

Key findings

For every **$1** spent on the Sparking Conversations, Igniting Action program, it is estimated that the local community will receive between **$1.3 and $2.9** in benefits over a 10-year period, of which:

- **38%** will be due to avoided property damage costs from reduced risk of bushfire
- **9%** will be due to avoided response costs from emergency service response to bushfires
- **51**% will be due to avoided health costs and social wellbeing impacts from both reduced risk of bushfires, and improved community safety when bushfire events do occur
- **1%** will be due to avoided environmental damages from reduced bushfire risks.

These are conservative estimates of the full range of benefits provided by this program, as they do not include mental health costs associated with bushfire events, for both residents and emergency responders, as well as costs of disruption to businesses and communities. This analysis does not account for increasing risks of bushfires due to climate change, which would significantly increase the calculated benefits of the program.

Broader insights for this type of local adaptation

The highest benefits under this case study come from combining both reduced risk of bushfires affecting properties and residents, with reduced risk of injury or fatalities when a property or area is affected. This program combines activities to reduce the spread and risk of bushfires, and to increase community bushfire preparedness in the event a bushfire occurs. This demonstrates the value of a program that takes a multi-pronged approach to bushfire resilience. This program does not have ongoing funding; however, a future program that delivered the same outcomes at lower cost by embedding the lessons from this program could deliver greater net benefits for the community.

Moyne Shire Council – Coastal hazard management

Planning amendment C69

Moyne Shire Council introduced a planning amendment in Port Fairy to prevent new development in areas projected to be inundated by sea level rise, as part of its Coastal Hazard Management Plan. This forward-looking policy represents a proactive local government approach to long-term climate risk management. The town of Port Fairy is low-lying and therefore at risk from both riverine flooding and coastal inundation, with climate change resulting in rising threats from coastal erosion, storm surges and sea level rise. Moyne Shire has amended its local planning regulations (Amendment C69) to ensure future development and land use in Port Fairy are climate-resilient – protecting lives, property, and the town's cultural and environmental values.

Type of action	**Relevant hazards**
Regulatory	Sea level rise, flooding

Outcomes and benefits quantified in this case study

				
Fewer residential properties affected by flood events	Avoided property damage and clean-up costs	Avoided emergency response costs	Avoided fatality and healthcare costs including mental health costs	Avoided loss of social wellbeing and mental health costs due to flood events

Key findings

For every **$1** spent on the updates to the planning scheme, the local community will receive between **$1.2 and $2.9** in quantified benefits over 30 years, of which:

- **90%** are from avoided residential property damage costs incurred including clean up and emergency response
- **10%** are from avoided fatalities, injuries and metal health costs and social wellbeing impacts.

These are conservative estimates of the full range of benefits provided by this program. The quantified benefits do not include significant other intangible benefits, including avoided risks to wellbeing of emergency responders, avoided disruption to tourism and other businesses, and avoided environmental costs from use of hard coastal protection measures such as sea walls. Under lower discount rates the benefits are greater than the costs, as benefits are accrued over a long period compared to relatively high upfront costs.

Broader insights for this type of local adaptation

This case study demonstrates the value of proactive land-use planning as a cost-effective measure to manage climate risks. Early action avoids future costs that would be borne directly by communities, and increases overall community resilience. The benefits of this case study would be significantly higher if sea level rises more rapidly than expected, or if a major flood event occurs.

Buloke Shire Council – Urban cooling

Cool It Program

Buloke Shire Council lead the 'Cool It' Phase 2 Program in conjunction with the Central Victorian Greenhouse Alliance and other Councils across the Mallee, Loddon-Campaspe and Central Highlands Region of Victoria. It follows the Cool It Phase 1 pilot program completed in 2018.

This program produced heat vulnerability street mapping and prioritisation, developed a climate resilient tree planting list, and enabled planting of climate resilient street trees and enhancement of existing green spaces in priority locations across regional localities such as Charlton, Birchip, Donald and Wycheproof. The project's objectives were to reduce ambient temperatures, but also increase planting of resilient species that will survive future climate impacts, and to improve liveability and social well-being in these rural communities.

Type of action	**Relevant hazards**
Physical and technical	Heatwaves, drought

Outcomes and benefits quantified in this case study

Reductions in local temperatures in priority areas

Improved thermal comfort and reduced heatwave impacts

Reduced air pollution

Improved stormwater management

Increased carbon sequestration

Key findings

For every **$1** spent on tree planting activities under this program, the local community will receive between **$1.0 and $1.6** in benefits over 30 years, of which:

- **65%** will be due to reduced fatality and healthcare costs associated with heatwaves affecting vulnerable populations
- **35%** will be due to additional ecosystem services such as carbon sequestration, avoided energy costs and reduced air pollution.

Greater benefits are achieving by focusing planting activities in highest vulnerability suburbs. In addition, quantified ecosystem service benefits such as air pollution reduction and carbon sequestration would increase significantly under higher future carbon and energy price scenarios. Additional qualitative benefits that were identified but could not be quantified included improved productivity of workers on hot days, enhanced urban aesthetics and biodiversity gains. The project also supports local amenity and strengthens the liveability of rural towns in a warming climate.

Broader insights for this type of local adaptation

This case study demonstrates that adaptation actions can be valuable in regional towns with smaller populations. Undertaking a highly targeted planting scheme in a confined area can still provide significant value by reducing risks during heatwave events, as well as providing ecosystem service benefits. This case study also demonstrates the value of collaboration across multiple councils, reducing costs and increasing benefits by enabling councils to undertake vulnerability mapping activities that are highly valuable but would be costly for individual councils.

How the case studies compare to findings on the costs of climate change and benefits of adaptation across Australia

The case studies demonstrate that local government adaptation actions can help to mitigate:

- Property damage and destruction costs associated with events such as flooding, bushfires, and coastal hazards
- Human health and fatality costs associated with a wide range of natural hazards and climate change impacts
- Emergency response costs related to responding to events, protecting communities and managing risks
- Social wellbeing and mental health costs associated with increased hazards and disruption to local communities.

Adaptation can also improve environmental outcomes, including by protecting habitats, and restoring or increasing ecosystem services. A wide range of other economic, social and environmental benefits could not be quantified as part of this assessment but may be significant. These findings are supported by Australian and international evidence, which consistently demonstrates that climate adaptation actions deliver significant economic, social, and environmental returns.

World Bank (2019)

Every $1 invested in infrastructure resilience can generate $4 in avoided losses and benefits

Global Commission on Adaptation (2019)

Every $1 invested in adaptation leads to potential savings of $2–$10

Victorian Department of Energy, Environment & Climate Action (2023)

Every $1 invested in adaptation saves society an average of $6 in future costs.

Across a wide range of sectors and geographies, adaptation investments are shown to be cost-effective, particularly when implemented early and strategically. Previous economic evaluations of have found positive returns on from investments in resilient roads (Queensland Government 2023, Infrastructure Victoria 2024) and coastal adaptation measures (DCCEE 2010).

The case study findings are also consistent with research on the estimated costs associated with hazard impacts across Australia in the absence of adaptation investment (Figure 11).

Specific example: A 2009 heatwave in Southeast Australia led to 500 excess deaths and more than 3,000 reports of heat-related illness with direct financial losses estimated at $800 million (QUT 2010).

Australia-wide: Reduced labour productivity due to heatwaves is estimated at $8.7 billion per year (Zander et al. 2015).

Specific example: Present day costs of flood damages to council owned assets across Greater Melbourne range from $90-$120 million (EAGA 2023).

Australia-wide: More than $226 billion in commercial, industrial, transport, and residential assets are at risk from flooding and erosion at 1.1 m sea-level rise (DCC 2009).

Specific example: Insurance costs of the 2010/11 Queensland floods are estimated at $2.38 billion (AIDR n.d).

Australia-wide: There are estimated to be 1.2 million properties at risk of flooding across Australia, with 230,000 properties facing a 1 in 20 risk of flooding each year (ICA 2024).

Figure 11 Damage costs of natural hazard events across Australia

The five case studies show how individual investments in adaptation reduce these disaster-related costs and deliver net economic, social and environmental benefits. There is clear national return on investment when local governments deliver this important work.

The value of increased ongoing funding for adaptation led by local government

Current adaptation investment and national benefits

As noted earlier, local government investment in climate adaptation is not consistently reported. This is unsurprising, given that many adaptation activities are embedded within broader environmental management, asset upgrades, or emergency recovery programs.

To assess current investment, this analysis draws on multiple sources, including a randomised council survey and a review of council annual reports. Randomised selection of councils invited to participate in the survey ensured modelling represented a diversity of councils and variation in expenditure. These sources reveal that councils are actively investing in a wide range of adaptation efforts. Actual adaptation expenditure, and reporting of adaptation expenditure, varies by local council; however, some councils reported spending up to 21.82% of their budget on adaptation in the 23/24 financial year. Taking a conservative approach to sampling expenditure, among the 14 councils responding to the survey, expenditure was reported to be up to 4.6% in the 23/24 financial year.

Our review estimates that current national expenditure across all local governments in Australia on climate adaptation is at least $400 million. This represents hundreds of projects nationwide that bolster community resilience to floods, bushfires, heatwaves, and sea level rise. Projects can vary significantly in scale, from

over $10 million to less than $10,000 depending on council size and types of action. **In general, large-scale investments are funded by one-off grant funding.**

Some councils are spending significantly more than the modelled $400 million figure on adaptation. Others may be spending more on activities not directly identified as adaptation but that contribute to resilience, emergency management and disaster recovery, and which help deliver adaptation outcomes.

If local governments maintain current adaptation spending levels, they will invest at least $2 billion nationally by 2030. Based on the case studies and literature review, this will generate between at least $2.2 and $4.7 billion in avoided costs and community benefits (in net present value terms). The true value may be ever greater where adaptation action achiever higher returns, as seen in studies $4 to $10 in benefits for every $1 invested.

The benefits of consistent funding

Consistent ongoing funding is critical to unlocking the full economic, social and environmental value of local government adaptation. Findings from the detailed case studies, survey of councils and broader literature demonstrate that secure funding enables councils to deliver better designed, more effective adaptation measures, improving resilience outcomes while saving costs over time.

Example in lights

Coastal Hazard Management, Noosa Shire Council (Qld)
Internal governance and processes – integrating climate change imperatives into council strategies, plans, business processes and services

Adaptation planning is critical for supporting informed decision-making. In 2020 Noosa Shire Council undertook a cost benefit analysis of proposed coastal adaptation options as part of their Coastal Hazard Adaptation Plan (CHAP). The analysis identified the most effective and efficient strategies to protect community assets, natural environments, and economic values.

By using previous risk assessments and coastal hazard mapping, the economic analysis was able to compare the costs and benefits of different adaptation options, including dune management, augmentation, planning controls, and property acquisition. The results showed not only which actions provide the highest net benefits but also highlighted the distribution of costs and benefits across the community.

The estimated outcomes for the community from different adaptation actions range from a net loss of $2.8 billion to a benefit of $239 million. If Noosa Shire Council had not completed a detailed adaptation plan and invested in hazard mapping, risk and vulnerability assessments and economic evaluation, the choice of adaptation action may have been costly and provided poor value-for-money for the community. Adaptation planning activities help councils make better decisions, improve community benefits and reduce costs.

Sustained adaptation actions are strengthened by mainstreaming climate considerations into institutional budget and policy planning cycles, statutory planning, monitoring and evaluation frameworks, and into recovery efforts following disaster events (IPCC 2022). Some of the key benefits of secure, ongoing funding for adaptation are described in Figure 12.

More strategic adaptation planning investment

- Adaptation planning activities such as risk and vulnerability assessments, options assessments and development of adaptation pathways help increase benefits to the community. Effective adaptation requires coordinated, long-term planning (DAWE 2021), and consistent monitoring and evaluation to track progress (IPCC 2022).

Improved capability reduces costs of adaptation actions

- Stable, long-term funding enables local governments to build capability, apply lessons learned, and scale what works – ultimately reducing the cost of adaptation. Councils with secure funding can extend successful projects, negotiate better value through longer-term contracts, and avoid repeating costly mistakes. Planning and sequencing adaptation measures improves both cost-efficiency and effectiveness.

Increased confidence for local governments to invest

- Local governments cannot invest in essential adaptation activities, such as risk assessments, vulnerability analyses, and cost-benefit studies, if they lack confidence that well-planned projects will be funded (Infrastructure Victoria 2024). This uncertainty discourages upfront planning and delays action. Dedicated funding can ensure that well-designed projects receive support. A secure, ongoing funding stream gives councils the confidence to invest in planning and implementation of adaptation.

Enhanced social, health and community outcomes

- As noted earlier, local government-led adaptation can reduce underling drivers of community vulnerability to climate change Increased funding for adaptation will further increase the social, health and community benefits from adaptation. Where local governments have good information on risks and vulnerability, adaptation actions can be more effectively targeted.

Figure 12 Benefits of secure ongoing funding for adaptation

Ongoing stable funding is critical to enable effective local government adaptation. Councils that can plan and deliver adaptation measures over multiple years achieve higher returns, as they can stage projects logically, integrate maintenance, and refine actions based on monitoring results. Ad-hoc, short-term funding risks inefficiency and lower returns. Supporting councils through predictable funding streams enhances the effectiveness and value of adaptation investments.

Potential return on investment from increased ongoing funding

Ongoing funding for local government adaptation is crucial to keep communities safe and economies strong in the face of climate change. Disasters related to natural hazards already cost Australia $38 billion annually. Without investment in adaptation, this figure could nearly double to $73 billion by 2060 (Deloitte 2021). These effects are felt most directly by local communities through damaged infrastructure, disrupted

services, business losses, health impacts, and the destruction of cultural and environmental assets. This report finds that:

- **Doubling investment in adaptation will more than double the benefits:** Short-term, reactive funding is not sufficient to address the effects of climate change. Councils need consistent, year-on-year investment to plan, sequence, and implement effective adaptation strategies. These measures only work when built over time.
- **The return on adaptation investment is significant:** Funding local adaptation is not an expense – it is an investment with net economic, social, and environmental benefits. The Global Commission on Adaptation (2019) describes this as a triple dividend: avoided losses, economic gains, and broader social and environmental value.

Increasing Australian Government funding by at least $400 million per year—bringing total local government adaptation funding to $800 million annually—would more than double national benefits. Secure ongoing funding would enable better planning, build capability and target the most pressing risks. Every dollar would go further, delivering stronger returns through smarter investments and reduced future costs. Increased funding for local government adaptation is a triple-win investment. With climate threats growing, every dollar directed to local government adaptation helps avoid costly damages and creates a more sustainable future for communities across Australia.

Glossary and abbreviations

Key terms

Term	Definition
Adaptation, as in *climate adaptation*	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects (IPCC 2023).
Avoided cost	The estimated costs that would have occurred in the absence of an intervention, project, or policy, but are prevented due to that action. In adaptation planning, avoided costs often refer to damages, losses, or disruptions that are reduced or eliminated by proactive investments.
Benefit-cost ratio (BCR)	A summary indicator used in economic analysis to compare the benefits and costs of a project or investment. It is calculated as the present value of total benefits divided by the present value of total costs. A BCR greater than 1.0 indicates that the benefits outweigh the costs, supporting a positive investment decision.
Blue physical infrastructure	'Blue' physical infrastructure measures are often alternatively called 'nature-based solutions' and involve natural or semi-natural systems that provide environmental benefits but also specifically relate to water-related infrastructure, e.g. lakes, wetlands, and sustainable urban drainage systems.
Discounting	The process of converting future costs or benefits into present value using a discount rate. Discounting reflects the principle that people generally prefer to receive benefits sooner rather than later and to defer costs where possible.
Green physical infrastructure	'Green' physical infrastructure measures are often alternatively called 'nature-based solutions' and involve natural or semi-natural systems that provide environmental benefits, e.g. parks, green roofs, urban forests, and ecosystem functions and services.
Grey physical infrastructure	'Grey' physical infrastructure measures typically include traditional, human-made infrastructure solutions that are often constructed with concrete and steel, e.g. roads, bridges and drainage systems.
Grey literature	Reports, publications and other literature or documentation published by government, peak bodies and other organisations.
Place-based adaptation	Recognises that climate change affects different places in different ways, and encourages place-specific strategies and approaches; implies a spatially distinctive 'ensemble' of human and biophysical conditions or human-environment systems (DELWP 2020)
Exposure to climate risk	When things we value are in places that could be affected by hazards (e.g. assets in a flood zone).
Net present value (NPV)	The current value of a stream of future costs or benefits, discounted to reflect the time value of money. Net present value allows decision-makers to compare costs and benefits that occur at different points in time on a consistent basis.
Resilience	The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation (Arctic Council 2016 in IPCC 2023).
Risk, as in *climate risk / climate-related risk*	The potential for adverse outcomes resulting from the interaction of climate-related hazards with the exposure and vulnerability of the affected human or ecological

Term	Definition
	system to the hazards (IPCC 2023). Climate-related risk is often expressed as a function of hazard, exposure, and vulnerability.
Typology	A system of classifying objects or concepts by dividing them into different types and sub-types, often based on shared characteristics.
Vulnerability	Factors that can cause things we value to be affected differently and disproportionately (e.g. low income, existing health conditions).

Abbreviations

Abbreviation	Name
ACT	Australian Capital Territory
ALGA	Australian Local Government Association
BCR	Benefit-cost ratio
CBA	Cost-benefit analysis
CHAP	Coastal Hazard Adaptation Plan
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEECA	Department of Energy, Environment and Climate Action, Victorian Government
DRF	Disaster Ready Fund
DRFA	Disaster Recovery Funding Arrangements
IPCC	Intergovernmental Panel on Climate Change
LGA	Local government area
MNES	Matters of National Environmental Significance
NBN	National Broadband Network
NCRA	National Climate Risk Assessment
NDIS	National Disability Insurance Scheme
NEPMs	National environmental protection measures
NESP	National Environmental Science Program
NPV	Net present value
NRM	Natural resource management
NSW	New South Wales (State of)
NT	Northern Territory
Qld	Queensland (State of)
SA	South Australia (State of)
SOCI Act	*Security of Critical Infrastructure Act 2018*
Tas	Tasmania (State of)
VHBB	Voluntary Home Buy-Back
Vic	Victoria (State of)
WA	Western Australia (State of)

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Appendices

Appendix 1: List of local governments with actions analysed in this study

This appendix lists all local governments that provided input and/or were considered as part of the study through analysis of selected reported adaptation actions, which were documented in their own publications or other sources as cited throughout the report. This includes local governments that were part of:

- Five case studies selected for economic analysis of costs and benefits of adaptation actions
- A survey and broader analysis of selected local governments' expenditure on adaptation
- Longlist of local government areas whose adaptation actions were analysed using documented information.

Case studies, information and contact with councils was facilitated both in written and verbal form through state and territory associations, which are Western Australian Local Government Association (WALGA), the Local Government Association of the Northern Territory (LGANT), the Local Government Association of Queensland (LGAQ), Local Government New South Wales (LGNSW), the Municipal Association of Victoria (MAV), the Local Government Association of Tasmania (LGAT), and the Local Government Association of South Australia (LGASA).

While the 219 project examples included in this review illustrate a diverse range of local-level adaptation actions underway across Australia, they do not provide an exhaustive picture of all local government-led adaptation action. The sample is also not intended to be representative of demographic, geographic or local government variables. Some jurisdictions, such as NSW and VIC, have a higher representation of project examples than others, such as the NT. Where jurisdictions are less well represented, this does not indicate that meaningful adaptation action is not being carried out by the respective local governments. Lower shares of project examples among jurisdictions with smaller populations can in part be attributed to their smaller population size, comparatively lower funding and/or other forms of resourcing for adaptation, and/or a lack of publicly available information on the actions being undertaken.

Five case studies selected for economic analysis of costs and benefits of adaptation actions

The local governments that provided information for the five case studies included:

- City of Darwin (NT)
- Lockyer Valley Regional Council (Qld)
- City of Hobart (Tas)
- Moyne Shire Council (Vic)
- Buloke Shire Council (Vic)

A survey and broader analysis of selected local governments' expenditure on adaptation

- A total of 14 local governments responded to a survey conducted for this project (including one unnamed council), including:
    - Alice Springs
    - Broome
    - Eurobodalla
    - Huon Valley
    - Inner West
    - Ku-ring-gai
    - Litchfield
    - Melbourne
    - Moorabool
    - Nillumbik
    - Onkaparinga
    - Port Lincoln
    - Rockingham

In addition, 30 local governments were randomly selected for analysis of their annual reports to identify information on adaptation expenditure, including:

- Adelaide
- Albury
- Ballarat
- Bayside (NSW)
- Bayside (Vic)
- Brisbane
- Busselton
- Charles Sturt
- Clarence Valley
- Darwin
- East Gippsland
- Esperance
- Gold Coast
- Greater Geraldton
- Greater Shepparton
- Hawkesbury
- Hobart
- Lake Macquarie
- Maribyrnong
- Marion
- Melbourne
- Noosa
- North Sydney
- Perth
- Port Phillip
- South Perth
- Sunshine Coast
- Sydney
- Yarra

Longlist of local government areas whose adaptation actions were analysed to inform the typology

Information sourced from a database provided to ALGA by the National Environmental Science Program (NESP) Climate Systems Hub. All actions analysed from this source can be explored at the Australian Adaptation Database (note that data analysed for this study was the version provided directly by the Hub to ALGA as of December 2024):

- Adelaide
- Adelaide Hills
- Albury
- Alexandrina
- Ararat
- Ballarat
- Ballina
- Balranald
- Brisbane
- Buloke
- Burnside
- Byron
- Campbelltown (SA)
- Cardinia Shire
- Charles Sturt

- Clarence
- Coorong
- Darebin
- Eurobodalla
- Georges River
- Glenorchy
- Golden Plains
- Greater Bendigo
- Greater Geelong
- Greater Geraldton
- Greater Shepparton
- Hindmarsh
- Hobart
- Holdfast Bay
- Horsham
- Hume
- Kangaroo Island
- Katherine
- Kingborough
- Launceston
- Lismore
- Lockyer Valley
- Loddon
- Maranoa
- Marion
- Merri-bek
- Mingenew
- Mitcham
- Morawa
- Moreton Bay
- Nillumbik
- Noosa
- Northern Grampians
- Onkaparinga
- Perenjori
- Playford
- Port Adelaide Enfield
- Prospect
- Pyrenees
- Redland
- Salisbury
- Southern Grampians
- Southern Mallee
- Sunshine Coast
- Sutherland
- Tweed
- Unley
- Wagga Wagga
- West Torrens

Information sourced from Victorian Government (2020):

- Ararat
- Bendigo
- Buloke
- Caulfield
- Central Goldfields
- Gannawarra
- Greater Geelong
- Greensborough
- Hepburn
- Hobsons Bay
- Indigo
- Macedon Ranges
- Melbourne
- Moonee Ponds
- Mornington Peninsula
- Mount Alexander
- Pyrenees
- Sandringham
- Warragul
- Whittlesea

Information sourced from LGNSW (2025):

- Albury
- Ballina
- Bega Valley
- Bellingen
- Blacktown
- Bland
- Blue Mountains
- Byron
- Central Coast
- Cessnock
- Clarence Valley
- Cobar
- Cumberland
- Dubbo Regional
- Dungog

- Goulburn-Mulwarree
- Gunnedah
- Gwydir
- Hawkesbury
- Kempsey
- Ku-ring-gai
- Kyogle
- Lake Macquarie
- Leichhardt
- Lismore
- Liverpool
- Liverpool Plains
- Maitland
- Manly
- Mid Coast
- Muswellbrook
- Nambucca Valley
- Narrabri
- Newcastle
- Northern Beaches
- Penrith
- Port Macquarie-Hastings
- Port Stephens
- Queanbeyan-Palerang
- Richmond Valley
- Shoalhaven
- Singleton and Upper Hunter
- Tamworth Regional
- Tweed
- Uralla
- Wagga Wagga
- Walcha
- Waverley
- Western Parkland councils
- Wingecarribee
- Wollondilly

Information sourced from LGASA (2025):

- Adelaide
- Burnside
- Campbelltown
- Holdfast Bay
- Marion
- Mitcham
- Onkaparinga
- Port Adelaide Enfield
- Salisbury
- Unley
- West Torrens

Information sourced from internal documentation provided by ALGA:

- Bunbury (WA)
- Canning (WA)
- Cockburn (WA)
- Darwin (NT)
- Fremantle (WA)
- Gosnells (WA)
- Greater Geraldton (WA)
- Joondalup (WA)
- Launceston (TAS)
- Melbourne (Vic)
- Melville (WA)
- Stirling (WA)
- Sydney (NSW)
- Whittlesea (Vic)
- Bassendean (WA)
- Bridgetown/Greenbushes (WA)
- Canberra Region Joint Organisation (NSW)
- Cottesloe (WA)
- Council of Mayors SEQ (QLD)
- GVROC Regional Climate Alliance (Ngaanyatjarraku, Wiluna, Menzies, Laverton, Leonora, Coolgardie, Kalgoorlie Boulder, Dundas, Esperance) (WA)
- Hawkesbury City (NSW)
- Huon Valley (TAS)
- Mornington Peninsula (Vic)
- Murray (WA)
- Peron Naturaliste Partnership (Bunbury, Busselton, Capel, Dardanup, Harvey, Mandurah, Murray,

Rockingham, Waroona) (WA)

- Port Headland (WA)
- Serpentine Jarrahdale (WA)
- South East Councils Climate Change Alliance (Vic)
- Sunshine Coast (QLD)
- Tweed (NSW)
- Victorian Climate Resilient Councils (Western Alliance for Greenhouse Action) (Vic)
- West Tamar (TAS)
- Western Sydney Regional Organisations (WSROC) (NSW)

Spread of adaptation action examples across NRM clusters

The project examples reviewed for this study also reflect that local governments across Australia face varied climatic conditions and hazards. Each of the project examples were tagged against the eight natural resource management (NRM) clusters defined by Commonwealth Scientific and Industrial Research Organisation (CSIRO 2015), each of which reflect different biophysical factors and the expected broad patterns of climate change (Table 20).

Table 20 Summary of project examples included in review grouped by NRM cluster.

NRM cluster	Description of NRM cluster	Example population centres in the cluster	Number of project examples reviewed in NRM cluster
Central Slopes	Range of climates from sub-tropical in the north, through to temperate in the south, with a typically drier winter and wetter summer.	Orange, Dubbo, Toowoomba	5
East Coast	Predominantly sub-tropical climate, with regional variability such as some tropical influences in the north and some temperate influences in the south.	Sydney, Brisbane, Newcastle, Rockhampton, Emerald	56
Monsoonal North	Covers tropical rainforests, wetlands and arid rangelands, in addition to relatively intact savannah woodlands.	Darwin, Broome, Rockhampton, Katherine, Mt Isa	3
Murray Basin	Relatively dry and temperate, with a warm and dry grassland climate in the north-west ranging to temperate to hot summers further east.	Canberra, Wagga Wagga, Bendigo, Mildura, Mt Gambier, Mt Barker	32
Rangelands	Rainfall systems vary from seasonally reliable monsoonal influences in the far north through to very low and variable rainfall patterns in much of the centre and south.	Broken Hill, Alice Springs, Port Headland, Kalgoorlie	3
Southern Slopes	The dominant rain-bearing weather systems are cold fronts and troughs coming from the west, but some regions receive significant rainfall.	Melbourne, Geelong, Hobart, Launceston, Batemans Bay	64
Southern and South-Western Flatlands	Predominantly Mediterranean climate, with high winter rainfall and little summer rainfall.	Adelaide, Ceduna, Esperance, Perth	55

NRM cluster	Description of NRM cluster	Example population centres in the cluster	Number of project examples reviewed in NRM cluster
Wet Tropics	Characterised by two seasons: the monsoonal wet season (from December to April), which is dominated by prevailing north-westerly winds, and the dry season (May to November) when south-easterly trade winds dominate.	Mackay, Cairns, Thursday Island	1
Total			**219**

Appendix 2: Summary of review of adaptation typology literature

There is currently no comprehensive and empirical framework or typology that specifically characterises local governments' approaches to climate adaptation action, either in Australia or overseas. This appendix summarises analysis that informed the development of a dedicated typology of climate adaptation action by Australian local governments (see *How Australian local governments are adapting to climate change*).

Method and key findings

We reviewed how climate adaptation is described and classified in a set of 15 documents from both grey and peer-reviewed literature, selected based on their currency, relevance to the Australian context, and prominence/ubiquity among adaptation decision makers and practitioners in Australia and internationally. We analysed each typology's approach (as relevant and applicable) to the following adaptation considerations:

- Overall organising framework of adaptation interventions in the typology (its defined framework of system(s) in which adaptation is intended to occur)
- Adaptation leader or instigator (the intended user of the typology - i.e. the actor (e.g. organisation or institution) that will be undertaking the adaptation, if applicable)
- Adaptation target or primary recipient (the actor(s) targeted by the typology, if applicable)
- Degree of planning involved in adaptation (how the typology conceptualises unplanned versus intentional adaptation action)
- Degree of change (how the typology categorises the extent/degree of change triggered by adaptation action, e.g. incremental adaptation versus transformational adaptation)
- Timing of adaptation action (how the typology categorises adaptation action according to time: e.g. anticipatory, concurrent, reactive)
- Risk characterisation (how the typology defines or incorporates risk frameworks)
- Spatial focus (the spatial focus or scale for which the typology is intended)
- Sectoral focus (any specific sector targeted by the typology)
- Adaptation driver (any specific driver for applying the typology, e.g. legislative mandates, voluntary initiatives)
- Implementation scale (the implementation scope of the typology, e.g. for discrete projects versus institutional or policy mainstreaming; community-led versus technical expert driven).

Through this analysis, we identified three broad themes across the typologies:

a) Typologies that categorise actions by intervention type (e.g. higher-level categories such as *Infrastructural and technological / Institutional / Behavioural and cultural / Nature-based*, with some typologies defining further sub-categories)

b) Typologies that categorise actions by theme, hazard or sector (e.g. specific typologies for coastal adaptation that categorise action as *Avoid / Accommodate / Protect / Retreat*)

c) Typologies that categorise according to risk management approach (e.g. typologies that categorise actions according to their aims to reduce exposure or vulnerability).

Table 21 below provides a summary of the review of 15 items from grey and peer-reviewed adaptation typology literature.

Conclusions that informed the development of a dedicated typology

Through this review, we found that several existing adaptation typologies partially articulated how local governments in Australia address climate-related risks and adapt to climate change, but none provided a framework that accurately characterised the specific levers available to local governments within the Australian governance context. We concluded that the first theme identified above (typologies that categorise actions by intervention type) offered the most comprehensive and appropriate framework for adapting to the Australian local government context, then developed a tailored set of categories and sub-categories to describe the key adaptation levers available to local governments.

As outlined in the report section *How Australian local governments are adapting to climate change*, the final typology situates these categories and sub-categories as the 'Response' component of a wider framework that also includes 'Risk' and 'Remit'. Through this, the typology encompasses additional important dimensions of how Australian local governments adapt to climate change; specifically:

- The 'Risk' dimension considers 'What are the problems and opportunities driven by a changing climate?', grounded in the IPCC three-part risk framework wherein risk is a function of climate-related hazard, exposure and vulnerability.
- The 'Remit' dimension considers 'To what extent can local government directly address the risk or opportunity?', employing an adapted version of Stephen Covey's (1989) concept of three 'circles' or 'spheres' of influence—control, influence and concern.

Together, the risk, remit and response dimensions of the typology provide an organising framework for understanding how local governments take adaptation action, and, through this, how they help to ensure healthy, prosperous and sustainable communities in a changing climate.

Table 21 Summary of review of 15 items from grey and peer-reviewed adaptation typology literature

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
Climate Risk Management Guide: Organisation Application Guide *(Commonwealth Climate Risk and Opportunity Management Program)*	Australian Government DCCEEW	Grey	Components of the Climate Risk and Opportunity Management Program and how they work together to assist Commonwealth organisations in integrating climate risk and opportunity management into different types of actions.	2023	National	- Infrastructural and technological - Institutional - Behavioural and cultural - Nature-based	National framework for assessing and managing risks. Provides an overarching typology for adaptation actions.
Guide to Climate Change Risk Assessment for NSW Local Government (2019 revision)	NSW Government	Grey	This guide outlines a qualitative approach to climate change risk assessment for local councils.	2019	State	- Insurance - Structural or engineering adjustments - Policy and strategy amendments - Changing or developing institutional structures and decision-making systems - Research - Education or behaviour change activities	Provides defined typology for use by local governments in Australian context.
IPCC Sixth Assessment Report Working Group II: Impacts, Adaptation and Vulnerability. Chapter 17: Decision-Making Options for Managing Risk	[Citation:] New, M., D. Reckien, D. Viner, C. Adler, S.-M. Cheong, C. Conde, A. Constable, E. Coughlan de Perez, A. Lammel, R. Mechler, B. Orlove, and W. Solecki, 2022: Decision-Making Options for Managing Risk. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O.	Peer-reviewed	This chapter focuses on the 'how' of climate risk management and adaptation. It covers: the adaptation and risk management options that are available; the governance and applicability of options in different contexts; residual risk and Loss and Damage; the methods and tools that can be drawn on to support climate risk management planning and implementation; enabling conditions and drivers for adaptation; the role of monitoring and evaluation for integrated risk management and tracking progress, success and the risk of maladaptation; and finally, integration of risk management across sectors, jurisdictions and time horizons, under dynamic	2022	International	- Insurance - Coastal accommodation - Early-warning systems - Water use/demand - Coastal hard protection - Infrastructure retrofitting - Building codes - Farm / fishery practice - Diversification of livelihoods - Social safety nets - Infrastructure for health - Food storage / distribution - Restoration / creation of natural areas - Minimising ecosystem stressors - Ecosystem-based adaptation - Water supply / distribution - Seasonal / temporary mobility - Spatial planning	Provides extensive characterisation with global applicability across all scales of implementation.

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
	Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2539–2654, doi:10.1017/9781009325844.026.		conditions of environmental and societal change.			- Diets / food waste - Health care system - Water capture / storage - Cooperative governance - Permanent migration - Strategic coastal retreat	
NSW Disaster Adaptation Plan Guidelines (draft)	NSW Government Reconstruction Authority	Grey	Outline the approach to preparing and implementing a Disaster Adaptation Plan (DAP) to promote community resilience to the impact of disasters in NSW through disaster prevention, preparedness, and adaptation.	2024 (DRAFT)	State	Tools to reduce exposure - Evacuation infrastructure - Managed relocation - Mitigation infrastructure - Strategic planning controls - Warning systems Tools to reduce vulnerability - Building codes and standards - Community awareness and preparedness - Home modification - Infrastructure resilience - Nature-based measures - Social infrastructure and cohesion	Provides state-based Australian example of a classification of adaptation actions.
A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility	[Citation:] Rosemary Hill, Fiona J. Walsh, Jocelyn Davies, Ashley Sparrow, Meg Mooney, Russell M. Wise, Maria Tengö, Knowledge co-production for Indigenous adaptation pathways: Transform post-colonial articulation complexes to empower local	Peer-reviewed	Provides a generalised typology of adaptation actions carried out through activities funded by Least Developed Countries Fund, the Special Climate Change Fund and Strategic Priority for adaptation. Paper considers 133 adaptation projects in 70 countries with sufficiently documented experience to allow categorisation.	2014	International	- Capacity building - Management and Planning - Practice and Behaviour - Policy - Information - Physical Infrastructure - Warning or Observing System - Green Infrastructure - Financing - Technology	Provides an international example of implemented adaptation actions meaning typology is grounded in practical application.

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
	decision-making, Global Environmental Change, Volume 65, 2020, 102161, ISSN 0959-3780,						
Adaptation options for managing coastal risks under climate change	NCCARF Coast Adapt	Grey	CoastAdapt provides information, guidance and support on coastal adaptation for a variety of users, including tools, templates and checklists.	2017	National	- Avoidance - Managed retreat - Accommodation or limited intervention - Hold the line - Loss acceptance Each of these typologies can incorporate a variety of different options, including planning options, engineering options, environmental options, social, community and education options	Widely utilised framework for adaptation planning at local council level.
Marine and Coastal Policy	Victorian Government DEECA	Grey	Outlines Victoria's approach to sustainably managing marine and coastal environment. Provides direction to decision makers on a range of issues including climate change, population growth and ageing coastal structures.	2020	State	-Non-intervention - Avoid - Nature-based methods - Accommodate - Retreat - Protect	Further reinforces the CoastAdapt framework as a robust typology for management of coastal risks.
Regional Climate Change Adaptation Strategy Guidance Note 6	Victorian Government DEECA	Grey	5-year practicial strategies for each region in Victoria to address unique and localised challenges posed by climate change to guide locally relevant practical action.	2020	State	- On-ground works - Incentives - Policy - Governance arrangements - Research and learning - Information and communications - Advocacy / influence - Monitoring - Adaptive Capacity Building - Discussion and deliberative processes - Bear loss or share loss - Take up opportunities	Provides suite of adaptation options and supporting information around incremental vs. transformative adaptation actions.

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
Rationale, approach and added value of Key Type of Measures for adaptation to climate change	European Topic Centre Climate Change Impacts, Vulnerability and Adaptation	Grey	Provides a common framework for articulating adaptation actions / options being undertaken by EU Member States to ensure that monitoring of actions can be undertaken in a comparable way.	2020	International	Governance and Institutional - Policy instruments - Management and planning - Coordination, cooperation and networks Economic and Finance - Financing and incentive instruments - Insurance and risk sharing instruments Physical and technological - Grey options - Technological options Nature Based Solutions and Ecosystem Approaches - Green options - Blue options Knowledge and Behavioural Change - Information and awareness raising - Capacity building, empowering and lifestyle practices	Provides an international example of implemented adaptation actions meaning typology is grounded in practical application. Offers a comprehensive set of categories and sub-categories of adaptation action to allow European Union member states to cluster, report on and compare adaptation measures.
Methodologies for assessing adaptation needs and their application: Technical paper	UN Climate Change	Grey	Provides a process for assessing adaptation needs and charactering groups of actions to support adaptation planning and implementation. Builds on findings from AR5 and AR6, in addition to academic literature.	2022	International	- Biophysical and environmental - Social - Institutional - Information, capacity and resource needs	High-level but comprehensive approach to categorisation, informed by the approaches of IPCC/leading international organisations.
Chapter 14: Adaptation Needs and Options, Assessment Report 5	Intergovernmental Panel on Climate Change	Peer-reviewed	Establishes a foundation for considering adaptation, mapping broad categories of actions based on needs and options.	2014	International	Structural / physical - Engineered and built environment - Technological - Ecosystem-based - Services Social - Educational	Comprehensive categorisation approach and likely widely referred to internationally given it is from the IPCC.

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
						- Informational - Behavioural Institutional - Economic - Laws and regulations - Government policies and programs	
Global patterns of adaptation to climate change by Indigenous Peoples and local communities. A systematic review	Anna Schlingmann et al	Peer-reviewed	Provides a systematic review of Indigenous-lead adaptation to address climate change impacts, recognising that there is a diversity of actions implemented to manage and respond.	2021	International	- Practices & techniques - Resource input - Livelihood product - Capacity building - Practiced livelihood systems - Location '- Time management	Provides insight into Indigenous and First Nations-led adaptation types which is valuable to include to ensure full sweep of perspectives are accounted for across Australia. Also provides insight into autonomous, community-led adaptation types which are not covered by the other literature sources.
AS5334 2013- Climate change adaptation for settlements and infrastructure - A risk based approach	Standards Australia	Grey	Provides principles and a general guideline for the management of climate-related risks to settlements and infrastructure. It provides a systematic approach to planning the adaptation of settlements and infrastructure based on the risk management approach given in ISO31000:2009.	2013	National	- Avoiding the risk - Taking or increasing the risk - Removing the risk source - Changing the likelihood - Changing the consequence - Transferring or sharing the risk with another party or parties - Retaining the risk	Adaptation typology is less common as it is defined by its risk characterisation i.e. the component of risk it is acting on.
UKCIP Climate Wizard - Types of Adaptation Strategy	UK Climate Information Program (UKCIP)	Grey	Interactive platform to support decision-making for adaptation through knowledge exchange and creation.	2013	International	- Use of risk-based policy and project appraisal process and techniques - Delay and buy-time - Research - Monitoring - Information supply, education, awareness-raising - Contingency planning - Diversification or bet-hedging - Insurance - Defend and manage - Change of use - Retreat and abandon - Safety factors, climate	Provides comprehensive framework that could be applied across multiple scales.

Document/resource title	Author	Type of literature *(Grey / Peer-reviewed)*	Stated purpose of the document	Publication year	Jurisdiction / governance level *(International / Federal / State / Local)*	Organising framework of adaptation interventions in the typology	Overall conclusion of qualitative assessment
						headroom, buffering measures	
Classifying disaster risk reduction strategies: conceptualising and testing a novel integrated approach	Dimitorva, M., & Snair, M.	Peer-reviewed	Provides a systematised categorisation of disaster risk reduction (DRR) actions, reviewing interventions from the 2019 Cities100 Report.	2024	International	- Hazard, prospective - Hazard, corrective - Hazard, compensatory - Exposure, prospective - Exposure, corrective - Exposure, compensatory - Vulnerability, prospective - Vulnerability, corrective - Vulnerability, compensatory	Provides a typology in which the three components or 'drivers' of risk, being hazard, exposure and vulnerability, are centred. Actions are then classified around these three components, also recognising that adaptation actions can be implemented at different stages (i.e. anticipatory, concurrent and/or reactive)

Appendix 3: Methodology for economic analysis of five case studies of adaptation investments

Valuing the costs and benefits of adaptation actions using a case study-based approach

This analysis applies a structured cost-benefit analysis (CBA) framework to evaluate local government adaptation actions for five case studies. The CBA approach compares the expected outcomes under a base case scenario—where no additional adaptation measures are taken—with an investment case that includes the implemented adaptation actions. The analysis captures a broad range of benefits, including economic benefits (e.g. avoided property damage, reduced emergency costs), social benefits (e.g. improved health, community resilience), and environmental benefits (e.g. avoided air pollution, carbon sequestration). Where possible, benefits and costs are monetised using available data and accepted valuation methods; where monetisation is not feasible, significant non-monetary values—such as improved wellbeing or cultural benefits—are highlighted qualitatively to ensure a complete understanding of outcomes.

Understanding and valuing changes in risk profiles is central to the analysis. Adaptation measures provide value by reducing the likelihood or severity of future damages, rather than generating immediate financial returns. Therefore, the assessment focused on avoided costs over time, such as reduced damage and replacement costs, or averted health impacts from extreme events. Capturing these avoided costs requires careful consideration of how risks evolve under climate change, including the potential for escalating hazards such as more frequent flooding or heatwaves.

While the primary CBA results are reported in monetary terms where possible, this analysis also highlights many qualitative benefits of adaptation action that are often undervalued. These include benefits such as enhanced community trust and cohesion, mental health improvements, environmental stewardship, and safeguarding of cultural and recreational values. Recognising both the tangible and intangible benefits of adaptation provides a more accurate and compelling account of its value.

Given the inherent uncertainties in predicting future climate risks, costs and benefits, sensitivity analysis was used to test how results change under different assumptions. Sensitivity testing involves varying key inputs—such as the discount rate, the magnitude of climate impacts, or the cost of adaptation measures—to assess the robustness of the findings. This approach helps ensure that conclusions about the value of adaptation remain valid across a range of plausible future scenarios, strengthening confidence in the results. The results of the case studies are therefore presented as ranges, rather than absolute values.

The case studies that follow use these standard economic methods to provide a robust, transparent assessment of the value of local government adaptation actions. They demonstrate not only the economic viability of adaptation investments but also highlight the critical importance of early, well-planned action to protect Australian communities from escalating climate risks.

Selecting appropriate case studies from across Australia

The five case studies included in this analysis were selected through a structured process designed to ensure a diverse cross-section of local government adaptation actions across Australia (see Figure 13). The case studies were chosen to represent a range of different hazards (e.g. flood, bushfire, heat, coastal inundation), action types (e.g. green infrastructure, planning controls), and council types (metro, regional).

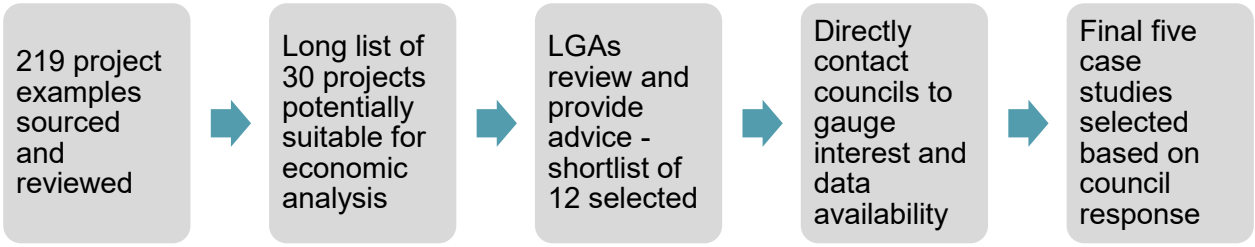

Figure 13 Case study selection process

The five final case studies and their key characteristics are shown in Table 22. This approach ensured a representative sample while managing feasibility and data access constraints.

Table 22 Summary of selected case studies

Case study	NRM region	Location type	Hazard	Type of action
City of Darwin (NT)	Monsoonal North	Metro	Heatwaves, cyclones	Physical and technical
Lockyer Valley Regional Council (Qld)	East Coast	Regional	Riverine flooding	Economic and financial
City of Hobart (Tas)	Southern Slopes	Metro	Bushfire	Knowledge-based, behavioural, and cultural change
Moyne Shire Council (Vic)	Southern Slopes	Regional	Sea level rise	Regulatory
Buloke Shire Council (Vic)	Murray Basin	Regional	Heatwaves, drought	Physical and technical

City of Darwin

Approach

The City's 2030 Greening Darwin Strategy includes actions to increase tree canopy coverage across heat-vulnerable and cyclone-prone areas. The program prioritises planting cyclone-resilient, climate-appropriate tree species in suburbs identified through detailed heat and vulnerability mapping. It is supported by an ongoing collaborative partnership with CSIRO through the Darwin Living Lab. The analysis assessed the costs and benefits of the proposed tree planting program. The key outcomes included in the analysis were:

- Changes in risks of injury and death during heatwave events due to reduced urban temperatures in areas with increased tree canopy cover
- Changes in amenity and recreational value associated with increased tree canopy cover in nearby public spaces
- Changes in ecosystem services from increased tree canopy including carbon storage and sequestration, air pollution removal, stormwater runoff reductions and avoided energy costs.
- Reduced costs from planting cyclone resilient trees which are less likely to be damaged in the event of a cyclone.

The analysis could not include the following benefits which are also expected to be significant:

- Improved worker productivity associated with lower urban temperatures
- Biodiversity benefits from increased tree canopy cover
- Avoided infrastructure damage and disruption caused by tree damage due to cyclones.

Data sources

The key data sources for this analysis included:

- City of Darwin internal data
- CSIRO Darwin Living Lab data
- iTree data
- Literature review of benefits associated with urban cooling and amenity values.

Limitations and challenges

The City of Darwin 2030 Greening Darwin Strategy does not include specific mapping of completed or proposed tree planting activities; therefore, a range of possible scenarios for increasing tree canopy cover in different suburbs was considered. There is no specific data available on how the possible tree planting activities will affect urban temperatures in specific locations although previous research in the City of Darwin has shown that areas of the city with higher tree canopy cover have lower average temperatures. The approach therefore focused on assessing the avoided death and injury during heatwave events rather than on valuing the overall change in urban temperature.

There is likely to be some overlap in the benefits, with avoided energy costs potentially overlapping with reduced illness and injury, and increased amenity being associated with both ecosystem services and reduced risk during heatwaves. However, the relatively lower value of these other benefits suggests that the overlap is not significant to the final results, and they have been reported as they are likely to also include benefits not elsewhere captured.

Assumptions

Assumption	Value	Source
Discount rate	7%, 3%	Infrastructure Australia
Analysis period	30 years	Infrastructure Australia
Tree data		
Inventoried trees	3,722 trees	City of Darwin, CSIRO
Canopy extent of inventoried trees	20.68 ha	City of Darwin, CSIRO
Total park and street tree area	163.30 ha	City of Darwin, CSIRO

Assumption	Value	Source
Cost per tree	$1,475 per tree	City of Darwin
Average mortality rate	3% per annum	CSIRO
Net gain in trees by 2030	18,000	City of Darwin Greening Darwin Strategy
Average cyclone damage – current tree stock	30%	City of Darwin
Average damage – resilient tree planting	26%	Assumed
Additional resilient trees planted to date	7000	City of Darwin
Tree canopy cover per suburb 2021	7%-42%	City of Darwin
Seasonal all mortality rates	0.12%	Amoaty et al (2025)
Average GP visitation rate	0.058	ABS (2025)
Increased risk of dying at highest heat vulnerability index	3.9%	BoM (2021)
Increased risk of GP visit at highest heat vulnerability index	2.2%	BoM(2021)
Change in risk of dying due to access to cool space	1.5%	BoM (2021)
Change in risk of GP visitation due to access to cool space	2.0%	BoM (2021)
Change in TCC associated with cool space	10%, 20%	Assumed
Fatality cost	$5,700,000	Office of Impact Analysis (2024)
Cost of a GP visit	$1065	NSW Values Database (2024)
Average number of severe and extreme heatwave days in Darwin (current)	3.4	BoM (2021)
Increase in hot days under 2030 RCP	290%	BoM (2021)
Heat vulnerability index by suburb	4.53-98.4	CSIRO Darwin Living Lab
Amenity benefits from a 10% increase in TCC	$19,441	
Carbon storage from new tree planting	287 tCO2/ha	iTree eco

Assumption	Value	Source
Carbon sequestration (ongoing)	2.75 tCO2/ha	iTree eco
Carbon price	$130/tCO2e	NSW Values Database
Avoided stormwater runoff	$360/ha	iTree eco
Avoided air pollution	$122/ha	iTree eco
Energy cost savings	$3,524/ha	iTree eco
Avoided GHG from energy	$213/ha	iTree eco

Summary of the findings

The analysis included a range of sensitivities and scenarios to capture the potential range of outcomes that could be delivered by different tree planting programs. The sensitivity analysis also captures the impact of the discount rate and other assumptions. Scenarios included:

- **A tree canopy cover focused scenario:** trees were assumed to be planted in suburbs with less than 30% tree canopy cover, with relatively high population density and lower heat vulnerability index (less than 50). Tree planting in each suburb was scaled by population, with total tree planting assumed at 18,000 net gain. The benefits of tree canopy cover are scaled based on the assumption that a 20% increase in tree canopy cover is required to deliver benefits during heatwaves.
- **A heat vulnerability focused scenario:** where trees were assumed to be planted in suburbs with heat vulnerability index greater than 50, with relatively high population density. Tree planting in each suburb was scaled by population, with total tree planting assumed at 18,000 net gain. The benefits of tree canopy cover are scaled based on the assumption that a 20% increase in tree canopy cover is required to deliver benefits during heatwaves.
- **A cyclone resilient trees scenario**: where it is assumed that a cyclone occurs in 2032 and estimates the avoided loss of trees from having planted cyclone resilient trees in the years up to 2030. Under this scenario, fewer trees need to be replanted, reducing the costs.

Other sensitivities tested were the discount rate (3% instead of 7%), and the assumed increase in tree canopy cover required to provide access to cool spaces in each suburb (10% instead of 20%). The results for each scenario and sensitivity are shown in Table 23.

Table 23 Results for City of Darwin Case Study

Scenarios	Tree canopy focus	Heat vulnerability focus	Cyclone resilient trees	3% discount rate	10% tree canopy cover for cool space
NPV	**$4 million**	**$31 million**	**$27 million**	**$73 million**	**$62** million
BCR	**1.1**	**1.9**	**1.9**	**3.0**	**3.1**
Benefits					
Heatwave benefits	$31 million	$52 million	$52 million	$104 million	$88 million

Amenity benefits	$1.1 million	$0.9 million	$0.9 million	$1.2 million	$0.9 million
Ecosystem service benefits	$1.9 million	$1.9 million	$1.9 million	$2.8 million	$1.9 million
Total	$34 million	$55 million	$55 million	$108 million	$91 million
Program costs	**$29.4** million	**$29.4** million	**$28.6** million	**$36** million	**$29.4** million

The results are driven by some key factors:

- An assumed increase in tree canopy cover in specific suburbs by between 7 and 10%, with 8 or 9 suburbs receiving increased tree canopy cover.
- Planting in suburbs with low tree canopy cover but that are not otherwise highly vulnerable to heat is estimated to lead to six fewer deaths and 430 fewer GP visits during heatwaves over a 10 year period from 2030, compared to not increasing tree canopy cover, providing an estimated $16 million in avoided costs (undiscounted).
- Planting in the most vulnerable suburbs would lead to an additional five fewer deaths and 103 fewer GP visits providing an additional $14 million in avoided costs.
- Planting more cyclone resilient trees would reduce costs compared to less resilient trees by $1.8 million (undiscounted) if a cyclone occurred in 2032 and all damaged trees were subsequently replanted.
- The values are significantly higher under a lower discount rate, due to the increased incidence of heatwaves over the longer term in Darwin, with the number of hot days expected to increase from 11 in 2021 to 43 in 2030.

Lockyer Valley Regional Council

Approach

After flooding events in 2022, the Australian and Queensland Governments announced a joint initiative to help people living in Queensland recover and become more resilient to future flooding events including the Voluntary Home Buy-Back (VHBB) Program which provides funding for Councils to buy back homes. In total, 24 properties across the Lockyer Valley region have been purchased under Tranche 1 and 2 of the Resilient Homes Fund VHBB Program. These properties were in highly vulnerable locations that are susceptible to extreme flood hazard risk. Of the 24 properties purchased nineteen were demolished and five were removed. The buyback program permanently reduced flood risk exposure for participating properties and the wider community. It also enabled the restoration of natural floodplain functions, contributing to broader environmental resilience.

The analysis assessed the costs and benefits of the voluntary home buyback scheme undertaken by Lockyer Valley. To assess the costs and benefits the NSW flood risk assessment tool was used, and updated to reflect appropriate values for the local area. The key outcomes included in the analysis were:

- Avoided residential property damage due to future flood events for the properties that were purchased and removed by the council including loss of structural and contents value based on average annual damage (AAD) curves.

- Avoided health and fatalities risks from future flood events including death, injury, mental health and social wellbeing impacts.
- Avoided emergency recovery costs associated with rescue and recovery after flood events.

The analysis could not include the following benefits which are also expected to be significant:

- Mental health and wellbeing impacts for local government and emergency responders in dealing with flood events.
- Environmental benefits from restoration of land to environmental uses and increased natural floodplain extent.

Data sources

The key data sources for this analysis included:

- Property purchase values and removal costs from Lockyer Vally Council
- Flood risk mapping from Lockyer Valley Flood Information Portal
- Property value data from Geoscience Australia NEXIS database
- NSW Flood Risk Assessment tool AAD.

Limitations and challenges

For this case study, detailed and comprehensive flood risk mapping and the use of the NSW flood risk assessment tool provide high confidence in the analysis. The main limitation for this analysis is that climate change impacts are only included in the 1% annual exceedance probability (AEP) risk. All other AEPs do not account for climate change impacts. The analysis will therefore be underestimating the risks and costs associated with increasing flood risk in future.

For this analysis the assumed program costs include the full property purchase price, as well as all removal, demolition and clean-up costs. This is likely to slightly overestimate the program costs as it assumes that the value of the land is zero after the property buyback program. It is likely that the land does retain some value in environmental use, or in the longer term as agricultural land; however, this could not be incorporated into the analysis at this time.

Assumptions

Assumption	Value	Source
Discount rate	7%, 3%	Infrastructure Australia
Analysis period	30 years	Infrastructure Australia
Flood risk assessment inputs		
Average dwelling size	298m2	Lockyer Valley West SA2 - GA NEXIS database
Average structural value	$2,275 / m2	Lockyer Valley West SA2 - GA NEXIS database (2024)
Average contents value	$206 / m2	

External damages	$17,000	Constant – NSW Flood Risk Tool
Emergency management cost uplift	10%	Assumed based on NSW Flood Risk Tool inputs
Cost per fatality	$5,700,000	Office of Impact Analysis (2024)
Cost per injury	$77,472	Transport for NSW (2019)
Average people per household	2.8	ABS (2025)
% residents suffering disability	20.9%	ABS (2025)
% aged over 75	6.2%	ABS (2025)
Flood rise	2 – around an hour or so	Lockyer Valley Council
Area type	2 – Detached residential dwellings	Lockyer Valley Council
Warning system	0.5 – warning system in place	Lockyer Valley Council
Warning time	0 - <2 hour warning time	Lockyer Valley Council
Community education	1 – Well educated community	Lockyer Valley Council
Relocation costs	$0	Lockyer Valley Council – tested in sensitivity analysis
Residential clean-up costs	$0	Lockyer Valley Council – tested in sensitivity analysis
Ground level AHD, flood height AHD, hazard level	Per property	Lockyer Valley Flood Information Portal
Mental health cost curve per 0.05 m over floor flooding	$545	NSW Flood Risk Assessment Tool
Social willingness to pay to avoid over floor flooding at 1% AEP	$55	NSW Flood Risk Assessment Tool
Costs		
Total costs of property purchase, removal and demolition and clean up	$10,520,701	Lockyer Valley Council

Summary of the findings

The analysis included a range of sensitivities and scenarios to capture the potential range of outcomes that could be delivered. The sensitivity analysis also captures the impact of the discount rate. Scenarios included:

- **Conservative scenario:** in this scenario no relocation costs for affected households are included, and residential clean-up costs are also excluded. Any injuries that occur as a result of floods are assumed to be minor injuries. A 7% discount rate is used.
- **Higher cost scenario:** in this scenario relocation costs of $430 per household are included, and $4,000 of clean-up costs. These costs are based on those provided in the NSW flood risk assessment guidelines. In this scenario it is assumed that 50% of injuries are major injuries with a higher cost per injury compared to minor injuries. A 7% discount rate is used.

The other sensitivity tested was the discount rate at 3%. The results for each scenario and sensitivity are shown in Table 24.

Table 24 Results from Lockyer Valley Case Study

Scenarios	Conservative scenario (7% discount rate)	Higher cost scenario (7% discount rate)	Low discount rate scenario (3% discount rate)
NPV	-$1.8 million	$0.7 million	$3.1 million
BCR	0.8	1.1	1.3
Benefits			
Avoided property damage and emergency response costs	$4.1 million	$4.5 million	$6.5 million
Avoided health and wellbeing impacts	$4.4 million	$6.4 million	$7.1 million
Total	$8.5 million	$11.0 million	$13.5 million
Program costs	$10.3 million	$10.3 million	$10.4 million

The results show that:

- Under a conservative scenario the quantified benefits are close to the costs. The overall benefits are therefore expected to exceed the costs of the program as significant benefits could not be quantified and the real costs are likely to be lower, if the purchased land has future value.
- The benefits outweigh the costs when including elements such as relocation costs and residential clean-up costs, and less conservative estimates of injuries incurred during flood events.
- The benefits outweigh the costs when using a 3% discount rate, given the high upfront costs and the longer term ongoing benefits. For these types of projects, a 3% discount rate may be more appropriate given the community benefits associated with this project.

City of Hobart

Approach

The City of Hobart's 'Sparking Conversations, Igniting Action' program focused on improving community bushfire preparedness through education, household planning support, and targeted vegetation management. The project was designed to reduce the city's exposure to bushfire hazards exacerbated by climate change. The program significantly improved household bushfire preparedness and awareness, reduced the risk of property damage, and supported stronger community networks. It enhanced capacity to respond to and recover from bushfire events, protecting people and infrastructure.

This analysis assessed the benefits of reduced bushfire risk for the areas that took part in the program. The key outcomes included in this analysis were:

- Reduced risk of bushfire leading to a reduced extent of bushfires occurring within the area targeted by the program
- Avoided costs due to property damage from bushfires
- Avoided injuries due both to reduced numbers of properties affected by bushfire, and increased planning and preparedness leading to reduced risk of injury even for properties affected by fire
- Avoided emergency response costs due to reduced risk of bushfire events
- Avoided environmental damage due to reduced areas of bushfires.

Additional benefits which could not be quantified but may be significant included:

- Damage to non-residential assets and properties
- Mental health and wellbeing impacts on affected communities
- Reduced instances of smoke inhalation
- Disruption to businesses.

Data sources

The key data sources for this analysis included:

- Geoscience Australia bushfire boundaries for historical bushfires that overlap the program area
- Geoscience Australia residential property extent and value
- A review of the costs of five bushfires in Southeastern Australia (Stephenson 2010)
- Information on the Sparking Conversations Igniting Action program from City of Hobart.

Limitations and challenges

For this case study, the key limitation was understanding the actual change in bushfire risk as a result of the program. This is much harder to directly measure than changes in flood risk, for example. Therefore, the analysis relies on assumptions of the overall change in risk as a result of the program. The findings show how much risk would have to change because of the program for the benefits to outweigh the costs.

The approach taken to quantifying the benefits is conservative, with fatality costs not included as the area affected is relatively small. This assumption is tested in the sensitivity analysis. The assumed baseline bushfire risk is also based on historical bushfire events. This will underestimate the future risk of bushfires under a changing climate.

Assumptions

Assumption	Value	Source
Discount rate	7%, 3%	Infrastructure Australia
Analysis period	10 years	Assumed based on program
Bushfire risk data		
Assumed change in bushfire risk due to the program	10%, 20%	Assumed

Assumption	Value	Source
Assumed change in injury risk per property due to the program	10%, 20%	Assumed
Historical bushfire occurrence in last 20 years		
Fires less than 25 ha	8	Geoscience Australia Historical Bushfire Boundaries
Fires 25-50 ha	2	Geoscience Australia Historical Bushfire Boundaries
Fires 50-75 ha	1	Geoscience Australia Historical Bushfire Boundaries
Fires greater than 75 ha	1	Geoscience Australia Historical Bushfire Boundaries
Average fire size		
Less than 25 ha	7 ha	Geoscience Australia Historical Bushfire Boundaries
25-50 ha	37.5 ha	Geoscience Australia Historical Bushfire Boundaries
50 - 75 ha	62.5 ha	Geoscience Australia Historical Bushfire Boundaries
Greater than 75	550 ha	Geoscience Australia Historical Bushfire Boundaries
Properties affected per ha burnt	0.104 / ha	Estimated based on NEXIS data and Bushfire extent data
Avoided damage costs		
Residential building and contents replacement value	$615,385 per property	Geoscience Australia NEXIS data
Depreciation factor	0.85	Stephenson (2010)
Avoided health costs		
Value of statistical life	$5,700,000	Office of Impact Analysis
Major injury cost	$1,130,103	NRMA (2014)
Minor injury cost	$36,370	NRMA (2014)
Fatality per home destroyed	0.054	Stephenson (2010)
Major injury per home destroyed	0.045	Stephenson (2010)
Minor injury per home destroyed	0.25	Stephenson (2010)
Avoided environmental damages		
Area burnt coefficient	$1,480/ha	Stephenson (2010)
Intercept	$0	Stephenson (2010)
Avoided response costs		
Area burnt coefficient	$207/ha	Stephensen (2010)
Fatality coefficient	$2,246,088	Stephensen (2010)
Intercept	$0	Stephensen (2010)
Program costs		
Total cost	$1,670,000	City of Hobart

Summary of the findings

The analysis included a range of sensitivities and scenarios to capture the potential range of outcomes that could be delivered. The sensitivity analysis also captures the impact of the discount rate. Scenarios included:

- **A 10% bushfire risk reduction scenario:** where there is a 10% reduction in overall bushfire risk leading to a reduction in the area affected by bushfires over the next 10 years and a 10% reduction in the risk of injuries per property affected by bushfires. The discount rate is 7%.
- **A 20% bushfire risk reduction scenario:** where there is a 20% reduction in overall bushfire risk leading to a reduction in the area affected by bushfires over the next 10 years and a 20% reduction in the risk of injuries per property affected by bushfires. The discount rate is 7%.
- **A 5 year scenario:** where a 20% reduction in both bushfire risk and injury risk is maintained for 5 years. The discount rate is 7%.
- **A fatality included scenario:** in this scenario the costs of fatalities are also included, noting that given the small area affected this represents a reduced risk of fatalities per property, which may not be equal to one fatality. This should be understood as a reduced risk, rather than an overall cost.

The other sensitivity tested was the discount rate at 3% on the 10% risk reduction scenario. The results for each scenario and sensitivity are shown in Table 25.

Table 25 Results from City of Hobart Case Study

Scenarios	10% risk scenario	20% risk scenario	5 year scenario	Fatalities included	3% discount rate
NPV	$0.5 million	$2.5 million	$0.9 million	$2.8 million	$1.0 million
BCR	1.3	2.6	1.6	2.8	1.6
Benefits					
Avoided response costs	$0.3 million	$0.6 million	$0.4 million	$0.3 million	$0.4 million
Avoided health costs	$0.3 million	$0.5 million	$0.5 million	$2.7 million	$0.4 million
Avoided residential damages	$1.4 million	$2.7 million	$1.6 million	$1.4 million	$1.8 million
Avoided environmental damages	$0.04 million	$0.08 million	$0.05 million	$0.04 million	$0.05 million
Total	$2.0 million	$4.0 million	$2.5 million	$4.4 million	$2.7 million
Program costs	$1.6 million	$1.6 million	$1.6 million	$1.6 million	$1.6 million

The results show that:

- Even relatively small reductions in risk (c.10%) over a short period of time can deliver positive net benefits for the community.
- More significant reductions in risk over a longer period can deliver significant net benefits for the local community.
- The reduction in risk under the 20% scenario over 10 years reflects only reduced risk of 8 properties being directly affected. This shows that only limited reductions in bushfire impact can have significant value for the community.
- The change in bushfire risk can reflect either reduced size or risk of small regular fires (the area has had 14 bushfires of varying sizes over the last 20 years) or avoiding one major fire event.
- Avoided health costs and risks are significant, and do not fully capture mental health costs or loss of community and social wellbeing.

Moyne Shire Council

Approach

Moyne Shire introduced a planning amendment in Port Fairy to prevent new development in areas projected to be inundated by sea level rise, as part of its Coastal Hazard Management Plan. This forward-looking policy represents a proactive local government approach to long-term climate risk management. The town of Port Fairy is low-lying and therefore at risk from both riverine flooding and coastal inundation, particularly under future sea level rise. The community faces rising threats from coastal erosion, storm surges and sea level rise. Moyne Shire has amended its local planning regulations (Amendment C69) to manage and mitigate these risks. The project's goal is to ensure future development and land use in Port Fairy are climate-resilient – protecting lives, property, and the town's cultural and environmental values.

This analysis assessed the benefits of reduced flood risk for the areas within the planning scheme amendment. The key outcomes included in this analysis were:

- Avoided residential property damage due to future flood events for future properties that would otherwise be developed in the area at risk, including loss of structural and contents value based on average annual damage (AAD) curves.
- Avoided health and fatalities risks from future flood events including death, injury, mental health and social wellbeing impacts.
- Avoided emergency recovery costs associated with rescue and recovery after flood events.

The analysis could not include the following benefits which are also expected to be significant:

- Mental health and wellbeing impacts for local government and emergency responders in dealing with flood events.
- Disruption to tourist visitation and local businesses because of property development within the area at risk of floods.

Data sources

The key data sources for this analysis included:

- Planning Scheme amendment extent from Moyne Shire Council
- Flood risk mapping from the Future Coasts – Port Fairy Coastal Hazard Assessment
- Property value data from Geoscience Australia NEXIS database
- NSW Flood Risk Assessment tool AAD.

Limitations and challenges

For this case study, the flood risk mapping is not available on a property by property basis. Therefore, overall flood risk was only available for the area as a whole. This analysis has therefore been simplified to consider average property impacts across the area of the planning scheme amendments, not on a property by property basis. For this analysis assumptions need to be made about the potential future property development that would have occurred in the absence of the planning scheme amendment. Given the limited mapping available a simple assumption has been included that 10 additional properties would be developed within the area by 2040. This is substantially less than the population growth rate of the area. To ensure the results are conservative the benefits of avoided flood risk are only considered between 2040 and 2054.

Assumptions

Assumption	Value	Source
Discount rate	7%, 3%	Infrastructure Australia
Analysis period	30 years	Infrastructure Australia
Flood risk assessment inputs		
Average dwelling size	320m2	GA NEXIS database
Average structural value	$2,032 / m2	- GA NEXIS database (2024)
Average contents value	$220 / m2	
External damages	$17,000	Constant – NSW Flood Risk Tool
Emergency management cost uplift	10%	Assumed based on NSW Flood Risk Tool inputs
Cost per fatality	$5,700,000	Office of Impact Analysis (2024)
Cost per injury	$77,472	Transport for NSW (2019)
Average people per household	2.5	ABS (2025)
% residents suffering disability	19.4%	ABS (2025)
% aged over 75	8.9%	ABS (2025)
Flood rise	2 – around an hour or so	Moyne Shire Council
Area type	2 – Detached residential dwellings	Moyne Shire Council
Warning system	0.5 – warning system in place	Moyne Shire Council
Warning time	0 - <2 hour warning time	Moyne Shire Council
Community education	1 – Well educated community	Moyne Shire Council
Relocation costs	$0	Tested in sensitivity analysis
Residential clean-up costs	$0	Tested in sensitivity analysis

Assumption	Value	Source
Ground level AHD, flood height AHD, hazard level	Per property	Water Research Lab Future Coasts – Port Fairy Coastal Hazard Assessment
Mental health cost curve per 0.05 m over floor flooding	$545	NSW Flood Risk Assessment Tool
Social willingness to pay to avoid over floor flooding at 1% AEP	$55	NSW Flood Risk Assessment Tool
Costs		
Total costs of planning scheme amendment	$500,000	Moyne Shire Council

Summary of the findings

The analysis included a range of sensitivities and scenarios to capture the potential range of outcomes that could be delivered. The sensitivity analysis also captures the impact of the discount rate. Scenarios included:

- **Conservative scenario:** in this scenario no relocation costs for affected households are included, and residential clean-up costs are also excluded. Any injuries that occur as a result of floods are assumed to be minor injuries. A 7% discount rate is used.
- **Higher cost scenario:** in this scenario relocation costs of $430 per household are included, and $4000 of clean-up costs. These costs are based on those provided in the NSW flood risk assessment guidelines. In this scenario it is assumed that 50% of injuries are major injuries with a higher cost per injury compared to minor injuries. A 7% discount rate is used.
- **Early inundation scenario:** in this scenario the estimated sea level rise for 2040 is assumed to occur from 2035 onwards, leading to increased flood risk for properties sooner than under the conservative scenario.

The other sensitivity tested was the discount rate at 3%. The results for each scenario and sensitivity are shown in Table 26.

Table 26 Results from Moyne Shire Council Case Study

Scenarios	Conservative scenario (7% discount rate)	Higher cost scenario (7% discount rate)	Early inundation scenario	Low discount rate scenario (3% discount rate)
NPV	$0.1 million	$0.2 million	$0.5 million	$1.0 million
BCR	1.2	1.4	2.0	2.9
Benefits				
Avoided property damage and	$0.6 million	$0.6 million	$0.9 million	$1.3 million

emergency response costs				
Avoided health and wellbeing impacts	$0.01 million	$0.1 million	$0.1 million	$0.1 million
Total	$0.6 million	$0.7 million	$1.0 million	$1.5 million
Program costs	$0.5 million	$0.5 million	$0.5 million	$0.5 million

The results show that:

- Under a conservative scenario the quantified benefits are greater to the costs showing that the planning scheme amendment is an effective low cost option for reducing risks to the community.
- Elements such as relocation costs and residential clean-up costs, and less conservative estimates of injuries incurred during flood events are not major factors affecting the value of the investment, which is mostly driven by avoided property damage.
- The timing of sea level rise impacts is significant, bringing forward the 2040 sea level rise flood risk to 2035 significantly increases the benefits.
- The benefits outweigh the costs when using a 3% discount rate, given the high upfront costs and the longer term ongoing benefits. For these types of projects, a 3% discount rate may be more appropriate given the community benefits associated with this project.

Buloke Shire Council

Approach

Buloke Shire Council led the Cool It Phase 2 Program in conjunction with the Central Victorian Greenhouse Alliance and other Councils across the Mallee, Loddon-Campaspe and Central Highlands Region of Victoria. It follows the Cool It Phase 1 pilot program completed in 2018. The Cool It program has produced heat vulnerability street mapping and prioritisation, developed a climate resilient tree planting list and enabled planting of climate resilient street trees in the priority locations with high heat vulnerability. The Cool It initiative aims to address urban heat issues in high vulnerability localities in regional towns (such as Charlton, Birchip, Donald and Wycheproof in Buloke Shire) through increased street tree planting, creation of shade, and enhancement of green spaces. The project's objectives are to reduce ambient temperatures, but also increase planting of resilient species that will survive future climate impacts, and to improve liveability and social well-being in these rural communities.

The key outcomes included in the analysis were:

- Changes in risks of injury and death during heatwave events due to reduced urban temperatures in areas with increased tree canopy cover
- Changes in ecosystem services from increased tree canopy including carbon storage and sequestration, air pollution removal, stormwater runoff reductions.

The analysis could not include the following benefits which are also expected to be significant:

- Improved worker productivity associated with lower urban temperatures
- Biodiversity benefits from increased tree canopy cover
- Increased resilience of new tree planting to the effects of climate change.

Data sources

The key data sources for this analysis included:

- Cool It project data
- iTree data
- Literature review of benefits associated with urban cooling.

Limitations and challenges

The Cool It program does not include specific mapping of completed or proposed tree planting activities, therefore a range of possible scenarios for increasing tree canopy cover in different suburbs was considered. There is no specific data available on how the possible tree planting activities will affect urban temperatures in specific locations. The approach therefore focused on assessing the avoided death and injury during heatwave events rather than on valuing the overall change in urban temperature.

There is likely to be some overlap in the benefits between ecosystem services and reduced risk during heatwaves. However, the relatively lower value of these other benefits suggests that the overlap is not significant to the final results, and they have been reported as they are likely to also include benefits not elsewhere captured.

Assumptions

Assumption	Value	Source
Discount rate	7%, 3%	Infrastructure Australia
Analysis period	30 years	Infrastructure Australia
Tree data		
Assumed leaf area per tree	0.006 ha/tree	Buloke Shire Council
Cost per tree	$130 / tree	Buloke Shire Council
Average mortality rate	3% per annum	iTree eco
Net gain in trees	153	Buloke Shire Council
Tree canopy cover per SA1	6%-25%	Buloke Shire Council
Average GP visitation rate	0.125	ABS (2019)
Increased risk of GP visit at highest heat vulnerability index	2.2%	BoM(2021)

Change in risk of GP visitation due to access to cool space	2.0%	BoM (2021)
Change in TCC associated with cool space	3%, 15%	Assumed
Cost of a GP visit	$1065	NSW Values Database (2024)
Average number of severe and extreme heatwave days in Victoria (current)	2.7	BoM (2021)
Increase in hot days under 2030 RCP	18%	BoM (2021)
Heat vulnerability index by suburb	15-90	Cool It program data
Carbon storage from new tree planting	287 tCO2/ha	iTree eco
Carbon sequestration (ongoing)	2.75 tCO2/ha	iTree eco
Carbon price	$130/tCO2e	NSW Values Database
Avoided stormwater runoff	$360/ha	iTree eco
Avoided air pollution	$122/ha	iTree eco
Program costs		
Cool it Program costs (split by councils)	$17,875	Buloke Shire Council

Summary of the findings

The analysis included a range of sensitivities and scenarios to capture the potential range of outcomes that could be delivered by different tree planting programs. The sensitivity analysis also captures the impact of the discount rate and other assumptions. Scenarios included:

- **A tree canopy cover focused scenario:** trees were assumed to be planted in suburbs with less than 15% tree canopy cover, and lower heat vulnerability index (less than 50). Tree planting in each suburb was scaled by population, with total tree planting assumed at 153 net gain.
- **A heat vulnerability focused scenario:** where trees were assumed to be planted in suburbs with heat vulnerability index greater than 50 and tree canopy cover less than 20%. Tree planting in each suburb was scaled by population, with total tree planting assumed at 153 net gain.

Other sensitivities tested were the discount rate (3% instead of 7% on the tree canopy focus scenario). The results for each scenario and sensitivity are shown in Table 27.

Table 27 Results for Buloke Shire Council Case Study

Scenarios	Tree canopy focus	Heat vulnerability focus	3% discount rate
NPV	**$0**	**$29,000**	**$16,000**

BCR	**1.0**	**1.6**	**1.3**
Benefits			
Heatwave benefits	$29,000	$51,000	$50,000
Ecosystem service benefits	$16,000	$16,000	$12,000
Total	$45,000	$67,000	$62,00
Program costs	**$44,000**	**$44,000**	**$46,000**

The results are driven by some key factors:

- Planting in suburbs with low tree canopy cover but that are not otherwise highly vulnerable to heat is estimated to lead to 11 fewer GP visits during heatwaves over a 5 year period from 2028, compared to not increasing tree canopy cover.
- Planting in the most vulnerable suburbs would lead to an additional 18 fewer GP visits.

These findings demonstrate that even small gains in health outcomes for local communities can provide significant value. Prioritised urban cooling activities can therefore be valuable in these locations.

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