Western Alliance for Greenhouse Action
Climate Change Adaptation Strategy: 2013-2020
Full Report

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Box 1. About the Western Alliance for Greenhouse Action and the region

About WAGA

The Western Alliance for Greenhouse Action (WAGA) is a partnership of councils in Melbourne's west committed to collaboratively responding to climate change. Currently its member councils includes Brimbank City Council, Hobsons Bay City Council, Greater Geelong City Council, Maribyrnong City Council, Melton City Council, Moonee Valley City Council, Moorabool Shire Council and Wyndham City Council.

WAGA's mission is to lead and support collaborative action to decrease greenhouse emissions and, through partnerships between local communities, government, industry and research bodies, to increase its communities' resilience and adaptive capacity so that they will remain livable now and in the future.

About the region

The WAGA region is more than 4700 sq. km and is amongst the fastest growing regions in Australia. The region is geographically varied ranging from high-density housing and business districts, to sparse rural and coastal communities. The region is home to a highly diverse community, and includes heavy industrial activities as well as key transport and logistics hubs.

Map of the WAGA region - project partners shown in blue.

Executive Summary

There is now overwhelming evidence that the climate is changing and that further change is unavoidable. Building resilience to climate change requires a coordinated response of both reducing greenhouse gases (*mitigation*) and adjusting to the impacts (*adaptation).*

Melbourne's western region faces a future of increasing temperatures, shifting rainfall patterns, sea level rise, and increasing intensity and frequency of extreme weather events, including heatwaves, bushfires, floods and storms[1]. Given Local Governments' proximity to climate change's impacts, WAGA Councils must adapt to the risks that climate change poses.

This WAGA adaptation project is one of the first regional climate change adaptation strategies developed in Victoria's local government sector. The Strategy builds upon the *WAGA Climate Change Risk Assessment (2011)* and aims to build regional local governments' capacity to adapt to the priority climate change risks by providing WAGA with a strategic pathway for action[2].

The *WAGA Climate Change Risk Assessment (2011)* found that climate change poses risks to the full range of council's operations, assets and infrastructure. This project is divided into two parts:

1) *WAGA Climate Change Adaptation Strategy 2013-2020*
2) *WAGA Climate Change Adaptation Action Plan 2013-2020*

The Strategy is based on the *AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines* and by providing a framework for regional climate change risk management, it will guide future management and adaptation. The Strategy will also be a key resource for its member Councils. It will guide them to develop municipal-level climate change adaptation plans that address the full range of climate risks affecting their municipalities.

The *WAGA Climate Change Adaptation Action Plan 2013-2020* details recommendations for adaptation for both WAGA and its member Councils. It includes an implementation timeline, estimated resource costs, delegated areas of responsibility, and key performance indicators. As shown in Table 1, the Adaptation Action Plan's scope is limited to addressing the 17 priority regional climate change risks identified during the *WAGA Climate Change Risk Assessment (2011).* There are many opportunities for WAGA to drive action on adaptation at the regional level, including:

- coordinating regional priorities, resources and action;
- leveraging funding for adaptation projects;
- advocating to State Government;
- conducting research and sharing information with stakeholders;
- developing tools and resources for Councils; and
- building regional partnerships between local government and other levels of government and sectors.

Key municipal-level adaptation actions for Councils include:

- updating plans, polices and budgets to account for climate change risks, including Municipal Public Health and Emergency Management Plans;
- working with vulnerable groups and sectors;
- engaging communities in climate change adaptation actions; and
- up-scaling existing projects and programs such as stormwater reuse projects, energy efficiency, and integrated transport planning.

1. Department of Sustainability and Environment (2008) Climate Change in Port Phillip and Westernport. Available: http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0008/73196/PPWP_WEB.pdf
2. The priority risks were identified in the WAGA Climate Change Risk Assessment (2011).

Figure 1 Provides an outline of how this Strategy and Action Plan will align with WAGA's 2012-15 strategic directions.

Figure 1. Strategic overview of the Regional Adaptation Strategy.

RISK ID	RISK	RISK DESCRIPTION	RISK LIKELIHOOD RATING	RISK CONSEQUENCE RATING
1	**Business continuity and service delivery**			
78PA	Inadequate Council resourcing	Council services unable to cope with climate change impacts due to inadequate resources and shortages of appropriately skilled staff.	Likely	Major
66PA	Lack of staff skills	Lack of skilled people in climate change adaptation means Councils cannot respond adequately to climate change.	Almost certain	Major
78PA	Inadequate long-term planning	Current strategic planning and budget processes do not encourage long-term adaptive management to climate change.	Almost certain	Major
53PA	Inadequate finance for asset renewal	Councils are unable to finance the asset renewal gap reduced lifespan.	Likely	Catastrophic
65PA	Conflicts between OHS and community needs	Conflicts arise between Councils their OHS requirements for employees and meeting community needs, e.g. staff working on extreme hot days may be limited in the activities they can perform because of OHS requirements.	Almost certain	Major
58PA	Inability to deliver services	Climate change requires service delivery beyond business-as-usual, exceeding Councils' capacity and compromising routine service delivery.	Almost certain	Major
2	**Governance and regulation of planning and building**			
2PR	Inadequate planning	State Government provides inadequate advice to Councils regarding planning and adaptation resulting in poor planning and development responses to climate change.	Likely	Catastrophic
4PR	Inadequate building standards	Current building design standards inadequate for projected climate conditions in 20 to 50 years' time.	Possible	Catastrophic
3	**Infrastructure and assets**			
69PA	Increased asset maintenance costs	More extreme climate conditions such as severe weather events and higher temperatures increase asset degradation reduce lifespan and increase operating and maintenance costs for buildings.	Likely	Catastrophic
71PA	Damaged underground infrastructure	The overall drying trend combines with more extreme rainfall events to increase soil movement damaging underground infrastructure (e.g. drains and building foundations).	Almost certain	Major
4	**Water management**			
8PA	Drain blockages	Declining average precipitation and extended drought periods cause reduced drain flush-out events leading to drain blockages and localised flooding during extreme rainfall events.	Almost certain	Major
10PR	Decreased water harvesting	Reduced precipitation decreases the effectiveness of water harvesting and storage leading to reduced water availability for public use.	Almost certain	Major
11PA	Stormwater overflow	Severe rainfall events overwhelm stormwater systems causing overflow events, localised flooding, damage to infrastructure and environmental contamination.	Almost certain	Major
12PR	Disruptions to wastewater treatment	Hotter temperatures and more frequent severe weather events increase stress on electricity networks leading to power failures and subsequent impacts on water supply and wastewater treatment.	Almost certain	Major
5	**Emergency management**			
54PA	Inadequate emergency facilities	Councils have inadequate facilities to provide shelter and refuge during severe weather events and heatwaves, leaving communities vulnerable.	Almost certain	Major
6	**Regional mobility**			
67PR	Transport service disruption	Railways and main road systems are damaged during severe weather events restricting mobility of people and goods.	Almost certain	Major
7	**Regional economy**			
27PR	Slowing of local economy	Extreme weather events and sea level rise damages businesses and industry, which leads to slowing of local economy and job losses.	Almost certain	Catastrophic

Table 1. Priority regional risks.
NB. The risk themes and risk identification codes relating to each risk were extracted from the WAGA Climate Change Risk Assessment 2011. PR – Regional risk that affects multiple Councils; PA – Priority risk that affects all Councils.

1. Introduction

1.1. Purpose

The purpose of the Strategy and the accompanying Adaptation Action Plan is to provide a framework for building resilience to priority climate change risks in Melbourne's western region. The Strategy is designed to be a key resource for WAGA and its member Councils as a guide to developing municipal-level climate change adaptation plans.

1.2. Aims and objectives

The Strategy leads on from the *WAGA Climate Change Risk Assessment (2011)* that identified risks to regional Councils and aims to transform the region's adaptive capacity and resilience to priority climate change risks by:

- establishing a shared vision for long-term cooperative action to adapt to climate change in Melbourne's western region;
- providing a framework for strategically and collectively implementing actions for adapting to the priority climate change risks;
- providing WAGA and its members with a strategic pathway for action on how to adapt to the priority regional risks between now and 2020; and
- continuing to build strong regional partnerships to coordinate risk identification, adaptation action and review.

1.3. Scope

This Strategy outlines a strategic pathway for action between now and 2020. The scope of the Strategy is limited to addressing the 17 priority regional climate change risks[3]. This includes risks that are trans-boundary and municipal risks common across Councils. It is anticipated that Councils will need to develop municipal-level climate change adaptation plans that address the full range of climate risks affecting their municipalities as identified in the WAGA Climate Change Risk Assessment.

The Strategy is based on the *AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines*. The Strategy will guide climate change risk management and adaptation into the future by providing a framework for climate change adaptation planning, while the Action Plan contains details of the practical actions required to adapt to the risks.

1.4. Strategy outline

The Strategy is divided into three sections:

(1) Adapting Regionally to Climate Change: Why is adaptation necessary? What is the policy context? What are the roles and responsibilities for local government? What are the benefits of regional adaptation?

(2) Regional Climate Change Futures: Climate change impacts and key vulnerabilities? Translation into LG risks?

(3) Regional Adaptation Framework.

The accompanying *WAGA Climate Change Adaptation Action Plan (2013-2020)* identifies options for how WAGA and its member Councils can adapt to the priority regional risks. Timeframes, resource requirements, cost estimates, responsibilities and key performance indicators have been assigned to the actions. The Adaptation Action Plan divides risks into seven themes that relate to the roles and functions of local government, including:

1. business continuity and service delivery;
2. buildings and properties;
3. governance and regulation of planning and building;
4. water management;
5. emergency management;
6. regional mobility; and
7. regional economy.

3. Priority risks were identified during the WAGA Climate Change Risk Assessment (2011). In each municipality, Council officers and other stakeholders identified these risks as those most pressing for Melbourne's west. The project involved the municipalities of Brimbank, Hobsons Bay, Maribyrnong, Melton, Moonee Valley and Wyndham, although the Strategy will be relevant to all WAGA Councils.

2. Adapting regionally to climate change

What is climate change adaptation?

Climate change adaptation is defined for this Strategy as a *process of continuous institutional learning, adjustment and transformation*[4]. Climate change adaptation actions are the various decisions that are made to prepare for, and respond to, direct and indirect changing climate risks.

2.1. Rationale for climate adaptation

Due to the time lag between when greenhouse gas emissions are released and their affect on global warming, further climate change is now unavoidable[5]. Based on current greenhouse gas mitigation pledges internationally, it is now anticipated that global temperature will rise between 2.5 – 3.5°C by 2050, and up to 5°C of warming by 2070[6]. This extent of warming is far beyond the 2°C estimated as the upper 'safe' threshold[7]. What is more, recent observations show that the climate is changing more dramatically and the risks are more severe than previously anticipated[8].

Councils and communities are already experiencing the affects of these changes. Managing climate change now requires the complementary approach of *mitigating* greenhouse gas emissions, and *adapting* to the impacts[9 10].

Adaptation to the adverse impacts of climate change needs to begin without delay - both for the managing risks that we are already being observed, as well as those we anticipate. Beginning adaptation now is likely to avoid significant future costs, and the sooner savings and other co-benefits can be obtained[11].

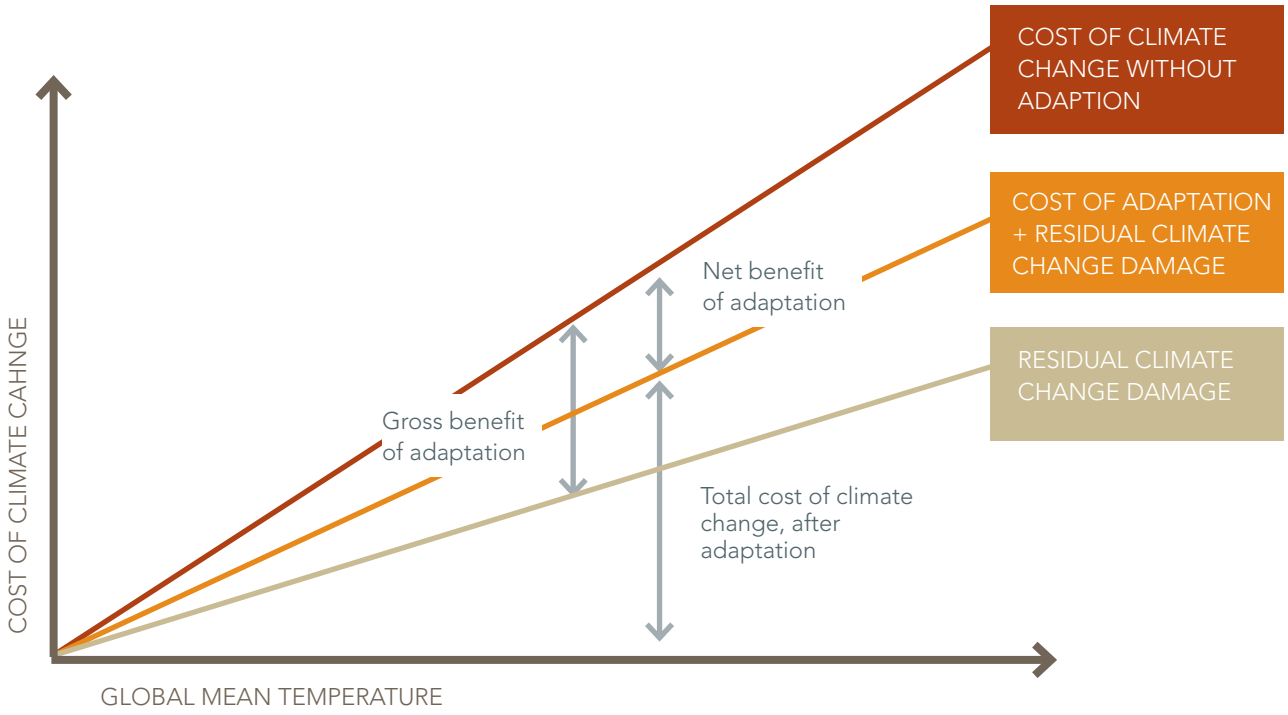


Figure 2. Economics of adaptation. Source: Stern Review (Part V, p. 405).

4. Fünfgeld, H and McEvoy, D. (2011) Working Paper 1: Framing Climate Change Adaptation Policy and Practice. Victorian Centre for Climate Change Adaptation Research. Available online at: http://www.vcccar.org.au/sites/default/files/publications/Framing_project_workingpaper1_240611_1.pdf
5. IPCC (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge: Cambridge University Press.
6. UNEP (2012) The Emissions Gap Report: A UNEP Synthesis Report. Nairobi: United Nations Environment Programme (UNEP).
7. Peters G., Andrew, R., Boden, T., Canadel, J., Ciais P., La Quere, C., Marland, G., and Raupach, M. (2013) The Challenge to Keep Global Warming Below 2 °C. Nature of Climate Change, 3, 4-6.
8. Steffen, W (2009) Climate Change: Faster and More Serious Risks. Commonwealth of Australia: Canberra.
9. IPCC (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge: Cambridge University Press.
10. World Bank (2012) Turning Down the Heat: Why a 4-degree Warmer World Must be Avoided. Pg. 2. World Bank, Washington.
11. IPCC (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge: Cambridge University Press.

2.2. Adaptation policy context

This Strategy and the accompanying Action Plan were developed to complement the roles, activities and priorities set out for local government in Federal and State Government climate change adaptation policies as well as sharing the responsibility for adaptation to climate change across all sectors of society.

The *Victorian Climate Change Action Plan (2013)* outlines the following roles for local government[12].

- Managing risks and impacts to public assets owned and managed by local government and to local government service delivery – including managing risks to assets and infrastructure such as local roads and providing ongoing service.
- Supporting measures to build adaptive capacity and climate resilience in local communities – including delivering information about relevant climate risks.
- Collaborating across councils and, with the Victorian Government, managing regional climate change risks.
- Working in partnership with the community, locally based organisations and stakeholders to manage relevant climate risks.
- Implementing relevant legislation to promote adaptation (e.g. the *Emergency Management Act 1986*) – including, ensuring that through administering local planning schemes they appropriately incorporate climate change considerations and that decision-making is consistent with State Government adaptation approaches.
- Contributing appropriate resources to prepare, prevent, respond and recover from detrimental climate impacts.

An overview of how this Strategy fits with other major Federal, State and Local Government climate change adaptation policies and plans is mapped below in figure 3. Explanations of these key policies and projects numbered 1-7 are provided on the subsequent page in Box 1.

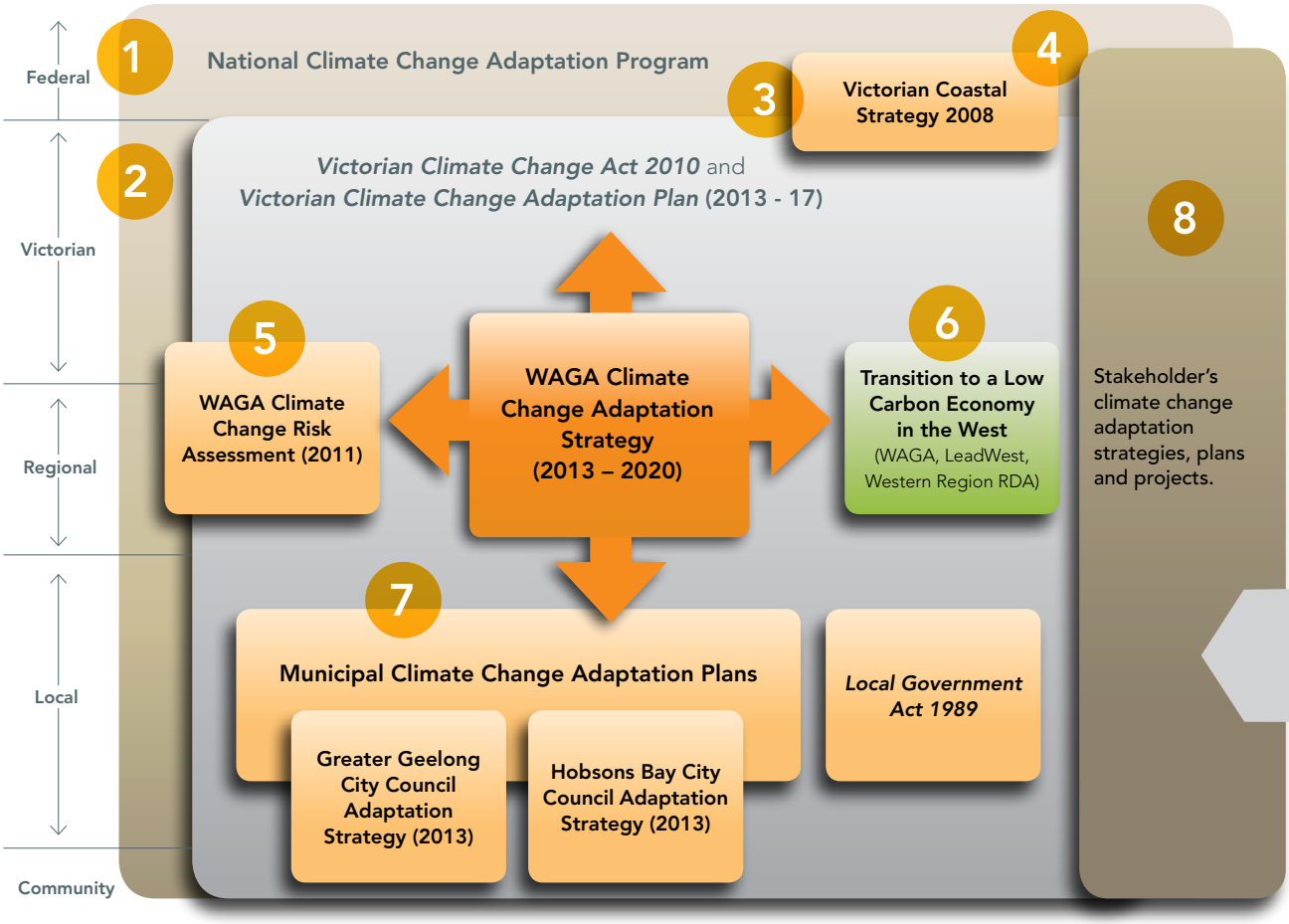


Figure 3. Adaptation policy and activity landscape.

12. Department of Sustainability and Environment (2013) Victoria's Climate Change Adaptation Plan.
Available online: http://www.climatechange.vic.gov.au adapting-to-climate-change/Victorian-Climate-Change-Adaptation-Plan

Box 1. Key climate change adaptation policies and activities relevant to WAGA

Australian Government

1. *National Climate Change Adaptation Program* – The Australian Government has funded a range of projects to improve understanding about climate change risks and how to best manage them. Funded projects include: National Climate Change Adaptation Research Facility (NCCARF), grant programs for local government and professionals, and major vulnerability assessments. The *Climate Change Adaptation Outlook: A Proposed National Adaptation Assessment Framework (2013)* is the first of a series of reports on how to how well-placed Australia is to manage the impacts of climate change.

Victorian Government

2. *Victorian Climate Change Act (2010)* legislates the Victorian Government's roles and responsibilities in addressing climate change, which encompass both mitigation and adaptation. Under the Act, Local Governments are also required to 'have regard to climate change' in the preparation of the Municipal Public Health and Wellbeing Plans.

3. *Victorian Climate Change Adaptation Plan (2013-17)* as prepared under the *Victorian Climate Change Act 2010*. The first iteration of the VCCAP identifies strengthening partnerships between Local Government and communities as a key strategy. Partnerships with Local Governments are noted as being important for working effectively with local communities, for both providing information and developing local and regional adaptation plans.

4. *Victorian Coastal Strategy (2008)* provides program guidance on the potential inundation associated with sea level rise along the Victorian coastline. *Victorian Coastal Hazard Guideline (2011). Coastal Climate Change Advisory Committee* – under Section 151 of the Planning and Environment Act 1987. The Committee's role is to advise the Minister for Planning about how Victoria's land-use planning and development controls can best support the Victorian Government's policy for managing coastal impacts of climate change. This policy was outlined in the *Victorian Coastal Strategy* released in December 2008.

Regional actions

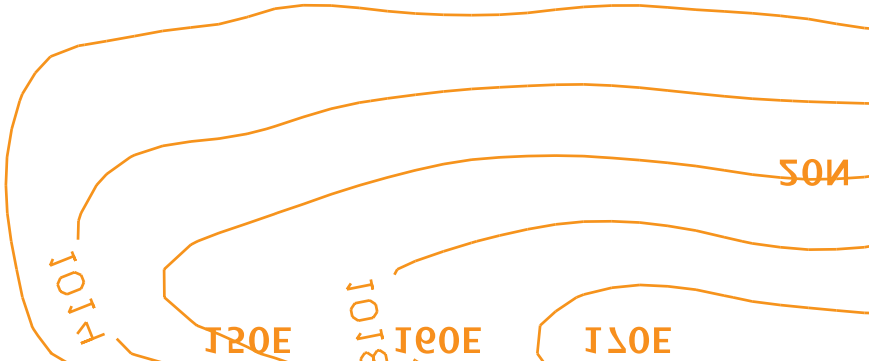
5. *WAGA Climate Change Risk Assessment (2011)* is a preliminary climate change risk assessment, which informed the development of this Regional Adaptation Strategy.

6. *Transition to a Low Carbon Economy in the West* (Western Regional Greenhouse Strategy). WAGA is developing a climate change mitigation strategy in conjunction with LeadWest and Western Melbourne Regional Development Australia. The strategy will complement this Adaptation Strategy and Action Plan.

7. *Municipal Climate Change Adaptation Plans* are the plans and activities WAGA'S individual member Councils undertake. At time of writing, the Cities of Hobsons Bay and Greater Geelong have already developed Adaptation Strategies to address climate change risks affecting their municipalities.

Regional stakeholder actions

8. There are a number of adaptation strategies and projects already underway in the region, including: the *Western Region Integrated Transport Strategy; Department of Transport's Climate Change Risk Management; Greening the West's adaptation projects;* and *Melbourne Water Climate Change's Adaptation Strategy 2013.*



2.3. Importance of regional climate change adaptation

Support for a regional approach to climate change adaptation is woven through State and Federal Government policy. The *Victorian Climate Change Adaptation Plan (2013)* "recognises the importance of place-based responses to managing climate risks and the need to develop regional partnerships and deliver effective action on the ground".

Regional adaptation is vital for effective and efficient overall adaptation. This is because managing climate change risks at local and regional levels frequently requires management across conventional boundaries of responsibility, long-term planning, and significant resource inputs.

This regional Strategy creates opportunities for WAGA to facilitate action between Councils and other stakeholders by:

- coordinating strategic responses, networks and partnerships between Councils and other stakeholders;
- sharing knowledge, learning, decision-making tools and programs to develop best and common practice;
- sharing costs and resources and taking advantage of economies of scale;
- advocating to community and government about opportunities for adapting to climate change; and
- providing leadership and support for adaptation to climate change across the region, and more broadly[13].

Figure 4 provides an overview of some examples of adaptation strategies and how they align with WAGA's Strategic Directions (2011-15).

Figure 4. Roles of WAGA in climate change

13. Municipal Association of Victoria (2011) Stocktake of Current Victorian Climate Change Adaptation. MAV, Melbourne.

3. Future climate in Melbourne's west

3.1. Overview

This section provides an overview of the regional climate change impacts, including rising temperatures, altered rainfall, sea level rise and extreme weather events, and how these impacts translate into risks for regional Councils. The data has been drawn from the *Climate Change in Port Philip and Westernport Report* (2008), which is the most recent downscaled climate change modelling for the region for 2030 (A1B scenario) and 2070 (A1F1 scenario).

3.1.1. Higher average temperatures and solar radiation

Climate models suggest a that Melbourne's west can expect increasing average temperatures over time with a high degree of certainty, but our understanding of what this rising temperature will mean for the region in 2070 is much less certain. By 2030, average daily maximum temperatures are likely to rise by 0.5 to 1.5°C over most of Victoria; by 2070, they are likely to rise by 0.7 to 5.0°C compared to 1990. There will be more hot days and fewer cold days. Widespread decreases in atmospheric moisture are likely.

3.1.2. Reduced rainfall, but heavier rainfall during rain events

Although average annual and seasonal total rainfall is expected to decline, the intensity of heavy daily rainfall is likely to rise in most seasons. However, fewer rain days are anticipated, along with more droughts. These heavy rains could contribute to soil erosion and movement.

Reductions in the total average annual rainfall of around four per cent are expected, with the greatest percentage reductions occurring in spring (7%) compared with 1990 figures. In Melbourne, the average long-term stream flow into water supply catchments could be reduced by up to 11 per cent by 2020, and as much as 35 per cent by 2050[14]. Projections suggest that annual runoff to the Maribyrnong and Werribee Rivers could reduce by five to 30 per cent by 2030.

3.1.3. Sea level rise

Port Phillip Bay sweeps the southern aspects of the region and falls within the municipalities of Wyndham, Hobsons Bay and Greater Geelong City Councils. Sea level rise is known to increase coastal erosion and storm surge. The Victorian coast has experienced increases of between 2.6 and 2.8 mm sea level rises per year since 1990[15]. It is projected that sea levels could rise by more than a meter by 2095.

Some western region suburbs closest to the foreshore are amongst Victoria's most vulnerable to sea level rise. Approximately 10,000–16,000 existing residential buildings in the municipalities of Hobsons Bay, Greater Geelong and Wyndham City Councils may be at risk of inundation from a sea level rise of 1.1 meters, and storm tide associated with a 1-in-a-100 year storm[16]. Approximately 250 properties are located within 110m of soft shorelines vulnerable to erosion[17].

3.1.4. Increasing intensity and frequency of extreme weather events

Without global action to reduce emissions, by 2070 Melbourne's average number of days above 35°C is likely to increase from 9 to 26[18]. An increase in the frequency, intensity and duration of heat waves may also amplify the risk of heat-related health problems, particularly in urban areas[19]. Higher temperatures may also shift energy use from winter heating to summer cooling[20].

"Extreme" fire danger days are expected to increase by 12 to 38 per cent by 2020, and by 20 to 135 per cent by 2050[21]. Between 2000 and 2007, Victoria experienced a 62 per cent increase in fire weather warnings. By 2020, they may occur twice as often, and by 2050 four to five times as often. This means the Melbourne region would experience catastrophic fire days once every 2.4 years on average, instead of the current average of once every 33 years[22].

14. Department of Climate Change and Energy Efficiency (2012) Victoria – Potential Impacts and Costs Factsheet.
15. ibid.
16. ibid.
17. ibid.
18. Department of Sustainability and Environment (2008) Climate Change in Port Phillip and Westernport. Melbourne: The State of Victoria.
19. Victorian Heatwave Strategy Hobsons Bay City Council Pilot Project Final Report 2008.
20. Department of Sustainability and Environment (2008) Climate Change in Port Phillip and Westernport. Melbourne: The The State of Victoria.
21. ibid.
22. Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts 2007.

3.2 Translation of regional climate change impacts into Local Government risks

The localised impacts of climate change will result in many perverse risks for Councils across the full range of Local Government's roles and functions. In many cases, climate change risks will magnify existing risks (e.g. stormwater overflow, increasing asset maintenance costs, and inadequate advice from the Victorian Government in regards to planning), while other risks will be introduced (e.g. sea level rise). Table 2 below outlines how climate change will impact Councils in the region in future.

Regional climate hazards	Projections for Melbourne's west 2030 (A1B medium growth)	Projections for Melbourne's west 2070 (A1F1)	Key impacts on Council roles, functions and responsibilities	Priority risks
Temperature	**0.8 °C** (0.6 – 1.1 °C)	**2.6** °C (1.8-3.7 °C)	Community and health services - Public Health Plan, Heatwave Plan	▪ Lack of staff skills ▪ Inability to deliver services
			Corporate services, asset management	▪ Inadequate Council resourcing ▪ Increased asset maintenance costs ▪ Inadequate finance for asset renewal
			Municipal Emergency Management Plans	▪ Inadequate emergency facilities ▪ Inability to deliver services
			OHS for outdoor workers	▪ Conflicts between OHS and community needs
Average rainfall	**-4%** (-8-0%)	**-11%** (-24-0%)	Open space/recreation assets and infrastructure (e.g. sports fields, parks and gardens)	▪ Decreased water harvesting ▪ Drain blockages ▪ Stormwater overflow ▪ Damage to underground infrastructure ▪ Increased asset maintenance costs
Rainfall intensity	0.9%	3.0-5.9%	Emergency Management, OHS for outdoor workers	▪ Inadequate emergency facilities ▪ Staff skills shortage ▪ Conflicts between OHS and community needs
			Statutory planning, economic and sustainable development, transport planning	▪ Slowing of the local economy ▪ Disruption to transport services
			Asset management, roads and drainage, service delivery	▪ Stormwater overflow ▪ Transport service disruption ▪ Inadequate building standards ▪ Increased asset maintenance costs
			OHS for outdoor workers	▪ Conflicts between OHS and community needs
Extreme fire danger days	12-38% by 2020,	20-135% by 2050[23]	Municipal Emergency Management Plan	▪ Lack of staff skills ▪ Inadequate emergency facilities ▪ Conflicts between OHS and community needs
			Asset management, service delivery	▪ Increased asset maintenance costs ▪ Inadequate building standards
Sea level rise (storm surge and coastal erosion)	200mm by 2040	800mm by 2100	Statutory and land-use planning	▪ Inadequate advice from DPCD ▪ Inadequate building standards
			Asset management, corporate services, economic/sustainable development, service delivery	▪ Inadequate resources for asset renewal ▪ Inadequate finance for asset renewal ▪ Increased asset maintenance costs ▪ Slowing of the local economy ▪ Stormwater overflow
Solar radiation	**0.9%** (0.2-1.7%)	**2.7%** (0.6-5.5%)	Asset management	▪ Increased asset maintenance costs ▪ Inadequate resources for asset renewal ▪ Inadequate finance for asset renewal ▪ Inadequate building standards
			OHS for outdoor workers	▪ Conflicts between OHS and community needs

Table 2. Translation of climate impacts into priority risks for Councils in the WAGA region.

23. Department of Sustainability and Environment (2008) Climate Change in Port Phillip and Westernport. Melbourne: The State of Victoria. Except sea level rise from http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0017/111950/Melbourne-Water-Planning-for-sea-level-rise-guidelines.pdf

4. Regional adaptation framework

The Regional Adaptation Framework is based on the *AS/NZS ISO 31000: 2009 Risk Management – Principles and Guidelines*. The Framework outlines the cyclical process of managing climate change risks across five stages:

- identify hazards and vulnerabilities;
- assess risks;
- evaluate and prioritise risks;
- identify and implement risk treatments; and
- learn about the performance.

This process should be used for updating the Action Plan and developing municipal climate change adaptation strategies.

4.1. Risk management and adaptation cycle

The Climate Risk Management and Adaptation Cycle demonstrates that adapting to climate change risks will be an ongoing process of continual improvement, illustrated in Figure 5.

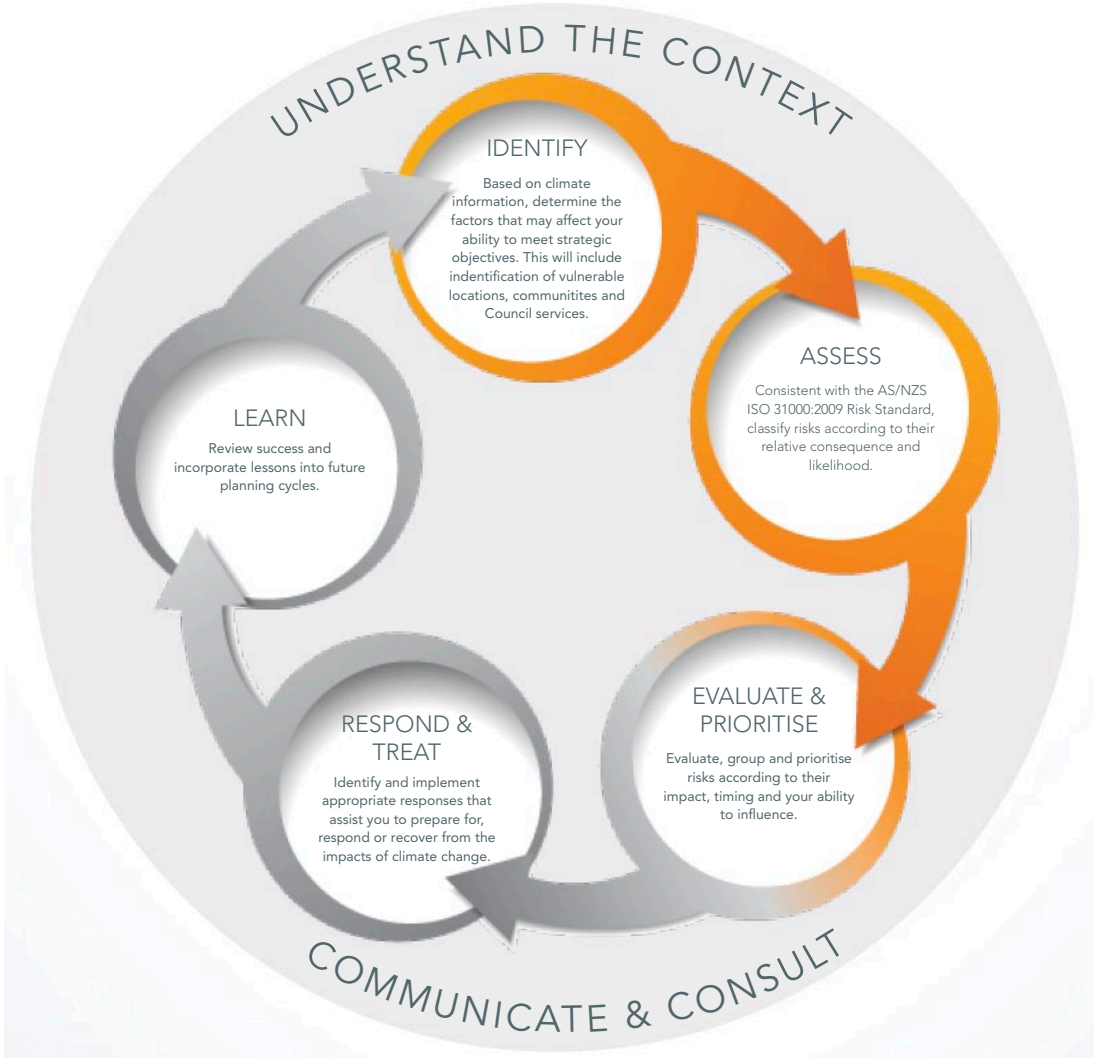


Figure 5. Climate Risk Management and Adaptation Cycle (amended from Net Balance)

Climate change risks often cross traditional boundaries of responsibility. Communication and consultation with stakeholders is therefore a hallmark of an effective management strategy. Engaging relevant stakeholders throughout the risk management process has been a key element of the Adaptation Strategy, central to planning an effective and efficient adaptation, particularly at the regional scale.

Avoiding mal-adaptation

If risk adaptation strategies are not carefully planned it can lead to 'mal-adaption'. Mal-adaptation is where actions increase vulnerability to a risk. Mal-adaptation may include actions that increase greenhouse gas emissions, do not match the magnitude of the risk (or are implemented at the wrong time or location (increasing vulnerability), have high costs relative to alternatives, or prevent future flexibility for future generations.

4.2.1. Identifying Adaptation Options

Adaptation (also known as 'risk treatment') involves identifying and implementing of range of adaptation options that will remain robust under numerous possible future scenarios (considering interconnections between climate and non-climate variables) and actions that reduce vulnerability. Adaptation actions may be:

- administrative (e.g. policy development, budgeting and resourcing);
- risk sharing (e.g. insurance);
- operational (e.g. drainage infrastructure, construction materials and design);
- standard-setting and regulation (e.g. building codes, planning provisions);
- research and monitoring (e.g. development of tools);
- education and communications (e.g. community engagement); or
- stakeholder partnerships.

Some of these adaptation decisions will be reactive (e.g. recovery efforts after floods), while others will be proactive (e.g. early warning systems for extreme weather events). Over time, adaptation actions will increasingly need to be proactive due to the likelihood and consequences of climate risks becoming more severe (illustrated in Figure 6).

Adaptation actions to treat climate change risks will be greatly dependant on the nature of the risk and the roles and responsibilities of those responsible for managing it.

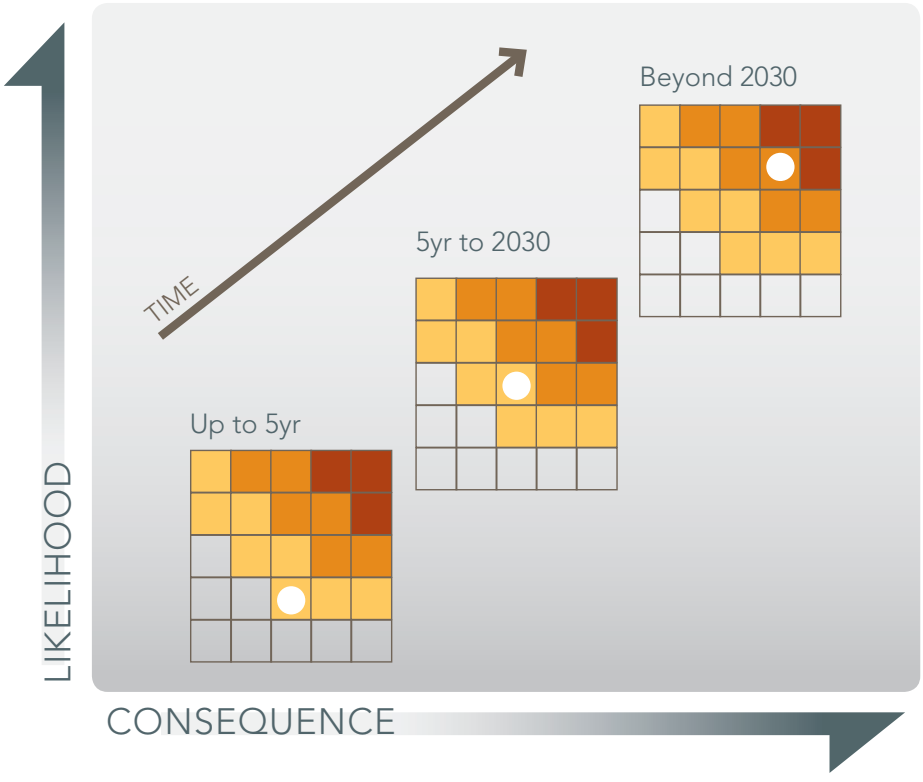


Figure 6. Climate change risks will become more severe over time.

Adaptation opportunities at the regional and municipal scales

WAGA has many opportunities to drive action on adaptation at the regional scale, including:

- coordinating regional priorities, resources and action;
- leveraging funding for adaptation projects;
- advocating to State Government;
- conducting research and sharing information with stakeholders;
- developing tools and resources for Councils; and
- building regional partnerships between Local Government and other levels of government and sectors.

Key adaptation actions for Councils to undertake include:

- updating plans, polices and budgets to account for climate change risks, including Municipal Public Health and Emergency Management Plans;
- working with vulnerable groups and sectors;
- engaging their communities in climate change adaptation actions; and
- up-scaling existing projects and programs, such as stormwater reuse projects, energy efficiency, and integrated transport planning.

4.2.2. Appraise and select adaptation options

To appraise and prioritise effective adaptation actions the following criteria should be applied to the selection of adaptation actions:

I. reduce vulnerability and enhance resilience;
II. be appropriate to WAGA's and/or Local Government's role and responsibility;
III. account for uncertainty of the future risk context;
IV. be proportionate to the severity of risk, and robust under a range of scenarios; and
V. have long-term cost effectiveness.

The principles outlined below will guide the WAGA region's ongoing development and implementation of climate change adaptation planning, improving the region's resilience to climate change risks. These principles can be applied to both regional and local climate change risks.

Principles of effective regional adaptation

Managing climate change risks requires mitigation and adaptation

Adaptation strategies that also reduce or stabilise greenhouse gases are preferred because the sooner greenhouse gases are stabilised the less costly and drastic adaptation will need to be.

Deal with uncertainty

There is a high degree of confidence in historical data that shows the climate is shifting, but predicting the precise location, magnitude and timing of *future impacts locally* is less certain, especially beyond 2030. Adaptation planning will need to account for this uncertainty. Strategies such as planning for a range of possible future scenarios, maintaining flexibility, and modelling and considering the avoided costs and non-financial benefits of early adaptation must be adopted.

Mainstream and embed adaptation processes

Climate change risks will have impacts across local government's full range of roles and functions. Therefore robust adaptation processes must be embedded across the breadth of local government's decision-making mechanisms in order to enhance its adaptive capacity to manage climate change risks..

Shared action, resourcing and responsibility

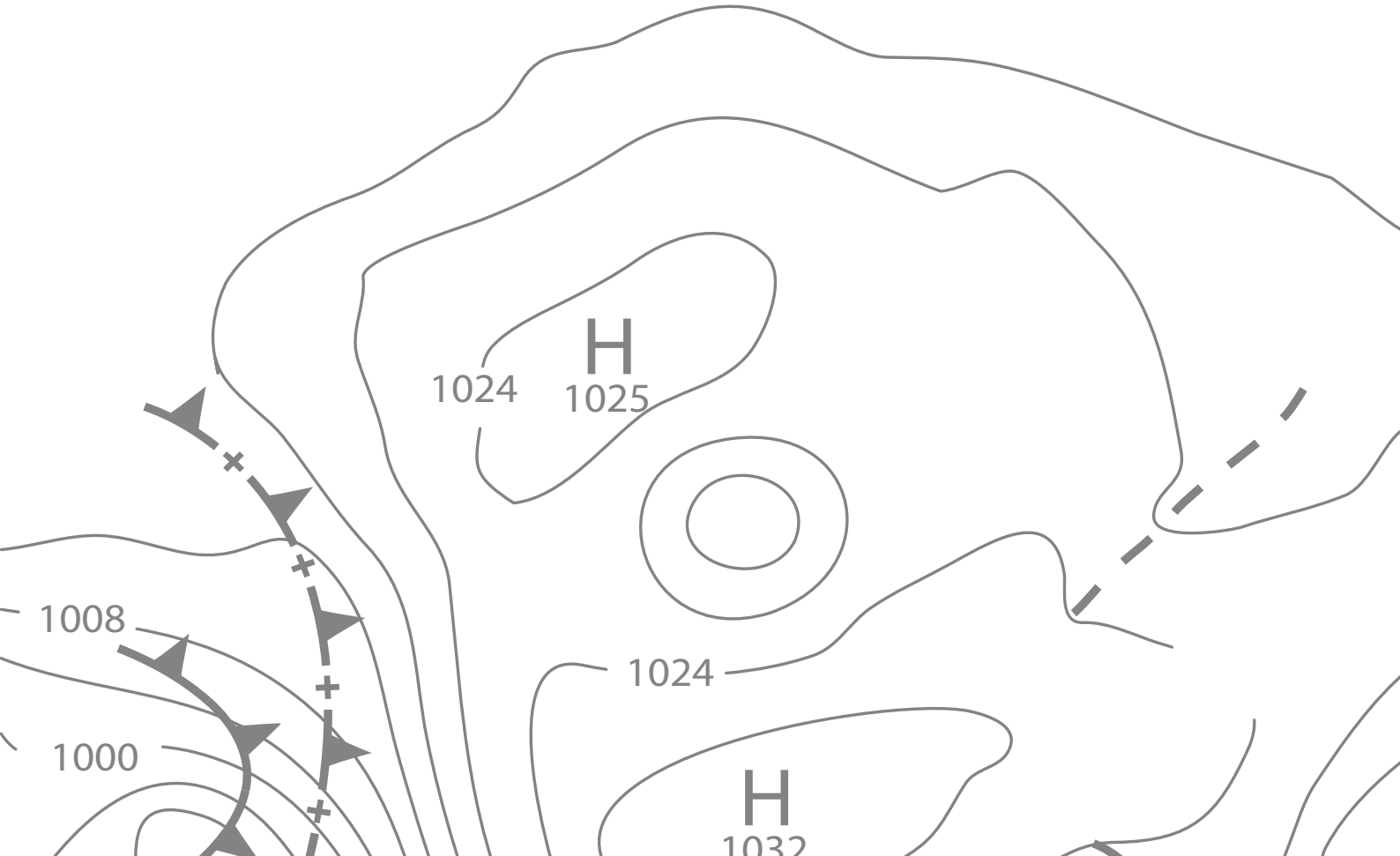
Adaptation needs to be shared and coordinated throughout society and government. Appropriate responsibility for roles, responsibilities and actions should be delegated to WAGA and local government.

Integrated approach

Exploration of the adaptation context must consider the long-term interactions between relevant climate and non-climate (social and economic) factors.

Act early to improve efficiency and effectiveness

Early action on risk adaptation will lead to avoidance of many future costs. The sooner adaptation action is implemented, the greater will be the savings from avoided costs – and the sooner those savings and other benefits will be obtained. While there is a high degree of confidence in historical data that shows the climate is shifting, predicting the precise location, magnitude and timing of *future impacts locally* is less certain, especially beyond 2030. Strategies such as planning for a range of possible future scenarios, maintaining flexibility, and modelling and considering the avoided costs and non-financial benefits of early adaptation will account for this uncertainty.



Further information on planning climate change adaptation in Victoria

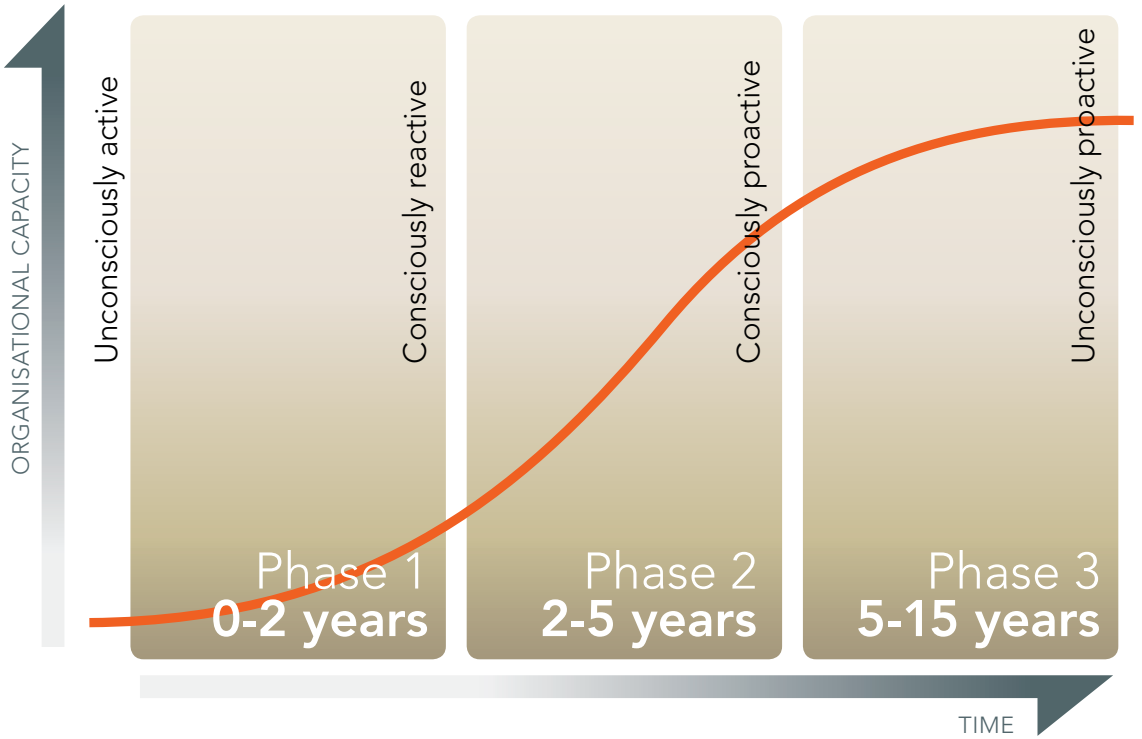
Victorian Climate Change Adaptation Plan, Department of Sustainability and Environment
http://www.climatechange.vic.gov.au/adapting-to-climate-change/Victorian-Climate-Change-Adaptation-Plan

Climate Change Adaptation Toolkit , NetBalance, Geelong City Council and VCCCAR
http://www.geelongaustralia.com.au/ct/tag/article/item/8cf7e8cfb9bad9d.aspx

The Adaptation Navigator, Victorian Centre for Climate Change Adaptation Research
http://www.vcccar.org.au/navigator

The NCCARF Local Government Portal, National Climate Change Adaptation Research Facility
http://www.localgov.nccarf.edu.au/

Climate Change Adaptation Strategy Implementation



Systematic Challenge

DRIVE ADAPTATION AS A MAINSTREAM ISSUE

- Begin to mainstream adaptation planning across organisation and community
- Begin the process of cultural change and communication within council
- Incorporate robust decision-making principles into all major council decisions
- Roll out community consultation plan
- Maintain and build links to other Government agencies (Federal and State) and NGOs

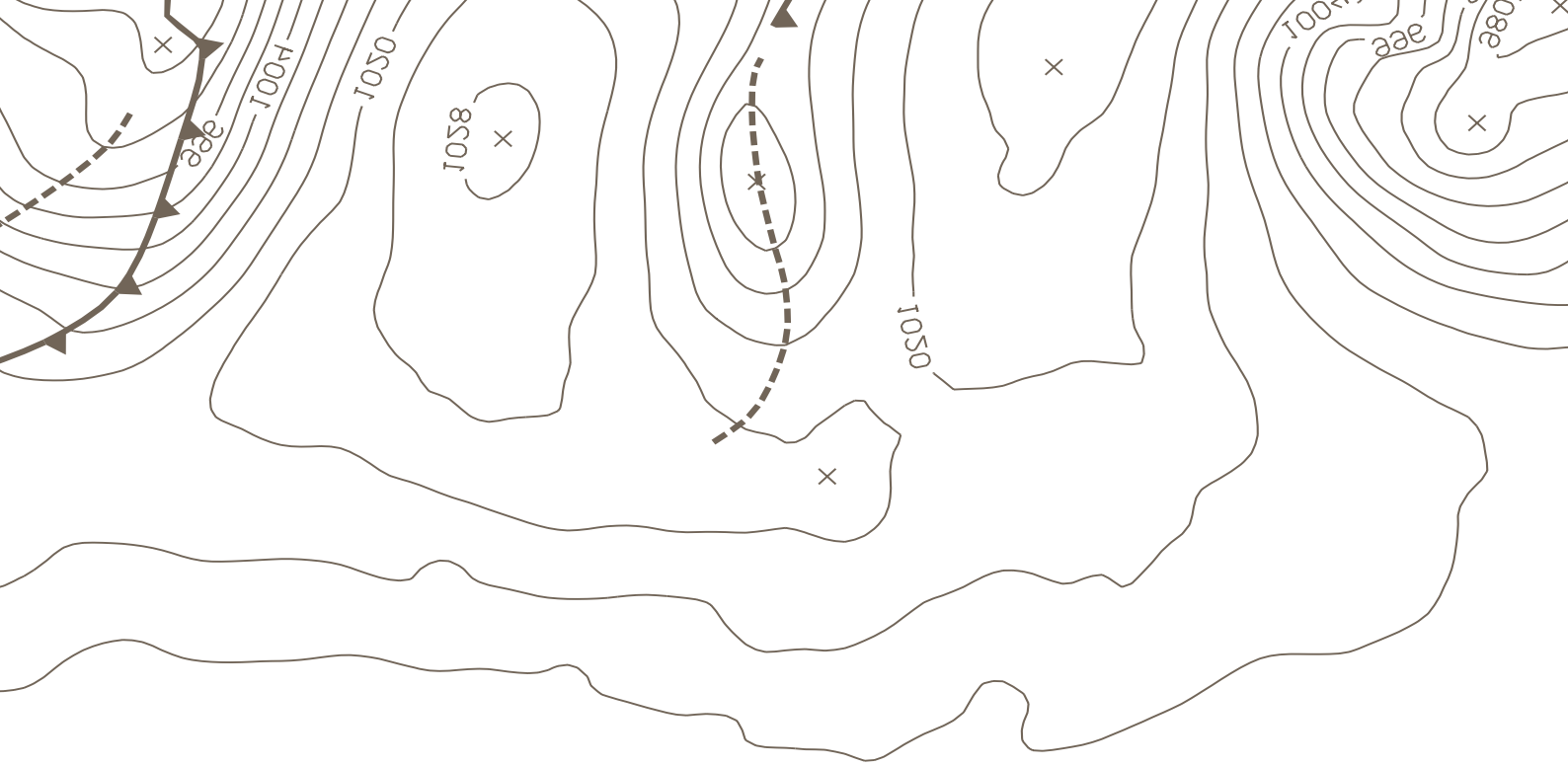
EMBED ADAPTATION

- Embed adaptation planning and preparation as part of "everybody's everyday job"
- Build on initial community consultation to overcome barriers to adaptation
- Work closely with other Government agencies and NGOs on delivery of climate change adaptation plans
- Monitor science and policy closely and respond to changes

REVIEW PROGRESS

- Measure robustness of council and community planning for adaptation and incorporation of robust decision-making principles
- Maintain agility and flexibility with council and community to respond to adaptation challenge
- Foster continual "unconscious" innovation

Figure 7. Implementation framework.
Source: Greater Geelong City Council's Climate Change Adaptation Strategy (2013).



4.3. Implementation

Greater Geelong City Council and NetBalance developed the *Climate Change Adaptation Strategy Implementation* framework shown in Figure 7[24]. This Framework will be used to structure and coordinate regional action within the Adaptation Action Plan across three phases: Mainstream Adaptation, Embed Adaptation, and Monitor and Review

The *Adaptation Working Group* will be responsible for implementing, evaluating and reviewing the Adaptation Action Plan and the Annual Progress Report.

Updating Council Risk Registers

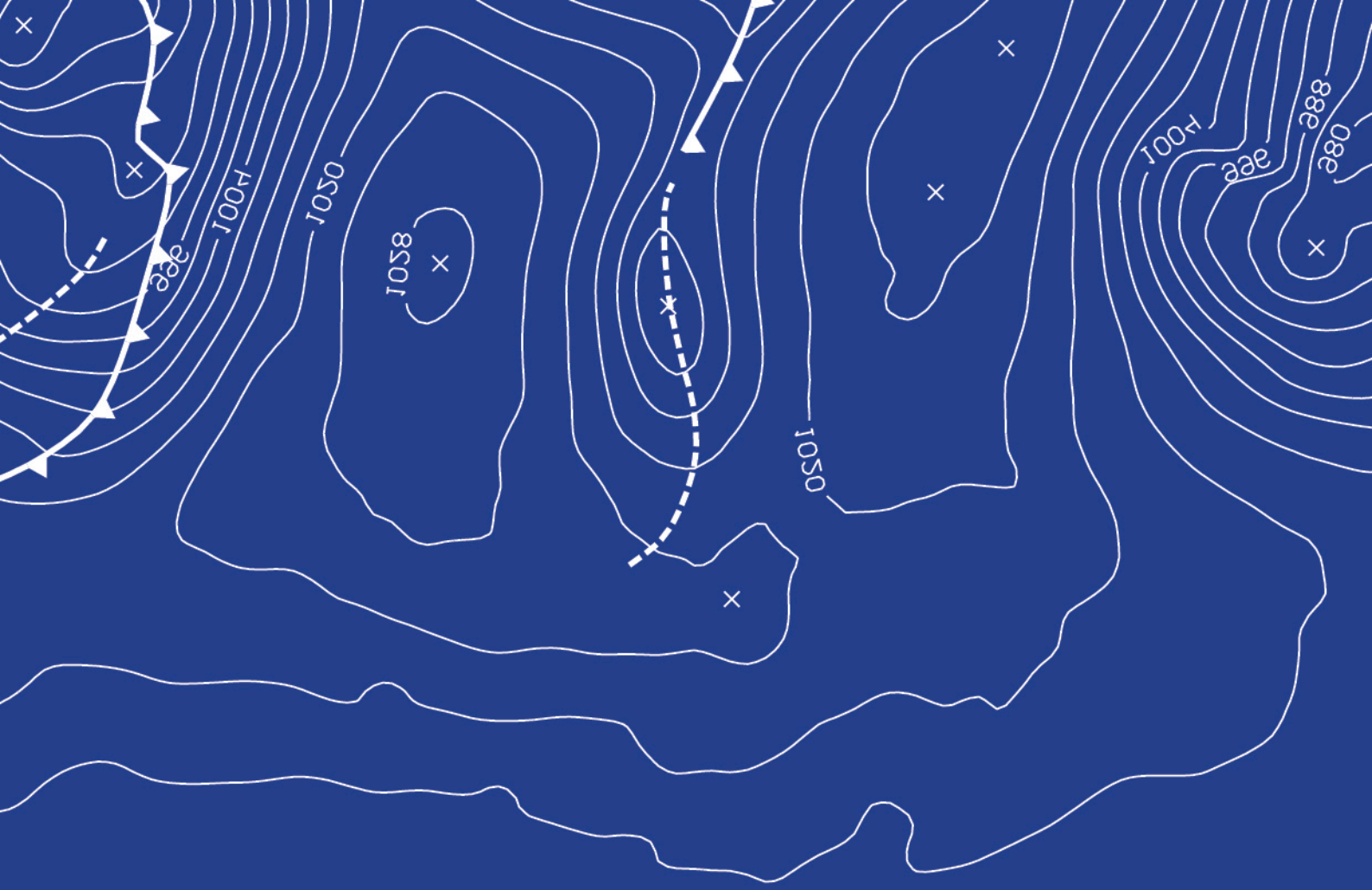
Council Risk Registers are central repositories for recording and tracking risks. Updating Council Risk Registers will therefore be a key strategy for Councils as they mainstream and embed climate change risk management processes for the risks affecting their municipalities. The WAGA Adaptation Action Plan will identify important areas for regional collaboration and should be used to inform the review of Council Risk Registers.

4.4. Monitoring and review

Monitoring and review of the effectiveness of the Adaptation Plan will need to be conducted at regular intervals. The Adaptation Action Plan's progress and effectiveness should be reported on annually, and major reviews should also be conducted every two years. Major reviews would include the Risk Assessment, regional and municipal priorities, and adaptation actions.

It is important to note that there is currently a lack of well-developed metrics for climate change adaptation outcomes. This is largely due to the lack of certainty in the cause-effect relationship between adaptation options and outcomes. For example, there is often a long delay and/or indirect relationship between the implementation of an adaptation strategy and its long-term effectiveness. It is important, therefore, that KPIs are reviewed at regular intervals by applying principles of adaptive learning, innovation and refinement.

24. City of Greater Geelong (2013). Greater Geelong Climate Change Adaptation Strategy, Implementation Framework (p.10). http://www.geelongaustralia.com.au/common/public/documents/8ce5879f7f85db8-Climate%20Change%20Adaptation%20Strategy.PDF



Further information

The full version of this report is available from the WAGA Coordinator. Please contact:
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WAGA

Victorian Adaptation & Sustainability Partnership

State Government Victoria

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City of Melton

City of Moonee Valley

Maribyrnong City Council

Brimbank City Council

Hobsons Bay City Council