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

Background

This WAGA Climate Change Adaptation Action Plan 2013-30 sets out a plan of action for WAGA and its member councils to respond to the priority climate change risks for the region, as described in the WAGA Climate Change Risk Assessment 2011. The Plan also outlines the governance structures for the ongoing implementation, monitoring and review as described in the *WAGA Climate Change Adaptation Strategy* 2013-20.

Priority regional adaptation action areas: 2013 - 2020

This Adaptation Action Plan focusing on the following seven action areas that represent the seventeen priority risks selected from the Risk Assessment.

1. Business continuity and service delivery
2. Infrastructure and assets
3. Water management
4. Governance and regulation of planning and building
5. Emergency management
6. Regional mobility
7. Regional economy

Box 1. Summary of the WAGA Climate Change Risk Assessment

The WAGA Climate Change Risk Assessment (2011) was limited to identifying risks facing councils. In total, the Risk Assessment identified eighty eight (88) risks affecting Local Governments in the WAGA region. The majority of these risks (75%) were either (i) common to councils across the region (e.g. Lack of staff skills), or (ii) trans-boundary risks that affect multiple municipalities (e.g. sea level rise). The remaining risks were specific to a few councils (25%) such as bushfires and coastal inundation, and were excluded from this project. All modelling was based on projections for the region for 2030 under the A1B emissions scenario (moderate growth), and A1FI for 2070 (high growth).

The final stage of the Risk Assessment involved Council staff prioritising the most pressing climate change risks, and rating their priority as major or catastrophic risk consequence rating The 17 priority regional risks were grouped into seven themes that related to local government roles and functions.

WAGA climate change hazard map.

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 shortage of appropriately skilled staff.	Likely	Major
66PA	Staff skill shortage	Lack of skilled people in climate change adaptation means Councils cannot respond to climate change adequately.	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 that occurs as a result of the affect of climate change on assets' longevity.	Likely	Catastrophic
65PA	Conflicts between OH&S and community needs	Conflicts arise between Councils meeting their OH&S requirements for employees and meeting community needs, e.g. staff working on extreme heat days may be limited in the activities they can perform because of OH&S 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 lifespans and increase buildings' operating and maintenance costs.	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 rainfall decreases the effectiveness of water harvesting and storage, leading to reduced water availability for public uses.	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 heat waves, 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 have been extracted from the WAGA Climate Change Risk Assessment 2011. PR – regional risk that affects multiple councils; PA – Priority risk affecting all councils.

Planning, implementation and governance

Governance

The WAGA Adaptation Working Group will oversee the implementation, monitoring and review of the Plan. This Adaptation Working Group should include representatives from across WAGA councils and focus on engaging a wide range of disciplines and departments. This Adaptation Working Group will also keep WAGA abreast of developments in climate change adaptation science and policy, particularly in regard to regional impacts.

Roles and responsibilities

The Action Plan includes recommendations for both WAGA and councils. The recommendations to WAGA are to be coordinated by the Adaptation Working Group on behalf of the region. Recommendations for councils may be taken up by WAGA members individually, as relevant to the municipality. Both regional and council-specific actions will need to be monitored and reviewed in accordance with the monitoring and review cycles described in the Adaptation Strategy.

As adaptation to climate change risks often crosses the existing boundaries of responsibilities between levels of government and other organisations, external stakeholders have been listed in the Stakeholders column of the Plan for WAGA's information and will be used to inform regional adaptation project planning. These stakeholders are listed for information.

Resourcing

Adaptation actions have been costed based on the following indicative cost categories - some costs will be ongoing, while others will be once off. These cost estimates have been developed to inform future budget decisions and are estimates only and the actions should be costed appropriately prior to implementation.

Resource categories	Cost Estimate
$	$0 - 10,000
$$	$10,000 - 100,000
$$$	$100,000 >

1. Business continuity and service delivery

As 2030 approaches, Councils will increasingly notice the impacts of climate change on their (triple) bottom line and their capacity to deliver services. As annual rainfall declines, heat waves occur more frequently, and floods, storms, and bushfires occur more severely and frequently, Councils' will be challenged to balance the short-term cost of reacting to climate change impacts with active adaptations that focus on long-term benefits, as well as to deliver services to the community.

Vulnerable services include roads/pavement, stormwater and drainage, buildings, parks and open spaces, emergency refuge centres, health services, and people services. The WAGA region is also experiencing significant development and population growth. This is putting pressure on social, health and community services, and climate change will add to these pressures. Updating council Business Continuity Plans will be an important step in enhancing the resilience of Council's services to climate change risks.

Regional priority risks

78PA INADEQUATE LONG-TERM PLANNING
Current strategic planning and budget processes do not encourage long-term adaptive management to climate change.

66PA CONFLICTS BETWEEN OH&S AND COMMUNITY NEEDS
Conflicts arise between Councils meeting their OH&S requirements for employees and meeting community needs, e.g. staff working in extreme heat may be limited in the activities they can perform because of OH&S requirements.

53PA STAFF SKILLS SHORTAGE
Lack of people skilled in climate change adaptation means Councils cannot respond adequately to climate change (emergency management).

65PA INABILITY TO DELIVER SERVICES
Climate change requires service delivery beyond business-as-usual, exceeding Councils' capacities and compromising routine service delivery.

58PA INADEQUATE COUNCIL RESOURCING
Council services may be unable to cope with climate change impacts due to inadequate resources and shortages of appropriately skilled staff.

Business continuity and service delivery

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources?	Responsibility	Indicators of performance
INADEQUATE LONG-TERM PLANNING *Current strategic planning and budget processes do not encourage long-term adaptive management to climate change.*	**Recommendations for WAGA**						
	Establish processes for the implementation, monitoring and evaluation of the *WAGA Climate Change Adaptation Plan*.	Establish a cross-Council working group to oversee the implementation and evaluation of the *WAGA Climate Change Adaptation Plan*, continue engaging with stakeholders and community, source funding for Adaptation Projects, and monitor and evaluate the project.		2013	$ - Staff time, monthly meetings (ongoing)	WAGA to coordinate across all Councils	Diversity of membership (Councils and divisions) Funding sought Stakeholder engagement M&E results
		Develop key documents to deliver the Plan, including the communications plan, stakeholder engagement plan, annual implementation plan, and budget.		2013 (review annually)	$ - Staff time for collecting, analysing and writing the report.	WAGA to coordinate across all Councils	Plans developed and revised annually.
		Develop an Annual Report on the progress of the *WAGA Climate Change Adaptation Plan*'s implementation and evaluation. This should report against regional and individual Council KPIs, as well as document and share lessons from individual Councils on the progress of scoping, implementing and evaluating climate change adaptation planning.		annually	$ - Staff time for collecting, analysing and writing the report.	WAGA to coordinate across all Councils	Annual report developed.
		Develop a Monitoring and Evaluation Plan for this Adaptation Plan to identify metrics and frameworks for evaluating the effectiveness of adaptation actions over time.		2014-15	$-$$	WAGA to coordinate across all Councils	
	Strengthen regional partnerships to build opportunities for collaborative action to manage climate risks across Melbourne's west by sharing resources, knowledge, skills and responsibility.	Foster partnerships and implement stakeholder engagement processes with other relevant organisations in Melbourne's west to address climate change risks across the region[1]. Expand opportunities and efforts to collaborate with and assist other regional climate change Alliances on climate change risk assessments and adaptation response planning.		2013 (ongoing)	$ - Staff time	WAGA coordinator and working group	High level of engagement and knowledge exchange with stakeholders.
		Develop and attend forums for sharing information and collaborating with organisations and communities on climate change risk management.	Alliances, VCCCAR, NCCARF	2013 (ongoing)	$ - Staff time, consultant fees	WAGA Adaptation Working Group	Participation in knowledge and information exchanges on adapting to climate risks.
		Continue to advocate to relevant stakeholders the need to strengthen the regional approach to climate change adaptation.	Alliances, VCCCAR, NCCARF	2013 (ongoing)	$ - Staff time	WAGA coordinator and working group	High level of engagement with other Councils and Greenhouse Alliances on adaptation.
	Build Councils' capacity to make long-term and robust adaptation decisions.	Work with research institutions to develop decision-making tools to cost and model adaptation options, including vulnerability assessments, hazard maps, trigger thresholds for implementation, and cost-benefit calculation tools.	Universities	2014 -15 (Review in conjunction with IPCC updates)	$ - Staff time External funding	WAGA Adaptation Working Group	Tools developed, Council processes updated, staff competency.

(53PA) STAFF SKILLS SHORTAGE *Lack of people skilled in climate change adaptation means Councils cannot respond adequately to climate change.*	**Recommendations for WAGA**						
	Develop and implement staff training program to provide information about the risks, and build staff capacity to understand how climate change will affect their roles. Influence managers to understanding their departments' future roles, and, assist effective decision-making.	Identify the training needs across Councils to address climate change risks in all Council departments.	DSE DPCD, ES, DoH	2013-14	$ - Staff time	WAGA Operational Committee and Adaptation Working Group	Training assessment completed.
		Establish networks between Councils, state government agencies, industry and other organisations to share and develop knowledge about regional Councils' specific roles and functions in adapting to climate change risks (e.g. emergency management, community health, asset management)[2].		2014-15	$ - Staff time	WAGA to coordinate across all Councils	
		Develop a climate change adaptation staff communications and training program. Training program should include: 1. Strengthen technical knowledge and enhance access to relevant resources related to vulnerability and adaptation to climate change; 2. Orient participants to methods and tools currently available for the assessment of vulnerability to climate change and the integration of climate risks into project and program design; 3. Provide training in the identification and integration of climate risks into project formulation.		2014-15	$ - Staff time, consultant fees	WAGA Operational Committee and Adaptation Working Group to coordinate across all councils	% of employees trained/ received training. Attendance to professional development modules.
(66PA) CONFLICTS BETWEEN OH&S AND COMMUNITY NEEDS *Conflicts arise between Councils meeting their OH&S requirements for employees and meeting community needs, e.g. staff working in extreme heat may be limited in the activities they can perform because of OH&S requirements.*	**Recommendations for WAGA**						
	Develop tools and guidelines for Councils to adapt their existing OH&S policies, event management guidelines, Sun/ Heat Protection Plans/policies to address the region's new climate extremes.	Conduct research and develop best-practice guidelines to assist councils to promote their employees' health in regard to new climate change risks, including heat, floods, bushfires, storms, hail events.	DoH, WS	2014-15	$ - Staff time	WAGA Adaptation Working Group	Research report and development of guidelines.
	Recommendations for councils						
	Review and update councils OH&S plans and policies to account for increased exposure to extreme weather events.	Review OH&S policy and guidelines for outdoor workers to ensure that policy accounts for increased exposure to heat, extreme winds, hail, flash flooding[3]. The review should also include Event Management Guidelines, OH&S Policies and Procedures, Sun Protection and Heat Strategies.		2014-15	$ - Staff time	Corporate Services, Sustainability/ Environment	Climate risks incorporated into relevant council policies, plans and strategies. # of work claims due to extreme weather (injuries, health insurance claims).

1. *Regional Development Authority (RDA) Western* and the *Growth Area Authority* to gain better access to information regarding growth projections for the region: work with *Lead West* to update climate change risk and adaptation in the *Werribee Plains Regional Sustainability Framework; Western CEOs Forum* to drive climate change adaptation as a priority issue for Melbourne's western Councils to address; *Greening the West* on implementation of projects and research (e.g. urban street tree plantations), and funding applications for joint projects; *Western Melbourne Tourism* to identify and monitor climate change's regional impacts and opportunities.
2. Note the Inner Melbourne Adaptation Network and VCCCAR Council Connections programs.
3. WorkSafe – *Working in Heat Guidelines, 2012* http://www.worksafe.vic.gov.au/__data/assets/pdf_file/0009/10143/guidance-working-in-heat2012d.pdf

2. Council-managed assets and infrastructure

Higher temperatures and severe weather were identified as the main hazards impacting buildings and property at a regional and council scale. This risk category is primarily concerned with physical damage to Councils' managed buildings, roads, pathways and drainage infrastructure.

Council-managed infrastructure, including buildings, roads, paths, bridges, drainage infrastructure and open spaces, plays a crucial role in supporting the community and local economy. Most current infrastructure, however, was not built to standards able to cope with the future climate[4]. As 2030 draws closer, it is expected that infrastructure will deteriorate more rapidly due to exposure to increased solar radiation, changes in soil moisture, and the increased frequency and intensity of extreme weather events[5]. Infrastructure's vulnerability will depend on its location, age, design, construction and use[6]. Looking towards 2070, infrastructure will need to cope with even more extreme climatic conditions, although there is significant uncertainty about the required benchmark for these future standards.

Given infrastructure's long lifespan and the need for large investment, it is critical that adaptation measures are considered early and carefully. Consideration must be given to the cost of maintaining and upgrading existing infrastructure, which is likely to be greatest during the short- to medium-term (asset renewal gap)[7]. It is also highly likely that insurance costs and availability will change; the insurance industry is already changing its policies around climate change due to a steady increase in the number of claims across Australia for extreme weather-related property damage. Some insurance companies are already demanding mandatory climate change risk mitigation controls as an insurance condition. In regard to insurance costs, flood, fire and storm surge are particularly important in the WAGA region. Early active adaptation will likely result in Councils avoiding significant future costs .

Regional priority risks

2PA INCREASED ASSET MAINTENANCE COSTS
More extreme climate conditions (such as severe weather events and higher temperatures) increase asset degradation, reduce lifespans, and increase buildings' operational and maintenance costs.

4PA DAMAGE TO UNDERGROUND INFRASTRUCTURE
The overall drying trend combines with more extreme rainfall events to increase soil movement, damaging underground infrastructure (e.g. drains, road and building foundations).

80PA INADEQUATE FINANCE FOR ASSET RENEWAL
Changed climate conditions reduce assets' lifespans and councils are unable to finance the resulting asset renewal gap.

Adaption opportunities will involve the thoughtful design and construction of assets resilient to new climate extremes. Although current planning schemes and building codes do not include climate change considerations, Councils should actively integrate higher standards into the design, construction and operation of their own assets. This will likely lead to avoiding significant future costs as asset integrity declines. WAGA should drive action on this. It should emphasise that adapting existing infrastructure (residential and commercial) will be a major challenge for Councils. Much current infrastructure will cease to function in future climate conditions because it was built before the existence of climate change standards and guidelines[8]. Opportunities include: new standards, training of planners, incorporating climate change in the Municipal Strategic Statement[9], pilot projects, retrofitting projects, planned retreat, build-it-back climate-resilient, insurance, re-zoning, regulation, building design, community education and behaviour change programs[10].

4. *Infrastructure adaptation to climate change* (2012) http://www.climatechange.gov.au/minister/mark-dreyfus/2012/media-releases/January/mr20120120.aspx
5. CSIRO, Maunsell Australia Pty Ltd, Phillips Fox, *Infrastructure and climate change risk assessment for Victoria*, Report to the Victorian Government, 2007.
6. ibid.
7. *City of Melbourne Climate Change Risk Assessment.*
8. *Infrastructure adaptation to climate change* (2012) http://www.climatechange.gov.au/minister/mark-dreyfus/2012/media-releases/January/mr20120120.aspx
9. *Municipal Strategic Statement* provides the broad local policy basis for making decisions under a planning scheme and is a key area for embedding climate change adaptation and mitigation into planning decision-making framework. Some Australian Councils have already updated the MSS to include climate change mitigation and/or adaptation (Port Phillip; City of Melbourne). Adaptation to climate change has been incorporated into all Councils' Municipal Strategic Statements in line with the State Government (Section 13 - Adaptation to Sea Level Rise).
10. *NCCARF Research Plan: Settlements and Infrastructure* http://www.nccarf.edu.au/sites/default/files/attached_files/NARP_SI_Summary.pdf


SUN
ROAD CLOSED

Council-managed infrastructure and assets

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources	Responsibility	Indicators of performance
80PA INADEQUATE FINANCE FOR ASSET RENEWAL	**Recommendations to WAGA**						
	Provide more information about the costs and benefits of adapting Councils' assets to climate change risks.	Seek more detailed information about the risk of liability and insurance costs associated with climate change impacts on Council's assets and infrastructure.	MAV, ICA	2013-14	$$ - Consultant fees	WAGA Adaptation Working Group	Development of tools for modelling adaptation options' costs and benefits.
		Work with research institutions to develop/identify tools to model the costs and benefits of building climate-resilient infrastructure across a range of long-term climate change scenarios. Tools would assist Councils to make asset management decisions[11] and model the potential economic affect of adverse climate change impacts on Council's assets and infrastructure[12].	VCCCAR, NCCARF, universities, MAV	2014-16	$$$ - Staff time, consultant fees	WAGA Adaptation Working Group	
	Seek alternative funding from ratepayers, external funding sources, and/or collectively pool funds to resource regional climate change adaptation projects.	Undertake research into alternative funding options to finance improvements to Council's assets in order to increase resilience to climate change risks (faster deterioration of assets, damage to buildings, relocation of infrastructure). Includes performance contracts, Environmental Upgrade Agreements, green loans, adaptation revolving funds, levies and rates.		2014-15	$ - Staff time	WAGA Adaptation Working Group	Funding secured for timely and adequately resourced adaptation. Funding secured for adaptation projects.
		Establish a funding register to collate potential funding sources for climate change adaptation projects. Where possible, funding applications should be made on behalf of WAGA municipalities[13].		2013-2020	$ - Staff time	WAGA Operational Committee and Adaptation Working Group	Tools available for costing adaptation strategies.
		Advocate to the Victorian Government and support Councils to allocate additional funding for managing capital expenditure increases resulting from upgrading new and existing buildings, and other Council-operated infrastructure.	MAV	2013-2020	$ - Staff time	WAGA Adaptation Working Group	
	Recommendations to councils						
	Update Council asset management practices to incorporate climate change risks into planning, implementation and evaluation of the full range of Council's assets, ensuring robust and effective climate change adaptation decision-making is embedded into the process.	Review current Asset Management Plans, maintenance programs and asset registers to ensure they support robust and effective long-term adaptation to climate change.		2014-16 (review bi-annually)	$ - Staff time	Asset Management, Risk Management	Asset management planning processes consider climate changes.
		Consider investment opportunities and payback periods when considering long-term climate change adaptation actions.		2014-16 (review bi-annually)	$ - Data analysis	Asset Management	
	To continue service delivery, review Councils' strategic plans, major project plans and budgets in light of climate change risks (relevant to each municipality) to identify changes to priority projects/areas and funding	Review departmental budgets in light of climate change impacts, identifying potential funding changes needed to address service delivery, regardless of climate change and depending on specific needs/priority areas. NB. Emergency Management and community services budgets should be increased proportionate to the increasing intensity and frequency of		2015-20 (review bi-annually)	$$-$$$ - Capital works budget	Asset Management, Risk Management, Corporate Services	Council budgeting processes adequately consider adaptation options' long-term costs and benefits.

	allocation.	extreme weather over time. Capital works budgets should be increased proportionate to the increasing intensity and frequency of extreme weather, as well as maintenance over time.					
	Seek better information about the risk of liability and insurance implications associated with climate change impacts.	Assess whether current insurance is sufficient. Control potential asset costs by Increasing and/or broadening Council buildings' insurance coverage.		2014 (review annually)	$$-$$$ - Insurance budget	Risk Management, Asset Management	
INCREASED ASSET MAINTENANCE COSTS	**Recommendations to WAGA**						
	Develop and implement standards for building maintenance.	In response to increased storms and heat waves, develop guidelines to assist Councils to amend their building maintenance programs to assess and manage assets. Guidelines should indicate contingency measures for asset types WAGA Councils manage.		2014-15 (review in 5 years)	$-$$ - Consultant fees, staff time	WAGA Adaptation Working Group	Guidelines developed and given to Councils
	Recommendations to Councils						
	Review and update asset management plans and processes to account for increased maintenance associated with increases in heat, storms, floods.	Identify where the maintenance shortfalls occur (vulnerability analysis) and use the asset register to track ongoing vulnerability to climate risks.		2015-18	$-$$ - Consultant fees, staff time	Asset Management, Maintenance	
		Update Asset Management Plans using WAGA's guidelines.		2016-17	$	Asset Management	
DAMAGE TO UNDERGROUND INFRASTRUCTURE	**Recommendations to Councils**						
	Improve understanding of strategies that can reduce climate change's impact on underground infrastructure.	Work with Melbourne Water and research institutions to investigate the severity of the risk to drainage and other Council-operated infrastructure. Develop guidelines for climate-resilience, and pilot adaptation strategies.	Melbourne Water	2014-16	$-$$	WAGA	Knowledge of how climate change will impact Councils' underground infrastructure and how to manage risks cost effectively.
	Recommendations to Councils						
	Increase drainage infrastructure's resilience to soil movement associated with drying (cracking, leaks, tree roots).	Ensure Council has adequate insurance cover for drainage infrastructure.		Annually	$-$$$	Asset Management, Risk Management	
		Update asset management plans, design standards, maintenance regimes.		2016-17 (ongoing)	$	Asset Management, Risk Management	Design standards reflect climate change risks.
		Review and update open space plans, including tree species and drought-suitable locations to prevent root damage to drainage infrastructure.		2014 (review bi-annually)	$	Open Spaces/Parks	Councils' Open Space plans facilitate adaptation to droughts, heat waves, floods and storms.

11. Martin Parry, Nigel Arnell, Pam Berry, David Dodman, Samuel Fankhauser, Chris Hope, Sari Kovats, Robert Nicholls, David Satterthwaite, Richard Tiffin, Tim Wheeler (2009): *Assessing the Costs of Adaptation to Climate Change: A Review of the UNFCCC and Other Recent Estimates*, International Institute for Environment and Development and Grantham Institute for Climate Change, London.
12. http://www.climatechange.gov.au/~/media/publications/adaptation/economic-framework-adaptation-options-20120817-pdf.pdf
13. Possible sources of funding include: Flood Recovery Community Infrastructure Fund, Infrastructure Funding and Developing Stronger Regions Program, Announced Local Government Infrastructure Program Grants (2011-2012), Announced Putting Locals First Program Grants (2011 -2012), Guidelines - Natural Disaster Resilience Grants Scheme 2012-2013 (PDF 164 KB), Victorian Climate Change Action Plan, MAV, DEECC, Local Government Energy Efficiency Program (LGEEP), Community Energy Efficiency Program (CEEP), Carbon Farming Initiative (CFI)

3. Governance and regulation of planning and building

This risk area focuses on the interactions between Local and State Governments, and the mechanisms in place that regulate planning and building e.g. building codes. The major risks identified were associated with lack of coordination between the different levels of government and current building standards' inability to deal with future climate change.

The WAGA region's future climatic trends include sea level rise, increases in storm surge, rising temperatures and soil movement. The increasing intensity and frequency of extreme weather events (including hail, wind, rainfall, floods, fires and heat waves) will introduce new challenges into the process of making long-term, robust and flexible planning decisions.

Anticipated urban population growth will compound regional climatic changes. By 2030, Melbourne is set to be Australia's largest city[14]. Melton Shire Council and Wyndham City Council are two of six nominated as Melbourne's *Urban Growth Areas*. In these two municipalities alone, 61,000 new homes are set to be built, which will by 2030 house approximately 445,500 new residents (45% population increase by 2030). The WAGA regions has 144,000 new homes currently under development. These new homes, along with roads, footpaths and drains etc., will bring with them additional challenges for Councils adapting to climate change. Development in low-lying areas (flood and inundation sea level rise) and the new hard-surfaces will increase rainfall run-off. Population increases will also speed asset deterioration and electricity networks will experience increased stress during peak cold/hot periods. Such intense development means Councils must immediately make design and development decisions that consider regional climate change's long-term impacts.

Regional priority risks

69PR INADEQUATE PLANNING ADVICE FROM STATE GOVERNMENT
State Government provides inadequate advice to Councils regarding planning and adaptation, resulting in poor planning for and development responses to climate change.

71PR INAD EQUATE BUILDING STANDARDS
Current building design standards inadequate for projected climate conditions in 20 to 50 years' time.

Furthermore, many new and existing buildings and other infrastructure in Melbourne's west are located close to Port Phillip Bay's coastline. These are some of Victoria's local government areas most vulnerable to the impacts of sea level rise and coastal erosion[15]. Together, Hobsons Bay, Geelong and Wyndham LGAs have approximately one-third of Victoria's residences vulnerable to sea-level rise of 1.1 metres and a 1-in-100 year storm tide. The LGAs also have almost half of the homes within 55m, and a quarter of the homes within 110m of Victoria's soft shoreline. While the evidence suggests Victoria may face sea level rise of 1.1m by 2100, the *Victorian Coastal Strategy* (2008) prescribes that planning decisions need to factor in a minimum 0.8m sea level rise by 2100. The policy's lack of consistency creates a significant challenge for planning practitioners as they attempt to make robust decisions in regard to sea level rise. An important step in building local governments' capacity to adapt will be to work with the Association of Bayside Municipalities (ABM) on a third pass assessment of Port Phillip Bay's potential climate change impacts.

Municipal Strategic Statement provides the broad local policy basis for making decisions under a planning scheme. This is a key area for embedding climate change adaptation and mitigation into planning decision-making frameworks. Some Australian Councils have already updated the MSS to include climate change mitigation and/or adaptation (e.g. Port Phillip, City of Melbourne). All Councils have incorporated adaptation to climate change into their Municipal Strategic Statements in line with the State Government (Section 13 - Adaptation to Sea Level Rise). Adaptation measures must be broadened in order to effectively address climate change's long-term impacts.. The *Municipal Strategic Statement* needs to lead transition/transformation of climate-adapted municipalities over the long term.

14. City of Melbourne, 2009. Climate Change Adaptation Strategy. City of Melbourne, Melbourne.
15. Department of Climate Change, 2009. Climate Change Risks to Australia's Coasts: A First Pass National Assessment. Department of Climate Change. http://www.climatechange.gov.au/~/media/publications/coastline/cc-risks-full-report.pdf

Regulation of land-use planning and buildings

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources	Responsibility	Indicators of performance
INADEQUATE STATE GOVERNMENT PLANNING ADVICE	**Recommendations to WAGA**						
	Advocate to the State Government for improved access to information about climate change's localised impacts as it applies to land-use and strategic planning, including future liability risks.	Work with MAV and other Greenhouse Alliances to advocate to the DPCD, DEPI and other State Government agencies for improved access to information regarding the localised impacts of climate change (flood-prone zones) and non-climate drivers (e.g. population and economic development projections). The information should be in a form that can be presented as legal evidence in regard to strategic planning decisions.	MAV, Alliances, DPCD, DSE, ABM	2014 (review annually)	$ - (ongoing) Staff time	WAGA Adaptation Working Group	Number of communications with State Government for more detailed information regarding climate change impacts, population dynamics, and economic development.
		Annually update Councils with information about liability and treatment issues relating to climate change risks and land-use planning, and develop communication materials for dissemination.		2014-2020	$ - Legal consultant fees (ongoing)	WAGA to coordinate across all Councils	Annual update of local risks is delivered to each Council.
	Build Councils' capacity to make robust land-use planning decisions regarding future climate change risks.	Develop tools and resources for raising awareness, and provide training for Council planning practitioners and other relevant staff on making robust decisions that consider climate change's long-term risks.	MAV, Alliances, DPCD, DSE, ABM	2014 (review annually)	$	WAGA to coordinate across all Councils	Training resources developed.
		Conduct an analysis of Councils existing zoning and other planning overlays (LSIO, FO, BO) to identify opportunities for Councils to strengthen regulation of land-use planning tools, therefore minimising observed and projected climate risks (floods, storm surge, bushfires). adverse impacts on the community.		2014 (review in 5 years)	$-$$ - Staff time, consultant fees	WAGA Adaptation Working Group	Processes for identifying and recording asset vulnerability to climate change are established.
		Work with research institutions to quantify the potential financial losses associated with climate change impacts on existing land-use. Estimate costs and benefits of effective adaptation as opposed to ineffective or no adaptation.		2015 - ongoing	$$ - Consultant fees	WAGA to coordinate across all Councils	
		Work with research institutions to develop resources and tools (e.g. hazard maps) to assist planners to make land-use planning decisions.	VCCCAR, NCCARF	2015	$-$$	WAGA to coordinate	Tools developed.
		Participate in the Association of Bayside Councils' Third Pass Assessment for Port Phillip Bay over the next 2-3 years and share lessons with members.	ABM, CCB, MW, DSE, DPCD	2013	$	WAGA Adaptation Working Group	
	Identify homes and infrastructure at-risk to adverse climate change impacts.	Raise awareness about adaptation strategies for coping with climate change risks in vulnerable communities..	MW, CWW, CFA, DoH, DoT, VT	2014	$$ - Consultant fees	WAGA to coordinate across all Councils	Vulnerable groups/areas identified.
		Identify pilot projects to model climate-resilient homes and commercial buildings[16].		2015	$$ - Consultant fees	WAGA Adaptation Working Group	
	Recommendations to Councils						
	Raise awareness of climate change risks and build Council Planning practitioners' capacity to make robust decisions.	Communicate to Council Planning practitioners the risks climate change poses for the municipality.		2014-15	$ - Staff time	Risk Management, Sustainability/ Environment, local laws	# of participants in training program.
		Review and update planning policies to include climate change risks, including strengthening Council planning regulations to prevent long-term risk of flood, storm surge, coastal erosion, bushfire. Opportunities include updating the LSIO, FO, and BO; land re-zoning, and reviewing the use of discretionary powers.		2016-19	$-$$ - Consultant fees, staff time	Planning, risk management	

	Coastal Councils to improve understanding of how sea level rise will impact their regions.	Coastal Councils to conduct a local sea level rise impact assessment (Third Pass Assessment) for their municipality as described in the Association of Bayside Municipalities' *Port Phillip Bay Managing Better - Now* prospectus[17].	ABM, MAV, DSE, MW	2015	$$$ - Consultant fees, staff time	Risk Management, Sustainability/ Environment, local laws	
INADEQUATE BUILDING STANDARDS	**Recommendations to WAGA**						
	In collaboration with MAV and the DPCD, advocate to the Building Commission for improved building standards.	Advocate to the Australian Building Commission for improved building standards that incorporate long-term local impacts of climate change.	MAV, DPCD, VBA, MW	2014 (ongoing)	$ - Staff time	WAGA Adaptation Working Group	Processes for ongoing communication with the ABC have been established. Climate change risks affecting the WAGA region and recommendations for action are communicated to the Australian Building Commission (ABC).
	Increase understanding of how to improve existing buildings' resilience to climate change impacts.	Conduct a vulnerability assessment to identify buildings most at-risk of experiencing effects of climate change.		2014 (review in 5 years)	$-$$ - Staff time, consultant fees	WAGA Adaptation Working Group	
		Conduct further research to identify strategies for improving building design. Liaise with insurance providers to gain information regarding changes to building insurance in the region.	ICA	2014	$-$$ - Consultant fees	WAGA Adaptation Working Group	
		Develop guidelines for Councils to improve their buildings', commercial buildings' and residential homes' resilience to climate change. High-value adaptation examples include: energy efficiency, passive solar, insulation, water sensitive urban design, green roofs/walls, mulch/gardens, renewable on-site energy generation, urban forests, street trees, permeable surfaces, and stormwater capture and re-use.		2014 (review in 3 years)	$ - Staff time, consultant fees	WAGA Adaptation Working Group	
	Recommendations to Councils						
	Councils to develop policies, standards, and procedures for improving climate-resilience in new and existing buildings' operation and design.	Use the review of the Australian Building Code to inform the development of Guidelines for design and construction that will cope climate change's long-term impacts. These Guidelines should be used for retrofitting and any new Council building developments.		2015-16	$-$$ - Consultant fees	Planning, risk management	
	Promote in the community strategies to enhance existing infrastructure's (homes, commercial, etc.) resilience to climate risks.	Develop information regarding land-use and climate change projections guidelines to promote climate-adapted homes.		2015-16	$ - Staff time, communications materials	Risk Management, Sustainability/ Environment, local laws	

16. For example see the SECCA community house: http://www.seccca.org.au/proj_overview.asp
http://www.dpcd.vic.gov.au/__data/assets/pdf_file/0003/41727/53-Managing-coastal-hazards-and-the-coastal-impacts-of-climate-change-PN53.pdf
17. See *Sports and Recreation Victoria*

4. Water management

The region can expect the total average annual rainfall to reduce by around 4-9% by 2030, with the greatest percentage reductions occurring in spring. By 2070, conditions will be increasingly drier as potential evaporation increases and relative humidity decreases[18]. Although average annual and seasonal total rainfall is expected to decline, the intensity of heavy daily rainfall is likely to rise. However, fewer rain days are anticipated, with more droughts[19]. Sea level rise and storm surges were identified as key specific risks for Hobsons Bay and Wyndham.

These impacts will result in reduced capacity to store and use water, increased drain blockage due to reduced "flush-out" events, damage to drainage infrastructure as soil moves (drying, drought, erosion) and tree roots search for water. Additionally, increases in the volume of water during rain events will result in overflowing stormwater drainage systems causing localised flooding. The waste water treatment plant in Werribee (Melbourne Water) may also be impacted during heat waves due to electricity shortages.

Melbourne Water and Local Governments have legislative responsibilities for water management. Councils are responsible for maintaining local drainage infrastructure, while Melbourne Water and VicRoads have responsibilities along major roads. Councils are also responsible for ongoing drainage management, operations and maintenance[20]. Local Councils are responsible for playing important roles in flood management in land-use planning and development decisions, with input from the relevant floodplain management authority. Further, under emergency management arrangements, Councils provide extensive support for emergency response and recovery, and many are involved in the provision of local flood warning services. They also play a lead role in the management of urban stormwater flooding.

Melbourne Water is the Floodplain Management Authority and has legislative responsibilities to manage stormwater infrastructure, including acting as the referral authority on planning permit applications made under the provisions of Land Subject to Inundation Overlay (LSIO). Melbourne Water will ensure that new developments do not increase risks to public health and safety, or increase the risk of property damage from flooding. The role of local government is to develop and implement the Municipal Emergency Management Plan, which includes tasks including communicating to the community, operating emergency facilities.

Regional priority risks

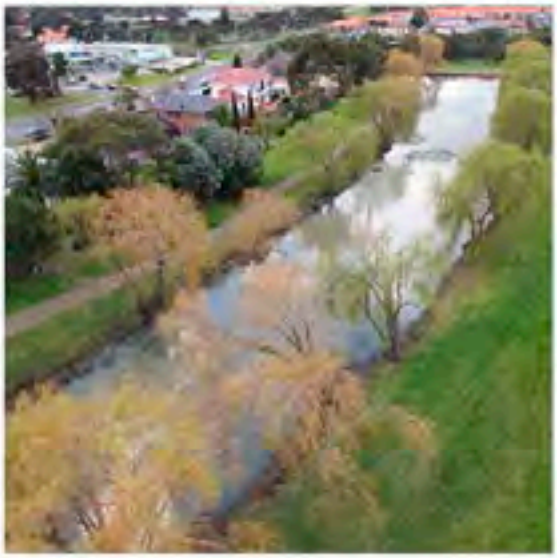
8PR DECREASED WATER HARVESTING
Declining average rainfall and extended drought periods cause reduced drain flush-out events leading to drain blockages and localised flooding during extreme rainfall events.

10PR DISRUPTIONS TO WASTEWATER TREATMENT
Increased 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.

11PA DRAIN BLOCKAGES
Declining average rainfall and extended drought periods cause reduced drain flush-out events leading to drain blockages and localised flooding during extreme rainfall events.

12PA STORMWATER OVERFLOW
Severe rainfall events overwhelm stormwater systems causing overflow events, localised flooding, damage to infrastructure and environmental contamination.

18. Department of Sustainability and Environment (2008). *Climate Change in Port Phillip and Westernport.* Melbourne: The State of Victoria; DSE (2012). *Report on Climate Change and Greenhouse Gas Emissions in Victoria. http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0005/136490/DSE_Greenhouse-Report_online.pdf*
19. ibid
20. CSIRO (2006) Infrastructure and Climate Change Risk Assessment for Victoria. http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0019/73243/InfrastructureriskassessmentPart1.pdf



Water management

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources	Responsibility	Indicators of performance
DECREASED WATER HARVESTING	**Recommendations for WAGA**						
	Increase the region's community facilities' drought resilience by improving efficiency, diversifying water resources, and revising water use.	Seek funding to develop new (and redevelop existing) sporting facilities using water-sensitive urban design principles[21].	2014-20		$ - Staff time	WAGA Adaptation Working Group	
		Identify opportunities for creating regional sporting partnerships to share regional sporting facilities, set efficiency targets and pilot new technologies.	When required		$ - Staff time	WAGA Adaptation Working Group	Regional projects identified in collaboration with water authorities.
		Identify large-scale programs to diversify the water supply for community facilities such as parks, gardens and sporting grounds.	2015-20	MW, CWW, SV	$$-$$$	WAGA Adaptation Working Group	
	Recommendations for Councils						
		Up-scale water efficiency and stormwater storage and reuse projects.	2014-20	OLV	$$-$$$	Environment/ Sustainability	% of community facilities with 'fit for purpose' water supply
		Review and update existing Open Space Management plans and policies to include provisions for long-term water shortages.	2014-15		$ - Staff time	Parks, Recreation, Open Space	
		Continue turf replacement with warm-season (drought tolerant) grass species and recycled water irrigation of sporting facilities and open spaces.	2014-20		$$$	Parks, Recreation, Open Space	
		Liaise with sporting and recreational groups to identify needs. Ensure Councils have adequate insurance to cover injury claims, and continue to seek legal advice.	2015 (review bi-annually)		$ - Staff time	Parks, Recreation, Open Space	
DISRUPTIONS TO WASTEWATER TREATMENT	**Recommendations for WAGA**						
	Increase the region's energy supply's resilience to prevent disruptions to wastewater treatment facilities.	Engage Melbourne Water to determine opportunities to ascertain the region's specific risks, and identify opportunities for collaboration.	2016-20	MW	$ - Staff time	WAGA Adaptation Working Group	
STORMWATER OVERFLOW	**Recommendations for WAGA**						
	Improve the capacity of drainage infrastructure to cope with increased volumes and more frequent flood events.	Undertake research to understand the nature of flooding under climate change in the region, particularly regarding: storm surges and wind intensity, tidal variations, flow of water along drains, creeks and rivers, capacities for increasing flood water storage, and the impact of waves on the shoreline. Work with Melbourne Water (the Floodplain Management Authority) to model flood risk changes across the region and to identify vulnerable locations, businesses and groups.	2014-16	MW	$$-$$$ - Consultant fees, staff time	WAGA Adaptation Working Group	

		Develop a regional *Stormwater Management Plan*. Develop construction and design standards for hard surfaces that improve permeability and reduce run-off – based on the revised Australian Rainfall and Runoff Standards (when released).	2016-17	CMA, MW, CWW, VT, EPA, DPCD	$ - Staff time	WAGA to coordinate across all Councils and stakeholders.	
	Recommendations for Councils						
		Seek funding to retrofit existing drainage infrastructure (e.g. relining, pipe expansion). Investigate options for funding drainage upgrades via rates, or under the Development Services Scheme for greenfield developments.	2014-20		$$$	Infrastructure, Environment	
		Review existing Stormwater Management Plans to ascertain whether they can be adapted to manage infrastructure and assets in light of increased flood risk (rainfall and sea level rise).	2015		$ - Staff time	Infrastructure, Environment	
		Continue focus on Water Sensitive Urban Design, and other Stormwater Reuse projects. Prioritise most vulnerable areas to inundation and risk. Encourage residents to install WSUD to manage stormwater onsite.	2013-20		$$ - Staff time	Infrastructure, Environment	
		Ensure Council has adequate insurance to cover for floods, including inundation from sea level rise if relevant.	2013 (review bi-annually)		$$ - Staff time	Infrastructure, Environment	
		Improve drainage infrastructure maintenance regime to clear blockages.	2013 (ongoing)		$-$$	Infrastructure	
		Upgrade and retrofit existing drainage infrastructure to increase its capacity to cope with increased run-off volumes. Use the revised *Australian Rainfall and Runoff Standards* (when released) and *Guidelines for Coastal Management Authorities*.	2018-20		$$$	Infrastructure	
		Implement measures to reduce environmental contamination in stormwater. Use Water Sensitive Urban Design principles to slow water run-off across the landscape and utilise stormwater for reuse (e.g. swales, wetlands).	2016-20		$$-$$$	Infrastructure, Environment	
DRAIN BLOCKAGES	**Recommendations to WAGA**						
	Increase drainage infrastructure's drought resilience.	Work with Melbourne Water to understand better how climate change compounds risks of drain blockages in the WAGA region.	2014-16	MW	$	WAGA Adaptation Working Group	
		Develop design and construction guidelines for Council drainage infrastructure to increase its resilience (e.g. traps, larger pipes, wetlands).	2017	MW	$$ - Consultant fees, staff time	WAGA Adaptation Working Group	
	Recommendations to Councils						
		Review maintenance regimes and maintain a drain blockage inventory of vulnerable infrastructure.	2015 (review 3 years)		$ - Staff time	Infrastructure	
		Promote the "Snap Send Solve" (or similar) smartphone app to community to assist with early response to localised floods and blocked drains.	2014		$ - Staff time	Infrastructure, Communications	

21. See *Sports and Recreation Victoria*

5. Emergency management

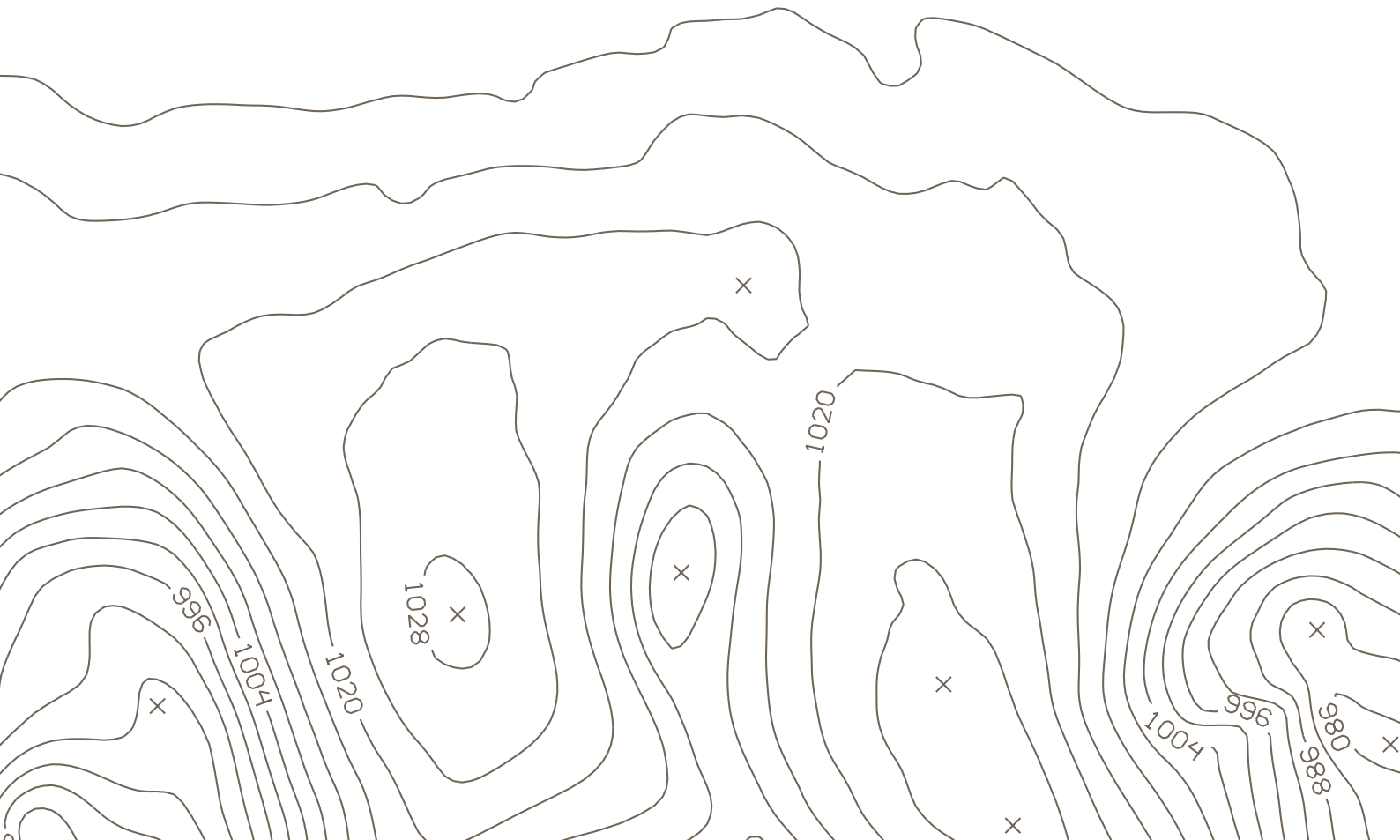
Recent events such as the 2009 Melbourne Heatwave, Christmas Day storm (2010), and Victorian Floods (2011) have highlighted community vulnerability to the increasing intensity and frequency of extreme weather events in our region. The direct consequences of extreme weather events can be catastrophic, with significant risks to life, public health and infrastructure. Under climate change, extreme weather events are projected to intensify across the region. Population growth and development pressures will compound these risks and increase the number of vulnerable people in the region.

The distribution of impacts associated with extreme weather events will be uneven. Climate change will disproportionally affect some community members, particularly those with poorer health and lower incomes (e.g. elderly, migrants, single-parent families, coastal properties). The WAGA region is already economically vulnerable. It has a higher than average unemployment rate, higher employment in lower skilled jobs, and approximately 10% of the population is either economically vulnerable or elderly. Much of the coastal region is low-lying and at high-risk of flooding, storm surge and sea level rise.

Local government is responsible for developing Municipal Emergency Management Plans and Municipal Public Health Plans. Under the Emergency Management Act 1986 (Vic), Councils are also responsible for operating and maintaining refuge centres needed to cope with the increased intensity and frequency of severe weather events.

Regional priority risks

54PA INADEQUATE EMERGENCY FACILITIES
Councils have inadequate facilities to provide shelter and refuge during severe weather events, leaving communities vulnerable.



Emergency Management

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources	Responsibility	Indicators of performance
INADEQUATE EMERGENCY FACILITIES	**Recommendations for WAGA**						
	Build Councils' capacity to support vulnerable communities to prepare for extreme weather events.	Collaborate with agencies /authorities/community sector organisations to develop targeted programs for preparing for extreme weather (businesses, homes in low-lying areas, aged care facilities).	Community service organisations	2013-20	$-$$ - Staff time, external funding for data, communication materials, other project costs	WAGA to lead coordination with all Councils	
		All Councils to sign up to MAV's Resource Sharing Protocol to assist with emergency response and recovery.	MAV	2013	$	WAGA to coordinate	
	Develop tools and guidelines to assist Councils to adapt refuge centres to cope with increased intensity and frequency of extreme weather events.	Work with government departments that lead emergency management (e.g. Emergency Services) to provide advice to councils, businesses and communities about regional vulnerabilities.	SES, ES DOH, DSE, research bodies	2014-15	$$ - Consultancy fees, staff time.	WAGA (Stakeholders)	
	Recommendations for Councils						
	Implement actions to improve the resilience of emergency refuge centres to real and projected climate-related risks.	Monitor the outcomes of the North West Metropolitan *Region Relief and Recovery Collaboration Project* (in which most WAGA Councils are participating). Identify opportunities for WAGA to be involved in the project.		2013-2016	$ - Staff time	Emergency Managers, Risk Managers	
		Review and update *Municipal Emergency Management Plans* to include planning for increased intensity and frequency of extreme weather events. The review should include a study of liability risks relating to emergency facilities' design and construction..		2014	$-$$$	Emergency Management	
		Communicate to the community members' the Council's capacities and limitations in regard to assisting them to respond to and recover from extreme weather events.		2014-2018	$	Emergency Management	

6. Regional economy

Extreme weather events and sea level rise will damage the region's businesses and industry, which will lead to the local economy slowing, and job losses occurring. Flooding and other extreme weather events will lead to temporary and permanent business closures, heavily impacting the level of insurance cover. Many small and medium businesses are likely to be most at-risk.

Though strategic, long-term economic development, Councils play an important role in the overall economic development of Melbourne's Western region. Climate change, however, will have profound impacts on economic activity. While it will create new business opportunities, e.g. through increased demand for some building and maintenance services, it is also likely to undermine other businesses via increased costs and/or reduced demand for the goods and services they supply.

The WAGA region is already economically vulnerable. It has a higher than average unemployment rate, higher employment in lower skilled jobs, and approximately 10% of the population are either economically vulnerable or aging. Much of the coastal region is low-lying and at high risk of flooding, storm surge and sea level rise.

Regional priority risks

67PR 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.

Regional Economy

Risk(s)	Strategies	Recommended actions	With who?	By when?	Resources	Responsibility	Indicators of performance
SLOWING OF THE REGIONAL ECONOMY	**Recommendations for WAGA**						
	Assist businesses and industry to prepare for climate change.	Identify the region's sectors and industries vulnerable to climate change risks.	Lead West, RDA	2013-14	$-$$	WAGA to coordinate	
		Ensure that the *Low Carbon Economy in the West Strategy* considers how climate change will impact the regional economy.	Lead West, RDA	2013-14	$	WAGA to coordinate	
		Work with research institutions to monitor the long-term impacts of climate change on the regional economy, and how Councils can continue to support a resilient local economy.	Lead West, RDA	2015 (report every 5 years)	$$	WAGA to coordinate	
	Recommendations for Councils						
	Implement programs to assist the region's vulnerable groups/industries to cope with extreme weather events.	Work directly with vulnerable businesses to communicate the risks and build capacity for how they can prepare and respond (e.g. Flood Management Plans, Insurance, Energy and water efficiency projects). Work with organisations that are already providing assistance in this area (for residents), including Local Traders Associations, the SES (Floods) and other non-government community service organisations.	Local Traders Associations, SES, Red Cross	2014-16	$ - Communications materials, staff time	Council – in conjunction with the Traders Associations.	% of vulnerable businesses with extreme weather plans in place.

7. Regional mobility

Heat waves can buckle train tracks, and flash flooding and storm surges can block roads, and train and tram tracks. Extreme weather events can therefore restrict mobility of people and goods, both during and after an event. As average temperatures, solar radiation, wind speed and sea levels rise and flash flooding increases, transport systems' resilience will need to be improved significantly. And, with expected lifecycles in excess of 100 years, transport infrastructure requires large investment. This might restrict the mobility of people and transport of goods.

Climate change is expected to have the greatest long-term impact on community members who are considered 'vulnerable', such as the elderly, disabled, children and low socio-economic groups. Vulnerability to climate change might be influenced by a person's mobility/isolation, access to information and services, geographic location, support networks and resources. Climate change could establish new classes of 'vulnerable' people, e.g. internally displaced people escaping climate-induced emergencies.

Regional priority risks

27PR TRANSPORT SERVICE DISRUPTION
Railways and main road systems are damaged during severe weather events, restricting mobility of people and goods.

Regional Mobility

Risk(s)	Strategies	Recommended actions	Stakeholders	By when?	Resources	Responsibility	Indicators of performance
DISRUPTIONS TO MOBILITY	**Recommendations for WAGA**						
	Improve integrated transport planning in the Western region (reduce greenhouse gas emissions across the transport sector).	Review the integrated transport plan for the Western Region and related plans, such as plans for walking and trails.	WTA, LW	1-2 years (ongoing monitoring)	$ - Staff time	WAGA Operational Committee	
		Monitor the outcomes of the Department of Transport's *Transport Resilience and Climate Extremes* project.	DoT	1-2 years (ongoing monitoring)	$ - Staff time	WAGA Operational Committee	
		Advocate to the Victorian Government for improving the resilience of the regional transport system to climate change impacts[22].	DoT, DPCD	1-2 years (ongoing)	$	WAGA Operational Committee	
	Recommendations for Councils						
	Improve Council's management of transport infrastructure design and maintenance.	Update the Council asset management register to include local roads, footpaths and cycle paths vulnerable to extreme weather events (coastal inundation, floods, storms, heat).		1-2 years (ongoing monitoring)	$-$$ - Consultant fees, staff time	All Councils	
		Continue integrated transport planning across the region to create incentives for sustainable transport options (e.g. active and public transport) using the sustainable hierarchy of transport options (Maribyrnong City Council). Integrated transport planning should consider issues that cross municipal boundaries. Use the recommendations from the Western Transport Strategy for planning regional transport resilience. Key issues include walking and cycling infrastructure linking with public transport to mitigate GHGs, and improving mobility across the region during extreme weather events.		1-2 years (ongoing monitoring)	$ - Staff time	All Councils	
		Increasing resources allocated to monitoring and maintenance of transport infrastructure.		1-2 years (ongoing monitoring)	$$-$$$ - Staff time, infrastructure upgrades	Council	
		Improve construction standards for new roads, footpaths, bike lanes etc. to cope with soil movement, sea level rise, storms and heat.		1-2 years (ongoing monitoring	$$$ - infrastructure	All Councils	
		Continue to promote sustainable transport to residents and Council staff.		1-2 years (ongoing monitoring)	$ - Staff time.	All Councils	
		Identify options for relocating transport infrastructure to adapt to sea level rise.		>10 years	$$$	Council	

22. http://www.climatechange.gov.au/~/media/publications/adaptation/adaptation-options-rail-case-study-20120817-pdf.pdf

Monitoring and review

WAGA will need to regularly review and update the risk assessment, adaptation priorities and actions. The Adaptation Plan will be monitored annually, with the Plan's progress recorded in the WAGA Annual Report. Major reviews will also need to be conducted every 2 years. Some key performance indicators have been identified in the Adaptation Plan but others will need to be further developed.

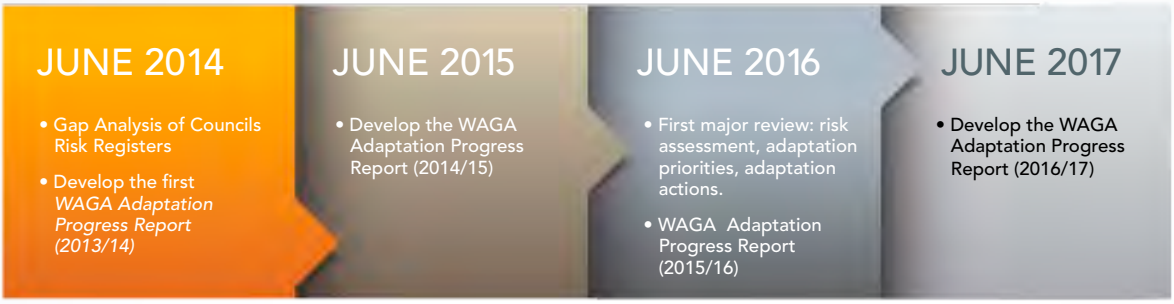
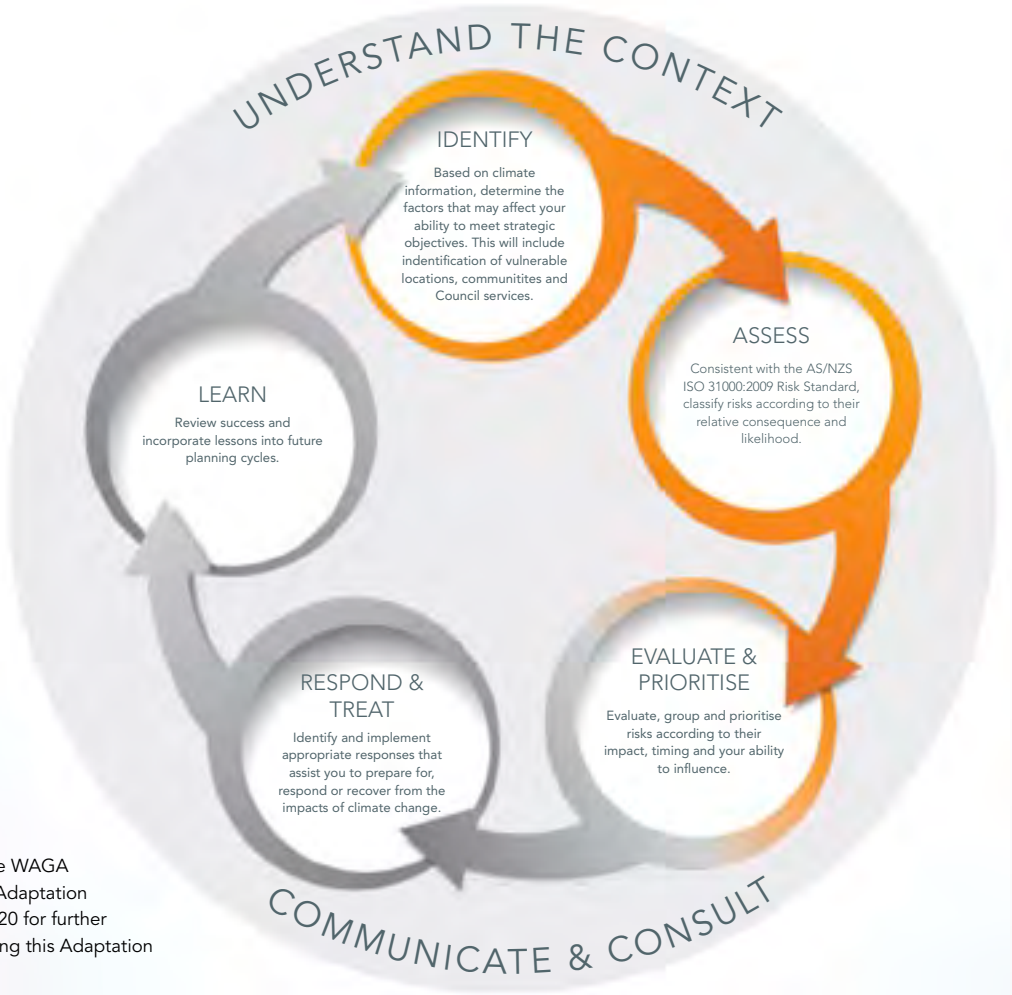


Figure 1. Timeline of key climate change adaptation monitoring and revision activities.

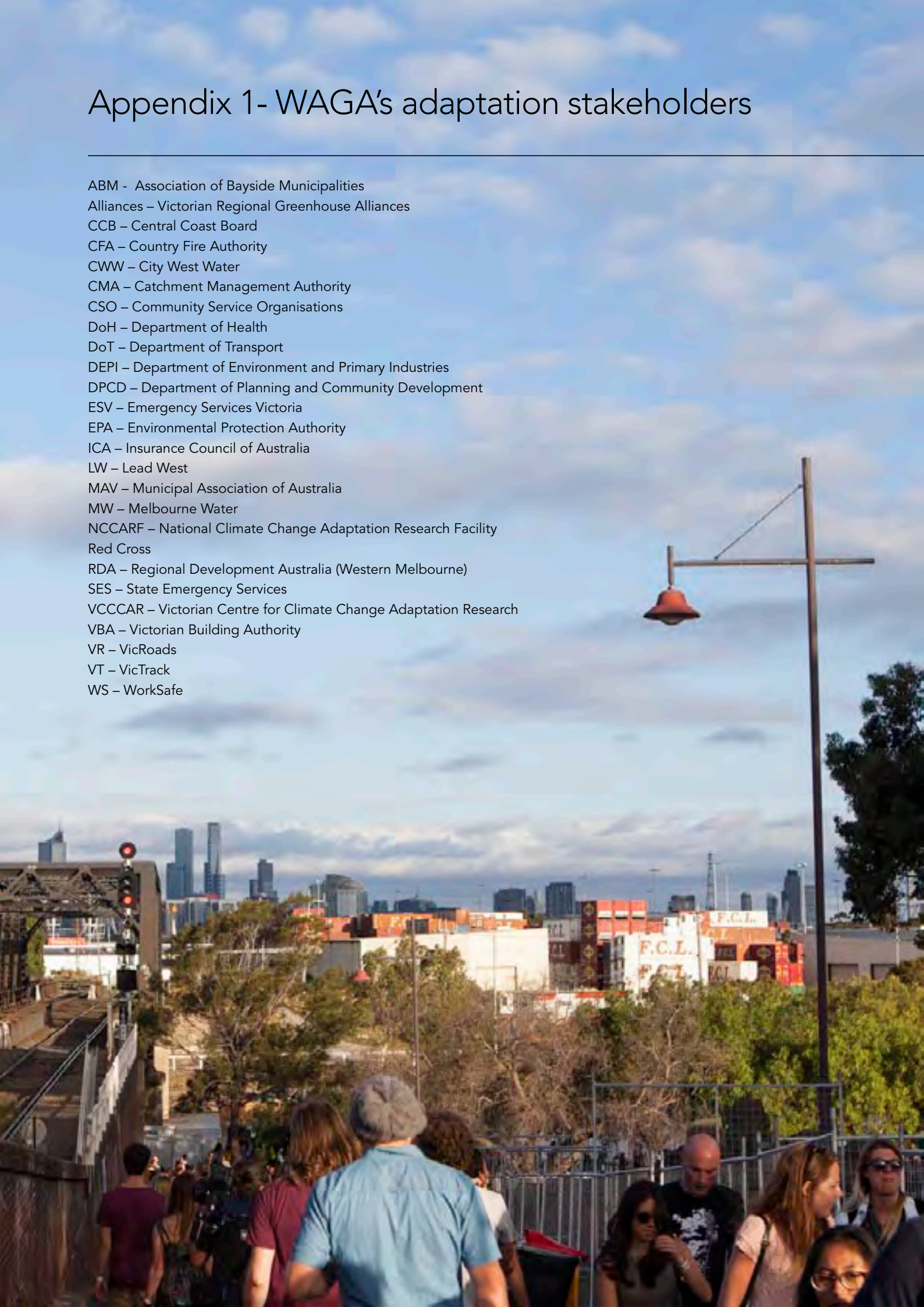


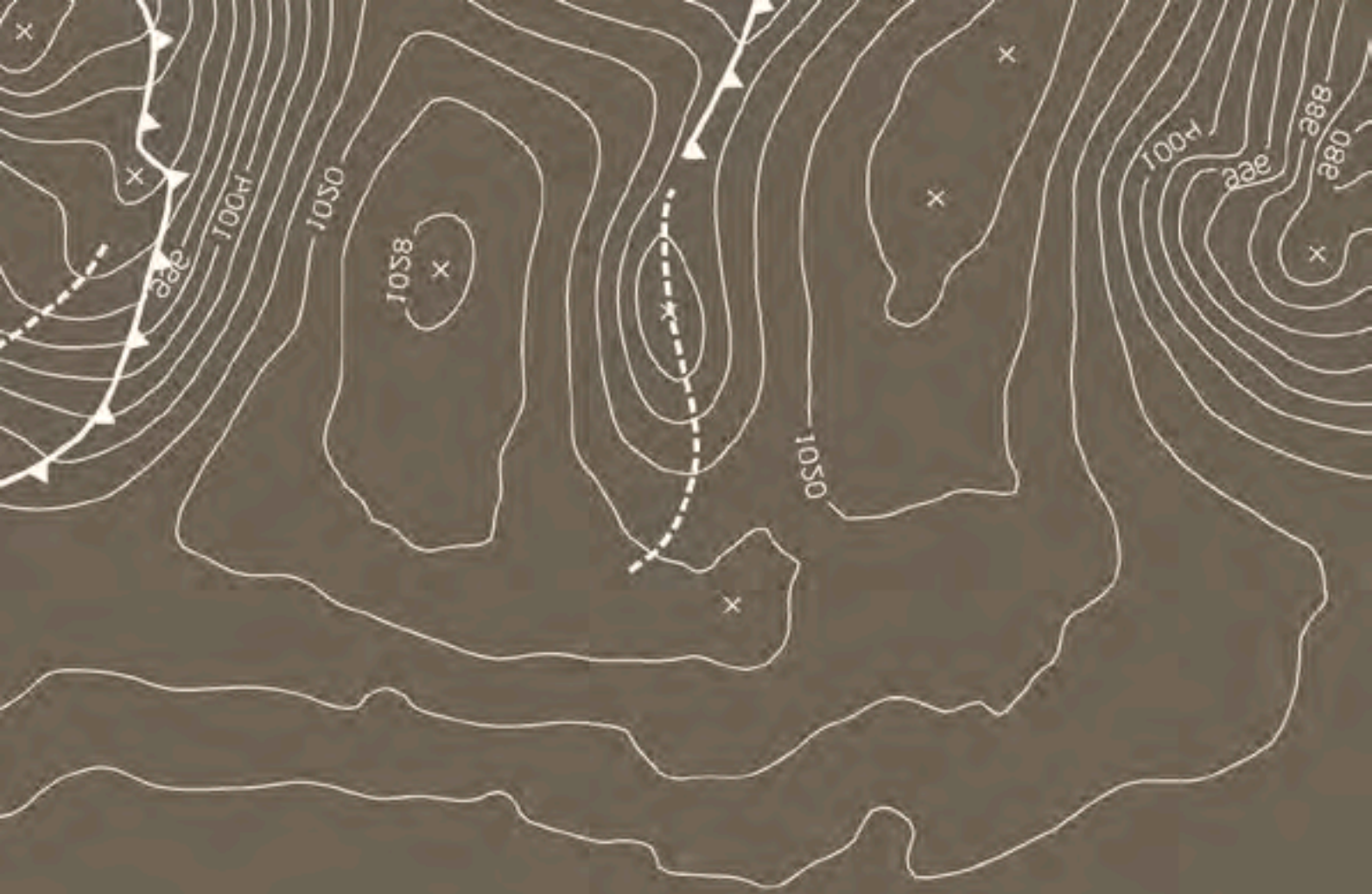
Please refer to the WAGA Climate Change Adaptation Strategy 2013-2020 for further details on reviewing this Adaptation Action Plan[25].

23. Standards Australia, (2012). Draft AS/NZ Climate Change Adaptation Standard for Settlements and Infrastructure. Standards Australia, Sydney.
24. Source: WAGA Climate Change Risk Assessment (2011).

Appendix 1- WAGA's adaptation stakeholders

ABM - Association of Bayside Municipalities
Alliances – Victorian Regional Greenhouse Alliances
CCB – Central Coast Board
CFA – Country Fire Authority
CWW – City West Water
CMA – Catchment Management Authority
CSO – Community Service Organisations
DoH – Department of Health
DoT – Department of Transport
DEPI – Department of Environment and Primary Industries
DPCD – Department of Planning and Community Development
ESV – Emergency Services Victoria
EPA – Environmental Protection Authority
ICA – Insurance Council of Australia
LW – Lead West
MAV – Municipal Association of Australia
MW – Melbourne Water
NCCARF – National Climate Change Adaptation Research Facility
Red Cross
RDA – Regional Development Australia (Western Melbourne)
SES – State Emergency Services
VCCCAR – Victorian Centre for Climate Change Adaptation Research
VBA – Victorian Building Authority
VR – VicRoads
VT – VicTrack
WS – WorkSafe





Further information

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WAGA

Victorian Adaptation & Sustainability Partnership

State Government Victoria

wyndhamcity
city coast country

City of Melton

City of Moonee Valley

Maribyrnong City Council

Brimbank City Council

Hobsons Bay City Council