



REGIONAL CLIMATE CHANGE ADAPTATION ACTION PLAN 2013 - 2016

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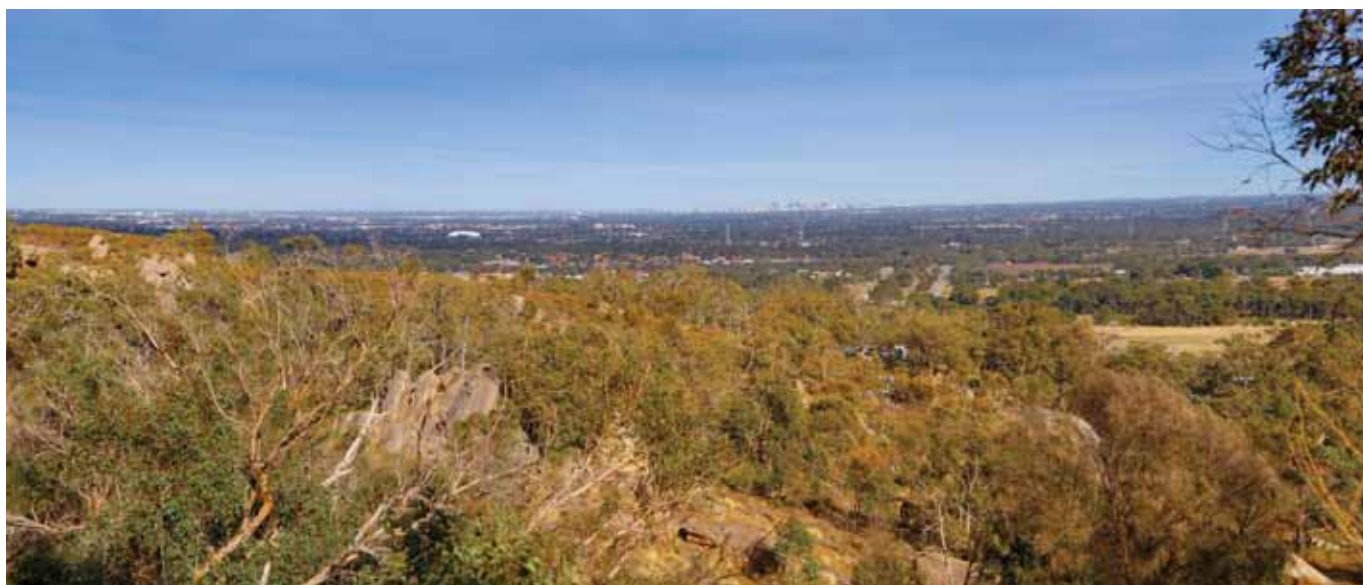
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Introduction

In 2013, the World Economic Forum ranked failure to adapt to the impacts of climate change as one of the five highest impact global risks. *Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education*

Climate change is already upon us. The evidence is clear. The summer of 2012-2013 was the hottest on record. Coined the 'Angry Summer', more than 120 weather records were broken in 90 days (Climate Council, 2013). On a global scale, 2013 was the fourth hottest on record (NOAA, 2013). The catalyst behind the rapidly increasing climatic conditions is unequivocally due to human interference (IPCC, 2013).

Adapting to a changing climate, particularly in south west WA, continues to represent the biggest challenge and opportunity faced by local governments now and into the future. Climate change is not just an environmental issue, it is also a social and economic issue that if not managed could result in devastating outcomes.

In September 2013, the Intergovernmental Panel on Climate Change (IPCC) announced in its fifth assessment report (AR5-2013) that we are now tracking what was previously (AR4-2007) the worst case scenario. The key outcomes from the AR5 report relate to strengthening the certainty that climate change is happening, has been considerably accelerated by human activities and will have significant impact on human health and the natural environment.

Some of the impacts of climate change will develop slowly while others will be in the form of big events that will affect communities, such as the 2014 fires in Parkerville where 57 homes were destroyed and 386 hectares burnt (Shire of Mundaring, 2014). Perth's Eastern Region (the Region) needs to adapt and be prepared for these events.

Climate change presents a huge challenge for local government with possible impacts including infrastructure failure, changes in land-use, loss or migration of biodiversity, reduction in environmental health and increased intensity and frequency of fire and emergency events. Other broader key risks include the potential for changing economic viability of local industries, social dislocation and impacts on human health and wellbeing.

Climate change can also present new opportunities whereby action taken to adapt will generate significant social, economic and environmental benefits and this will lead to more vibrant and resilient societies.

The following plan outlines regional-scale actions required to future proof Perth's Eastern Region.

CLIMATE CHANGE IMPACTS FOR PERTH'S EASTERN REGION BY 2070



Minimum 4°C temperature rise

Annual number of days above 35°C to increase from the current 28 days to between 36 and 67 days

Rainfall reduction by 20-40%

Sea level rise by 25 to 75cm

FLOW ON EFFECTS OF CLIMATE CHANGE ON PERTH'S EASTERN REGION



Reduced water—quality and quantity

Loss of biodiversity

Increased bushfires and heatwaves

Reduced air quality, health and wellbeing

(Information sourced from IPCC 2007, IPCC 2011)



Background

Since 2008, EMRC has implemented the Future Proofing Perth's Eastern Region: Adapting to Climate Change Program to actively implement actions to assist and prepare the Region to adapt to the threatening impacts of climate change.

In September 2009, EMRC's Council approved the *Future Proofing Perth's Eastern Region - Regional Climate Change Adaptation Action Plan (RCCAAP) 2009-2013* which identified regional risks and actions that would assist local government operations and services at a regional level.

Development of the Future Proofing Perth's Eastern Region Program and a regional adaptation action plan occurred through close collaboration with member councils: Town of Bassendean, City of Bayswater, City of Belmont, Shire of Kalamunda, Shire of Mundaring and City of Swan.

As a result of the development of the RCCAAP, each of EMRC's member councils undertook a similar risk assessment process and developed their own individual Local

Climate Change Adaptation Action Plans (LCCAAPs).

The combination of the RCCAAP and LCCAAPs has resulted in the EMRC and its member councils being at the forefront of adapting to climate change.

In 2010, the City of Swan withdrew its participation from the Future Proofing Perth's Eastern Region Program.

EMRC has been acknowledged by the National Climate Change Adaptation Research Facility (NCCARF) as a champion in climate change adaptation (2011) due to the leading work undertaken under the Future Proofing program.

In 2013, EMRC's Council approved the extension of the Future Proofing Program until

2016. This included the review of the *Regional Climate Change Adaptation Action Plan 2009-2013* and the development of the new 2013-2016 plan which occurred in close consultation with member council officers. The RCCAAP 2013-2016 will continue to progress and build upon the work that was started under the previous plan. This ensures that EMRC remains a leader in local government climate change adaptation planning.

The achievements of the past four years are outlined on the following page. EMRC and its member councils anticipate ongoing success as the program continues to lead the way for local governments in relation to climate change adaptation.

Monitoring and review

The RCCAAP will be monitored annually to determine progress against the plan.

An annual progress bulletin will be developed for member councils outlining achievements to date and reporting on any issues or changes that may have occurred. The bulletin will be delivered through EMRC's Council and directly to the Regional Environmental Advisory Group members.

There are currently no national standards to benchmark climate change adaptation actions however the Australian Government is working on the development of the National Adaptation Outlook Framework which is due for release late 2014 or early 2015. EMRC has provided feedback into the draft framework.

A major review of the RCCAAP will be undertaken in 2016. This review will include a review of the National Adaptation Outlook Framework to identify any strategic linkages.



Achievements for 2009-2013

- EMRC and its member councils became signatories to the Western Australian Local Government Declaration on Climate Change, a commitment which recognises the significant and continuing efforts that WA local governments are making in relation to adapting to climate change;
- Advocated for more localised flood modelling for the Region, via Geoscience Australia, the Department of Water, and the University of Western Australia;
- Provided a submission on *State Planning Policy 2.6 - State Coastal Planning Policy*, particularly regarding the possible effects of sea level rise on EMRC's four river-based councils;
- Advocated local government needs to the Department of Planning and WALGA to ensure appropriate planning frameworks are in place to address climate change;
- Advocated to the Department of Water for mapping of areas in the Region at high risk of subsidence due to lowering of the groundwater table;
- Provided information for member council staff on accessing mapping of acid sulfate soils (ASS) in the Region, as well as information on training in ASS for local government officers;
- Advocated and provided information to member councils on changes to communications for emergency management;
- Continued advocacy for increased funding and support for alternatives to overhead power;
- Assisted and supported other program initiatives for the Region such as Perth Solar City, ICLEI Water Campaign, Water and Energy Auditing, ACER program, and various Swan-Helena River initiatives, along with the employment of a Regional TravelSmart Officer;
- Advocated to the Department of Premier and Cabinet and the former Department of Environment and Conservation (Climate Change Unit) to develop a policy position and to build policy cohesion across all agencies in regards to climate change adaptation;
- Ongoing monitoring of emerging funding opportunities, including National Climate Change Adaptation Research Facility (NCCARF) grants, and the former federal government's suite of Clean Energy Future grants;
- Recognition of the Future Proofing program as a leading program in climate change adaptation and mitigation in the local government sector and granted a 2011 NCCARF Climate Change Champions Finalist Award;
- Coordination of a Climate Change Forum in April 2011, to inform local government elected members and key staff about the legal implications to local governments associated with exposure to climate change impacts, implications for planning approvals and building designs, and factoring climate change adaptation into decision making and emergency management;
- Review of all actions within the RCCAAP and LCCAAPs to identify their strategic alignment with all strategic community and corporate business plans, as well as alignment with other projects and programs being implemented by EMRC and member councils;
- Approval by EMRC's Council to extend the Future Proofing Perth's Eastern Region Program until 2016;
- Recognition by the Australian Government as a leader in adaptation in November 2013 which led to a meeting with representatives from the Department of Environment's Adaptation and Science Division. At this meeting the Department was seeking information and feedback on EMRC's findings from developing and implementing the Regional and Local Climate Change Adaptation Action Plans;
- Submission to the Australian Government in relation to the development of the National Outlook Framework. The framework is intended to assist businesses and governments with reviewing and monitoring adaptation and provide some consistency and monitoring in relation to Australia's adaptation efforts; and
- Launched the EMRC's Climate Change Risk Awareness Seminar Series in 2013. The series will be rolled out in 2014 and aims to raise the profile of climate change within the Region and to assist staff in understanding that climate change adaptation is everyone's responsibility.





Vision statement

Perth's Eastern Region will continue to be a leader in climate change adaptation by taking advantage of the opportunities created in a carbon constrained economy and evoking a sense of security, awareness and empowerment for residents living in the Region.

Aim and principles

The aim of the RCCAAP is to continue to provide best practice adaptation action planning through a risk management approach.

The past four years have seen the work undertaken by EMRC as a leading example of best-practice adaptation.

The priority risk area, actions and objectives have been developed to assist the Region with reducing the risk of climate change impacts.

The RCCAAP provides a direct link to *EMRC 2022 – 10 Year Strategic Plan*.

Key Result Area 1 – Environmental Sustainability

1.5 To contribute towards improved regional air, water and land quality and regional biodiversity conservation.

1.6 To address climate change issues within the Region.

Key Result Area 4 – Good Governance

4.1 To provide advice and advocacy on issues affecting Perth's Eastern Region.

- Promoting innovation and regional security in order to position Perth's Eastern Region as an ideal location for economic opportunities which may result from climate change such as new industry, markets and technologies to locate in the Region.

The following principles underpin all future planning of initiatives relating to climate change adaptation within the Region, whilst also addressing the key drivers for change:

- Value and engage with all stakeholders in planning for climate change and provide opportunities for networking and information sharing across stakeholder groups;
- Enable and involve senior local government officers in the integration of climate change adaptation into local government planning and operations;
- Gain support and momentum for climate change action in Perth's Eastern Region;
- Identify, analyse and evaluate key climate change risks to local government;
- Identify priorities and partnerships to fill information gaps;

- Identify and plan local and regional adaptation responses to address climate change risks;
- Gain the endorsement and ongoing support of all member councils to implement actions required to effectively future proof Perth's Eastern Region;
- Demonstrate that the EMRC and member councils are leaders in understanding and adapting to climate change;
- Implement the principles of betterment, resilience and sustainability in relation to climate change into day-to-day practices;
- Encourage local government planning schemes and development plans for commercial and residential development to reflect the principles of future proofing Perth's Eastern Region for climate change;
- Encourage and support community engagement during planning and implementation processes; and
- Identify opportunities that can arise from climate change that could benefit the Region.

The RCCAAP continues to address priority risk areas through:

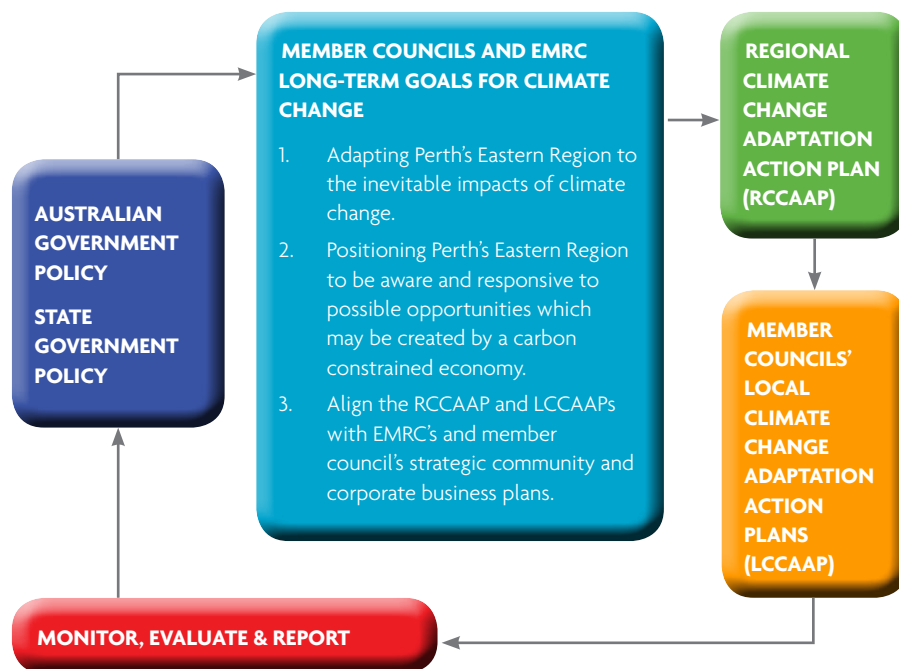
- Promoting resilience and supporting local communities in partnership with local government to improve the management of the local environment and community public assets;
- Securing future-focussed transport, planning and building systems that support low emissions and accommodate a changed climate;
- Identifying and supporting vulnerable communities in the Region to adjust to the cost of a low emissions economy so they are not further disadvantaged as a result of climate change; and



Regional strategic framework for climate change adaptation for Perth's Eastern Region

The RCCAAP continues to be a lead document that outlines what actions should be undertaken at the regional level to adapt to climate change within Perth's Eastern Region. The RCCAAP is a key component of the regional strategic framework for climate change.

In conjunction with member council's LCCAAPs, the two levels of planning will enable alignment of the continued work that needs to be undertaken within the Region. This assists member councils to be better placed to adapt to the challenges that will be presented by climate change and allow EMRC to focus on regional adaptation.



The role of government in adaptation

Climate change adaptation involves all levels of government (federal, state and local), as well as business and residential communities.

While government is a key player, the roles of businesses and individuals in the community are critical as scope and scale of adaptation is different to mitigation.

The Australian Government continues to have an important role to provide research on national priorities, to share knowledge and provide funding for adaptation measures. The Australian Government is working on the development of the *National Climate Adaptation Outlook Framework* which aims to assist organisations with undertaking adaptation planning and providing information back to the Australian Government to monitor Australia's adaptation progress.

The Australian Government's Direct Action Plan will have an impact on national carbon emissions. If there is no funding opportunity available to local governments through the Direct Action Plan, there may be an opportunity to gain access to resources through other programs such as the Green Army.

State and local government continue to have a clear role in leading and implementing adaptation strategies into communities. The relationship between the state and local government continues to be a critical success factor in achieving the action required. State government continues to have a key role in relation to providing vulnerability assessment research and climate modelling so that

local governments can make good planning decisions around the provision of community infrastructure.

In addressing climate change effectively for Perth's Eastern Region, there will need to be significant pressure continually placed upon the state and federal government to act in relation to their roles. This will come through the EMRC's advocacy role under the RCCAAP.



Priority risk areas

The RCCAAP comprises 10 priority risk areas which contain actions for implementing climate change adaptation across Perth's Eastern Region.

Actions identified include continuing actions from the 2009 plan and new actions that have been identified in close consultation with member councils.

Note: Some actions cross over more than one priority but they have been placed under the most appropriate priority risk area.

Priority Risk Areas
Infrastructure failure
Impacts on essential services (power loss and water availability)
Watercourse damage and loss
Increasing bushfires
Water decline and reduced water quality
Greenhouse gas emissions and related air pollution
Loss of ecosystems and provision of public open space
Decline in population health and wellbeing
Economic challenges and opportunities
Changing leadership and development requirements

Timeframes for implementation of actions

The timeframes link to local government planning and budget cycles and were selected based on an understanding of the regional context in which the action would be implemented.

* Some activities within the RCCAAP have already commenced by virtue of other programs/projects being undertaken to date or are part of ongoing management activities.

Timeframes	Time
Immediate	2013-2014
Short-term	2014-2015
Medium-term	2015-2016
Long-term	2016-onwards
Ongoing	In progress*





Priority risk area 1

Infrastructure failure

Climate change factors such as drought, bushfires and extreme temperatures have the potential to impact upon physical infrastructure. Australia's infrastructure will face major challenges in responding to climate change. Consideration needs to be given to planning for secure infrastructure that can withstand extreme climatic events. The design of buildings and open spaces needs to ensure that climatic extremes are considered from structural, environmental, social, economic and health perspectives (NCCARF, 2013).

Local government infrastructure, including roads, buildings and drainage, may require higher costs for maintenance from more frequent repair and maintenance schedules and

additional costs for upgrading. Water tables may drop if the demand on aquifers increases during drier summers, and shrinking and drying of clay soil may increase subsidence. As soil dries, trees send out longer and deeper roots, which may cause problems with foundations and drains.

Shallow foundations of buildings can be vulnerable to the natural expansion and contraction of the ground particularly in areas where clay dominates. Acid sulfate soils exposed by falling groundwater tables can degrade belowground infrastructure such as drainage pipes.

Climate change also poses risks to regional transport links and transport mechanisms. This

relates to several factors including the high number of population centres in the Region that are not yet well served by public transport networks. EMRC and its member councils have a role in ensuring that the Region's needs are well understood by all government agencies.

Objectives

- Ensure that local government infrastructure in Perth's Eastern Region is resilient to the impacts of climate change.
- Ensure local government has the skills and training to deliver new and higher standards for infrastructure provision.



Adaptation action required		Timeframe for implementation
1.1	Advocate to relevant agencies such as the Department of Environmental Regulation and the WA Planning Commission for ongoing awareness and education of member council planners so that climate change adaptation is incorporated into planning frameworks at a local level.	Medium
1.2	Engage with relevant agencies such as the Department of Planning in relation to increasing awareness of local governments obligations and responsibilities under a changing climate.	Medium
1.3	Advocate to relevant agencies such as the Department of Water for more specific flood modelling for the Region, including the influence of sea level rise and storm surge, so that member councils can phase in more robust and appropriate actions to adapt.	Medium
1.4	Advocate to relevant agencies such as the Department of Water for mapping of groundwater levels and subsidence risks in the Region so that appropriate planning considerations may be made.	Medium
1.5	Advocate to relevant agencies such as the Water Corporation to phase in appropriate upgrades to drainage systems in order to cope with flash flooding from the more intense storm events associated with climate change.	Long-term
1.6	Provide member councils with best-practice approaches for assessing the risk to their infrastructure from climate change.	Long-term

Priority risk area 2

Impacts on essential services

2.1 Power loss

The provision of power and energy are essential services provided by the state government and as such, local government has limited ability to influence future proofing of these services other than through advocacy.

Disruption to electricity and fuel supplies may result in consequences such as increased electricity and fuel costs, lack of access to air conditioning and lighting and disruptions to medical equipment, refrigeration and commercial equipment resulting in various negative health and financial consequences.

In Australia, street lighting can account for up to 50% of the energy allocation for

local governments (WALGA, 2011). In WA, the infrastructure for street lighting is owned by the state, while local governments pay tariffs for the power consumed. Street lighting is an area that local governments need to continue to consider under a climate change scenario as the stresses on power supply will continue to increase as temperatures rise.

Underground power continues to be an important mitigating option for disruption to power services, however the state operates the underground power program and has supported a funding policy that is not financially viable to many residents in Perth's Eastern Region.

Increased fuel costs are likely to have flow-on impacts to food production, food transport and transport mobility for member council residents.

Objectives

- Strongly advocate for improved power services to minimise power disruption to the Region.
- Investigate and encourage means for introducing greater uptake of viable energy alternatives for the Region.
- Help communities and businesses understand the impact of climate change on essential services.



Adaptation action required		Timeframe for implementation
2.1.1	Seek funding for regional projects that reduce energy use and engage in renewable technologies across the Region.	Ongoing
2.1.2	Continue to keep member councils informed of the latest power and fuel solutions and technologies (e.g. direct load controls, heat pumps etc).	Ongoing
2.1.3	Advocate to state government agencies to develop a public awareness campaign of the potential impacts of climate change in relation to power loss.	Medium
2.1.4	Advocate for the delivery of a reliable power supply with the ability to reduce risk in extreme natural disaster conditions (e.g. underground power).	Long-term
2.1.5	Advocate to relevant government agencies for residential/industry rebates and incentives to assist energy efficiency and in the transition to renewable energy.	Long-term
2.1.6	Engage and educate the local community in relation to the impacts of climate change on essential services and how this may impact them.	Long-term
2.1.7	Engage and educate the local business community in relation to the impacts of climate change on essential services and how this may impact them.	Long-term

Priority risk area 2 continued ...

2.2 Water availability

Rainfall in Perth has reduced 15% since the mid-1970's but more evident is the reduction in infiltration of water into dams. Between 1911 and 1974 the average infiltration was 338GL per year, between 1975 and 2000 infiltration fell 50% to 177GL and by 2001 to 2010 infiltration fell another 50% to 75GL per year. With Perth's population expected to increase by 2.2% per year, water demand is expected to increase by 2.4% (Department of Water, 2013).

Reduction in water availability adversely affects river health. Taking too much water out of Australia's river and groundwater systems can have detrimental economic and environmental consequences. There is added pressure on the system due to climatic conditions which affect native animal and plant populations, agricultural production and water availability for human consumption (Australian Bureau of Statistics, 2012).

Climate is a fundamental driver of the water cycle. It determines how much water is available for use in the short and long-term. In addition to natural variability, increased concentrations of greenhouse gases are leading to a long-term trend which superimposes on the natural variability, as is the case with a winter drying trend over south-west WA since the late 1960s. All of the research and trend modeling undertaken by the IPCC indicates that the south west of WA will continue to experience decreased rainfall.

The Department of Water released the *Securing Western Australia's Water Future Position Paper – Reforming Water Resource Management* in September 2013. The paper set out a proposed legislative

and policy framework to help deliver new water management solutions in Western Australia. EMRC provided a submission to the Department of Water in relation the paper and will continue to monitor its progress.

EMRC is a corporate member of the Cooperative Research Centre (CRC) for Water Sensitive Cities which is a partnership between universities, state and local governments, business and industry undertaking research to ensure that Australia can adapt to the drying climate and ensure enough water for future generations.

Objectives:

- Continue to encourage and raise awareness of increased water efficiency throughout the Region.
- Continue to advocate to state government to achieve positive outcomes in the area of sustainable water management.
- Ensure that member councils' water conservation issues are addressed.



Adaptation action required		Timeframe for implementation
2.2.1	Work with relevant agencies to increase community awareness in relation to water availability.	Medium
2.2.2	Work with relevant agencies to improve water conservation measures, including tighter water efficiency targets, increase water recycling, re-use of water and capture and storage technologies.	Medium
2.2.3	Advocate to state government for increased resources for enforcement of regulations relating to downstream water supply.	Long-term
2.2.4	Advocate to the state government and other relevant agencies for stronger planning and infrastructure guidelines that account for future climate change impacts.	Long-term
2.2.5	Advocate to the state government for more funding to assist with future proofing existing infrastructure.	Long-term

Priority risk area 3

Watercourse damage and loss

Perth's Eastern Region contains a major portion of Perth's most iconic strategic asset – the Swan River. In ensuring the ongoing future proofing of the Swan River, its tributaries and catchments within Perth's Eastern Region, four sub risk groups have been identified that require specific focus and attention.

3.1 Foreshore erosion and subsidence

Foreshore erosion and subsidence pose a significant risk to infrastructure, vegetation and habitat along waterways. It also can be a risk to public safety and amenity. Rigid building structures along the river foreshores such as

dual use paths, bridges, jetties, retaining walls and sandy beach fronts are at risk from erosion and subsidence. As sea levels rise and flooding from increased storm activity occurs, the river and its community assets will be under threat unless adaptation measures are put in place.

The *Swan Helena River Management Framework*, provides a strategic approach to addressing the issues of foreshore erosion. Support for its ongoing implementation will be critical to providing for the increasing pressure that will be placed upon the river and its catchment under a climate change scenario.

Objectives

- Increase community and political awareness of the impacts climate change will have on stream bank erosion and subsidence.
- Ensure that local government officers have best practice guidelines and information that assist in the management of stream bank erosion and subsidence.



Adaptation action required		Timeframe for implementation
3.1.1	Continue to provide support for the use of the Swan River Trust's practice approaches for <i>Foreshore Stabilisation Manual</i> within member councils.	Ongoing
3.1.2	Factor climate change impacts into the major review of the <i>Swan and Helena River Management Framework</i> .	Short-term
3.1.3	Provide assistance to the Swan River Trust in relation to the implementation of the <i>River Protection Strategy</i> .	Short-term
3.1.4	Advocate for increased funding for regional projects to protect river foreshore assets.	Medium
3.1.5	Provide assistance to the Swan River Trust to protect the catchments and tributaries of the Swan River.	Medium
3.1.6	Liaise with relevant agencies to increase community awareness and action for the prevention of river bank erosion.	Medium
3.1.7	Partner with the Swan River Trust and other relevant agencies to work with private landholders in the Region to apply best practice stabilisation techniques to protect the foreshore.	Long-term

Priority risk area 3 continued ...

3.2 Acid sulfate soils (ASS) and potential acid sulfate soils (PASS)

Falling groundwater tables and pressure for inner city high-rise density development in and around waterways have the potential to expose acid sulfate soils. Soils with a high to moderate PASS risk occur in the interdunal swales, flats and creeklines such as Ashfield Flats, Baigup, parts of Ascot and Viveash. Rural areas such as Woorloo also face potential threat from acid sulfate soils.

Objectives

- Increase community awareness of ASS and PASS.
- Ensure that local government officers have access to the best practice information that will assist in management of ASS and PASS.



Adaptation action required		Timeframe for implementation
3.2.1	Provide member councils with ongoing information in relation to ASS and PASS, such as mapping of risk location and management guidelines.	Medium
3.2.2	Educate the local community in relation to ASS and PASS and their potential impacts.	Long-term

3.3 Flooding

Riverine systems are likely to be impacted by alterations to sea levels and tidal and saltwater incursion further up the Swan River leading to salt water incursion into wetlands and groundwater supplies, flooding of low-lying areas and altered biodiversity.

The consequences of increased periodic river flooding events include:

- Damage to infrastructure;
- Higher risks to public safety and therefore higher costs for management, e.g. signage for peak events, temporary road and park closures and diversion of traffic;
- Higher costs for storm water drainage maintenance, repairs and upgrades;
- Higher emergency management and response costs; and

- Salt water intrusion into tributaries of the Swan River will impact on the vegetation and ecology of affected areas.

Objectives

- Ensure that the community infrastructure in Perth's Eastern Region is resilient against flooding.
- Increase the level of understanding of the ecological implications of sea level rise.

Adaptation action required		Timeframe for implementation
3.3.1	Seek funding to undertake vulnerability assessments of assets along the river foreshores to identify high risk assets.	Medium
3.3.2	Advocate to all levels of government for funding to upgrade or install resilient river infrastructure.	Medium
3.3.3	Advocate to the state government and relevant agencies for a consistent approach in relation to riverbank planning and infrastructure.	Long-term
3.3.4	Advocate to the state government and relevant agencies for a cohesive approach to emergency management.	Long-term

Priority risk area 3 continued ...

3.4 Sedimentation

Drought conditions are likely to exacerbate erosion and downstream sedimentation. Higher sediment loads enter rivers following extreme rainfall events or extreme bushfire events, both of which are projected to increase with climate change. Changed climatic conditions are also likely to produce conditions that favour riparian and aquatic weeds and algal blooms.

Sedimentation may also lead to increased blockage of gutters and drains.

Nutrient loading has also been highlighted as being a key issue for the Region. Testing and monitoring of these changes in loads will provide a good indication on how the river is adapting.

Objectives

- Educate the community and raise awareness of sedimentation issues.
- Ensure that local government officers have best-practice guidelines and information to assist in the management of sedimentation.



Adaptation action required		Timeframe for implementation
3.4.1	Monitor the Swan and Helena Rivers to profile nutrient loading, non-nutrient loading and river health.	Medium
3.4.2	Support Catchment Groups to protect and enhance riparian areas along the tributaries of the Swan River.	Medium
3.4.3	Investigate opportunities to work with relevant agencies to minimise sediment in the stormwater system.	Long-term
3.4.4	Assist in education about runoff and sedimentation issues and the role the community can play in reducing impacts.	Long-term

Priority risk area 4

Increasing bushfires

Climate Change is already increasing the risk of bushfires (Climate Council, 2013). Bushfires have the potential to destroy infrastructure and property. Fires can alter ecosystems and lower the yield and quality of water within the vicinity of the fire. Bushfires also increase greenhouse emissions and particulates in the atmosphere impacting on people's health. In serious cases, bushfires can also take lives and seriously injure or harm humans and wildlife. As a result of this, the social and economic fabric of local communities or regions can be devastated.

In the decade up to 30 June 2013, the insured losses due to bushfires in Australia totalled \$1.6 billion. However, these estimates of economic losses do not account for the full range of costs associated with bushfires. Very few attempts have been made to account for the loss of life, social disruption and trauma, opportunity costs for volunteer fire fighters, fixed costs for bushfire services, government contributions for rebuilding and compensation, impacts on health and ecosystems, and compensation, impacts on health, and ecosystems services.

The economic cost of the Black Saturday fires in Victoria 2009 resulted in the loss of 173 lives, more than 2,000 homes, 8,000 – 11,000 stock lives and \$1.27 billion in insurance losses (Climate Council, 2013).

Bushfire management is an issue that requires a shared response from all layers of government and the community. The bulk of scientific evidence argues that the magnitude and intensity of bushfires is expected to rise as a result of climate change.

The 2013/2014 summer, much like previous years, has seen above normal bushfire potential in Perth and the south west of WA due to the reduced rainfall, soil moisture shortage and high fuel loads (Bushfire CRC, 2013). The above normal range extends along the majority of WA's coast line and a large portion of WA's interior.

On 12 January 2014, the reality of climate change and the increasing impacts of bushfires was faced by the Shire of Mundaring's community after a faulty power pole ignited. The fire took hold due to climatic and environmental conditions. In total, 57 homes were destroyed by fire and a total 386 hectares were burnt throughout Parkerville, Stoneville and Mount Helena (Shire of Mundaring, 2014). This highlights the real impacts of climate change that Perth's Eastern Region has faced and will continue to face as climatic conditions worsen.



As a result of Perth's hot and dry summers, the impact of bushfire will continue to feature as a key discussion point for member councils. With such large portions of Perth's Eastern Region covered by natural bushland, the potential for large-scale events is both probable and likely to become more frequent with climate change.

A balance between human safety and environmental protection needs to be achieved, without detriment to one or the other.

Objectives

- Ensure that the EMRC and its member councils and their communities recognise the shared responsibility for fire management and are well prepared for the challenge.
- Ensure that the Region has the best possible bushfire coordination response in place.

Adaptation action required		Timeframe for implementation
4.1	Monitor outcomes from the Bushfire Cooperative Research Centre (CRC) and relay this information to member councils.	Short-term
4.2	Work with the Department of Fire and Emergency Services (DFES) and other relevant agencies to increase awareness within the community about bushfire risks.	Medium
4.3	Hold community workshops in relation to the development of community fire risk management plans.	Medium
4.4	Monitor the latest information and technologies in relation to fire and emergency response.	Long-term
4.5	Advocate to state government and relevant agencies to continue to improve emergency warning systems.	Long-term

Priority risk area 5

Water decline and reduced water quality

Since the mid seventies rainfall has declined by about 10-15% on average in the south west of Western Australia and stream flow into the Perth reservoirs from jarrah forest catchments has dropped by around 70% (Science Network WA, 2013).

The consequences of reduced rainfall and declining groundwater tables include higher costs for managing natural water features in parks and reserves such as creeklines, lakes and wetlands.

Other costs may include management of botulism outbreaks at more locations and over longer periods than at present, replacement or re-establishment of vegetation lost

through changing hydrology, higher costs for monitoring vegetation and for analysing and responding to observed changes.

Declining rainfall may also impact upon the orchards of the hills and the vineyards of the Swan Valley. These two industries provide direct economic benefit to the Region as well as visitor attractions linked to the identity of these areas.

Reduced water quality leading to illness and disease is also a concern. Salinity is another significant environmental problem exacerbated under a climate change scenario.

Objectives

- Ensure water resources are well managed within Perth's Eastern Region.
- Provide ongoing education to the community on best-practice water management.
- Research and investigate ways to better manage water and vector borne disease.
- Develop a water regime that considers environmental water requirements.

Adaptation action required		Timeframe for implementation
5.1	Continue to monitor research on changes in rainfall and the impact on regional water resources.	Ongoing
5.2	Continue to support participating member council's water quality and water conservation actions through their Water Action Plans.	Ongoing
5.3	Continue to support the Cooperative Research Centre (CRC) for Water Sensitive Cities.	Ongoing
5.4	Monitor the Cooperative Research Centre (CRC) for Water Sensitive Cities and relay relevant information to member councils.	Ongoing
5.5	Liaise to the relevant agencies to continue to support member councils in identifying sites for the use of recycled water.	Short-term
5.6	Assist and provide support to the Swan River Trust through the Eastern Hills Catchment Management Program (EHCMP).	Short-term
5.7	Advocate to state and federal government for more funding in relation to water conservation.	Short-term
5.8	Advocate to state government and relevant agencies to address water quality and leaching issues through the provision of sewerage services to industrial areas.	Long-term
5.9	Research and investigate ways to better manage water and vector borne disease within Perth's Eastern Region.	Long-term
5.10	Advocate for improvements to the urban drainage scheme for multiple outcomes including water quality and capacity to manage flash flood events.	Long-term
5.11	EHCMP to develop in situ water quality monitoring regime in collaboration with local governments and the Swan River Trust.	Long-term
5.12	Advocate to include water for the environment when calculating groundwater/surface water allocations.	Long-term

Priority risk area 6

Greenhouse gas emissions and related air pollution

Perth's Eastern Region faces some difficult challenges when it comes to the reduction of greenhouse gas emissions and potential air pollution. The Region contains Western Australia's major airport, heavy transport networks, large industrial sectors and significantly lacks efficient public transportation services. All these aspects give rise to vehicle dependency and increasing pollution. It also creates opportunities for reducing air pollution from improved public transport networks and transitions to fuel efficient or hybrid vehicle technologies.

Local governments in Perth's Eastern Region have been actively reducing emissions through the ACER: Achieving Carbon Emissions

Reduction program, however, it is recognised that this alone will not solve the issue. The Australian Government has a key role in providing regulatory mechanisms to reduce emissions with the State Government playing a key role in monitoring and driving policy and statutory mechanisms to reduce air pollution and improve air quality. Business and community sectors also have important roles.

The Australian Government's Direct Action Plan will have an impact on national carbon emissions. If there is no funding opportunity available under the Direct Action Plan to local governments there may be an opportunity to gain access to resources through programs such as the Green Army.

At the regional level, there is an ongoing need to keep member councils abreast of new efficiency technologies, national and state policy making and funding, so that Perth's Eastern Region is well positioned not only to adapt for climate change but also to seize opportunities that may arise.

Objectives

- Facilitate the transition to a low carbon economy in Perth's Eastern Region.
- Provide education to the community of the need for emissions reduction.



Adaptation action required		Timeframe for implementation
6.1	Continue to provide an emissions monitoring program for participating member councils to support mitigation actions (i.e. ACER program).	Ongoing
6.2	Advocate to state and federal government for more funding in relation to emissions mitigation and energy efficiency.	Short-term
6.3	Monitor developments at the Australian Government level in relation to energy efficiency and mitigation of greenhouse gas emissions.	Short-term
6.4	Monitor and review the Direct Action Plan to identify possible opportunities.	Short-term
6.5	Investigate opportunities to assist member councils and the community to adapt to a low carbon environment.	Medium
6.6	Engage with and educate the local community in relation to energy management and mitigation.	Medium

Priority risk area 7

Loss of ecosystems and provision of public open space

The natural ecosystems in Perth's Eastern Region are already under stress and climate change will add further pressure. Natural ecosystems are important as they provide ecosystem services essential for all life, as well as supporting regional industries and economies. A healthy natural environment is also essential for the health and wellbeing of local communities.

Failure to build resilience into our natural ecosystems, to help them to adapt to climate change, will result in far reaching consequences with many animal and plant species being lost forever.

It has been predicted that up to 30% of local species may be lost in south west ecosystems as reduced water availability and increasing temperatures adversely impact biodiversity (CSIRO, 2011). Climate change has the potential to change the nature and extent of threatening processes, the extent of which is still to be fully established through research, modelling and evidence.

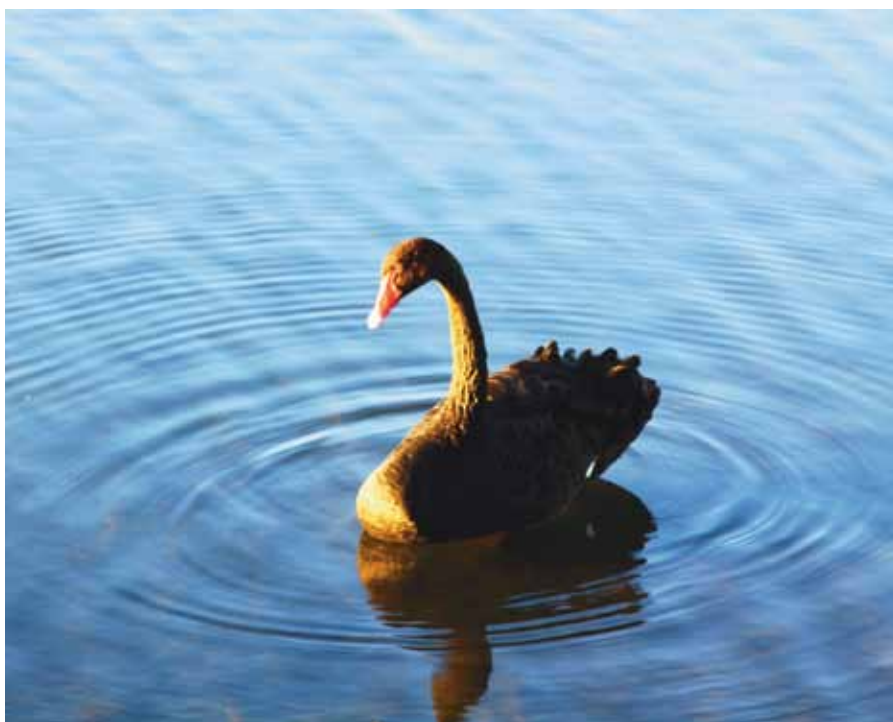
Diverse and resilient ecosystems can better withstand disturbances such as fire, drought and invasive species, and such systems can also store carbon over time. The interconnection between human and natural systems can be an opportunity to secure a better quality of life for Perth's Eastern Region.

EMRC has a strong commitment to natural resource management under the Eastern Hills Catchment Management Program (EHCMP). This program provides an avenue for research, funding, education, engagement and implementation of environmental protection actions.

Climate change additionally presents a real challenge for Perth's Eastern Region in maintaining the current level of provision and amenity of sporting, recreational and leisure facilities. Local government is required to balance finite resources against the community's expectations for increasing access to high quality public open spaces while also complying with a range of statutory obligations being placed upon them by state and federal agencies relating to aspects of public open space provision.

Objectives

- Build ecosystem resilience across Perth's Eastern Region.
- Promote, encourage and support sustainable land management within the community.
- Create, develop and implement improved sustainable public open space management practices.



Adaptation action required		Timeframe for implementation
7.1	Work with relevant agencies to identify and protect aquatic ecosystems that are important for providing connectivity and potential refugia.	Medium
7.2	Assist landowners to mitigate the impacts of climate change on the natural features on their properties (particularly along the river, watercourses and bushland areas).	Medium
7.3	Develop a regional tree canopy monitoring program to audit and monitor existing canopy coverage.	Medium
7.4	Monitor emerging issues for pest and weed management in relation to climate change.	Long-term
7.5	Identify and develop research priorities for biodiversity adaptation to climate change.	Long-term
7.6	EHCMP to continue to assist community groups to maintain and improve the natural areas.	Long-term
7.7	EHCMP to develop, seek funding and implement regional scale projects that address and improve the resilience of natural areas.	Long-term

Priority risk area 8

Decline in population health and wellbeing

In the 2009 Black Saturday bushfires, 173 people tragically lost their lives. This information was heavily reported throughout the news coverage of the event. What was not reported as widely was that 374 people had passed away in the weeks preceding the fires due to the continuing heatwave (Victorian Government, 2009).

8.1 Health

Heatwaves kill more Australians than any other natural disaster (Climate Council, 2014) and as a result there may be consequences for local governments whose facilities may not have adequate heating and cooling, particularly aged care and childcare facilities. There may also be additional occupational health and safety issues, particularly for outdoor workers.

One area of major concern is the urban heat island (UHI) effect and the impact this

has on human health. An UHI is defined as an urbanised area that is significantly warmer than its surrounding areas due to human activity. This is in direct relation to the increase of manufactured materials such as roads and the decrease in green vegetation.

Manufactured material has the ability to absorb and retain heat while trees aid in cooling of the surrounding area. The removal of trees has increased the localised temperatures of urban areas above and beyond those impacts of climate change. This can be anywhere between a 5-10 degree increase in temperature in an already warming climate.

Diagram 1 represents a cross-sectional snapshot of an urban area. From the diagram we can see the dramatic increase in temperature within the city and the cooling temperature in the fringe where vegetation is much more abundant.

There will be increased management requirements to deal with potential health risks associated with a changing climate. Possible impacts include increased risk of vector, food and water borne disease such as seasonal epidemics like Ross River Virus. Support needs to be provided to those in the community that will struggle to adapt to climate change, in particular infants, the elderly and those with a low income.

Objectives

- Ensure that the community is aware of the possible health impacts of climate change.
- Ensure that vulnerable groups are supported and able to adapt.

Diagram 1 - Urban Heat Island Profile



(Source: Climate Council, 2014)

Adaptation action required		Timeframe for implementation
8.1.1	Research the impacts of urban heat islands on the Region and investigate management options.	Short-term
8.1.2	Advocate to state government for continued education of the community about heat stress and other potential impacts of climate change on human health.	Medium
8.1.3	Provide education/training for member council staff about heat stress and other potential impacts of climate change on human health.	Medium

Priority risk area 8 continued ...

8.2 Displaced people

Displaced populations has been identified as being a high risk to local government services and operations, with climate change possibly resulting in increased urban immigration on a regional, national and international level.

Rising sea levels could see 'climate refugees' relocate to Australia with consequences for local governments such as increased pressure for social services and social issues. There may also be pressure applied to develop currently undeveloped land to meet increasing housing pressure.

Table 1 highlights the number of people worldwide that have been displaced due to climate events.

Objectives

- Ensure that vulnerable groups are supported and able to adapt.



Table 1 - Displacement due to climate/weather related hazard events

2008-2012 Climate/weather-related hazard events	People displaced	% of total displaced
Floods	89,181,000	74.4%
Storms	29,051,000	24.2%
Landslides (wet)	577,000	0.5%
Extreme cold/winter	923,000	0.8%
Wildfires	103,000	0.1%
Extreme heat waves	2,000	0.0%
Total	119,836,000	100%

(Source: iDMC, 2013)

Adaptation action required		Timeframe for implementation
8.2.1	Monitor information on the potential impacts of 'climate refugees' on housing and community services in the Region.	Long-term
8.2.2	Work with relevant agencies for assistance with appropriate planning for 'climate refugees'.	Long-term
8.2.3	Advocate for emergency plans to be developed in the case of a sudden influx of 'climate refugees' after an extreme event.	Long-term

Priority risk area 9

Economic – challenges and opportunities

Business and industry across Perth's Eastern Region may experience displacement due to climate change impacts. Possible examples include loss of vineyards in the Swan Valley and orchards in the Perth Hills due to increases in temperature and humidity, as well as declining rainfall.

Business, local government, industry and community may incur increased financial pressure as service provider charges rise to meet rising costs in areas including water, fuel, electricity and gas.

Local government has always been at the forefront of supporting communities to deal with climate change. The growing role of local government in strategic planning to foster economic development provides it with the mandate to support adaptation and innovation in existing industries to facilitate a change in the industry mix to better match the altered climatic, economic, planning and regulatory conditions and to attract new industries offering solutions to climate change. Early adopters will reap the greatest benefit for their communities and local economy, as new product markets emerge in response to climate change and changing global economics.

In particular, industries that require high inputs of carbon/energy and imported materials will be vulnerable, whereas industries requiring low levels of imports and carbon energy will yield opportunities, such as service industries including health and education.

Perth's Eastern Region has a competitive advantage given its inland location away from vulnerable coastal conditions and its spread of existing residential, commercial and industrial areas. Employment self sufficiency and self containment rates are also much better than other corridors of Perth's Metropolitan Area.

The EMRC's *Regional Economic Development Strategy* (REDS) builds upon the Western Australian Planning Commission's *Directions 2031 and Beyond*. This document sets in place a vision for Perth and Peel for the next 20 to 25 years that embraces continued growth with the preservation of local environments and valued quality of life.

Access and provision of transport in and around the Region will be a critical success factor for enabling local employment and local economic growth. The future of transport in the Region will need to shift from car dependency to alternative modes of transport and this issue will become a major responsibility for all levels of government.

To address escalating traffic congestion and related safety concerns, EMRC and its six member councils, in partnership with the Department of Planning and Transport, developed a *Regional Integrated Transport Strategy* (RITS) for Perth's Eastern Region.

In 2012, EMRC received funding through the Department of Transport for the employment of a full-time Regional TravelSmart Officer. This role has enabled continued promotion of alternative transport within the Region.

No actions have been included within this section of the report as actions are covered by the REDS and RITS. Please refer to these documents for more detailed information.

Objectives

- Position Perth's Eastern Region to recognise and seize opportunities for new and innovative business development and investment.
- Ensure that the EMRC and its member councils are prepared for potential economic impacts from climate change liability issues.
- Facilitate integrated land use and transport planning, encouraging alternative transport modes to reduce car dependency.



Priority risk area 10

Changing leadership and development requirements

The impacts of a changing climate will affect Perth's Eastern Region financially, environmentally and socially. The decision to not prepare or adapt is no longer a viable decision for local governments.

Local government operations cover an extensive range of activities and extremely large asset portfolios. It is inevitable that most of these activities and assets will be impacted by climate change. Therefore, decision makers in local government should show leadership and equip themselves with the right tools and information to see problems differently and solve them creatively.

The EMRC and its member councils need to be prepared to formally embed climate change into mainstream management and governance decision making to meet the challenges and opportunities that climate change will bring. This would result in climate change impacts and risks being recognised and

incorporated across all local government plans and procedures.

An improved decision making environment will enable capacity building so that those involved have access to the right skills development, training, education and information as it relates to climate change and a low carbon economy. By development and rollout of a range of new tools, such as lateral thinking and risk assessment, the Region will be better equipped to deal with uncertainty and complexity.

A broader issue for climate change adaptation is to understand the legal liability environment. This will require the clarification of issues and associated legal responsibilities relating to climate change. Insurers will also need to be transparent on matters of indemnification in order to make a level playing field for all.

Objectives

- For Perth's Eastern Region to address climate change by demonstrable leadership and building community and institutional capacity.
- Ensure the EMRC and member councils have a clear understanding of their legal responsibilities for climate change and have a planned strategy to meet their statutory responsibilities.



Priority risk area 10 continued ...

Adaptation action required		Timeframe for implementation
10.1	Continue to provide assistance to member councils with implementing their LCCAAPs.	Ongoing
10.2	Continue to seek endorsement of the Future Proofing Perth's Eastern Region program by member councils.	Ongoing
10.3	Continue to provide up-to-date and relevant climate change information to member councils in a timely manner.	Ongoing
10.4	Continue to promote the Future Proofing Perth's Eastern Region program and its achievements.	Ongoing
10.5	Develop and implement a series of climate change risk awareness seminars to increase member council's staff knowledge and understanding in relation to climate change and how it impacts their roles.	Short-term
10.6	Develop an annual briefing document to council in relation to the progress of the RCCAAP.	Short-term
10.7	Advocate to WALGA to provide leadership in best practices for local government adaptation.	Short-term
10.8	Advocate to state government for funding to implement the proposed actions in the state government's <i>'Adapting to our changing climate'</i> .	Medium
10.9	Identify stakeholders and key contacts within a variety of organisations that may be able to assist with the implementation of actions within the RCCAAP and LCCAAPs.	Medium
10.10	Investigate a methodology to be used to benchmark adaptation success and maladaptation.	Medium
10.11	Develop staff and elected member induction packages in relation to climate change and their responsibilities under the RCCAAP and LCCAAPs.	Medium
10.12	Monitor and inform member councils of changes in local government legal liability with respect to climate change.	Medium
10.13	Work with state government departments and relevant agencies to raise community awareness of the implications of climate change.	Medium
10.14	Investigate further studies on regional scenarios/analogues and the implications for member councils.	Medium
10.15	Review EMRC's policies and procedures to ensure the inclusion of climate change impacts and risks.	Medium
10.16	Incorporate climate change risks into EMRC's regional strategies and actions, such as transport and economic development.	Long-term
10.17	Explore the barriers relating to language and climate change communication and its impact on successful adaptation.	Long-term
10.18	Monitor job specific information, training and resources required by local government staff regarding adaptation.	Long-term



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