CITY OF NORWOOD PAYNEHAM & ST PETERS

Climate Change Adaptation Report

November 2011

Prepared for:

City of Norwood Payneham & St Peters

Facilitated and Developed by:
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The climate change risk management assessments contained within this report have been developed solely on the site-specific information supplied by City of Norwood Payneham & St Peters and have been prima facie accepted by the authors of this report and have not been independently verified for accuracy.

Use of this Report:

This report has been prepared for the City of Norwood Payneham & St Peters for the purpose of climate change risk management and adaptation planning.

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EXECUTIVE SUMMARY

1 The purpose of the Local Government Climate Change Adaptation Program is to enhance resilience through the development and integration of adaptation strategies and measures into Council's Strategic Management Plans. The assessment of risks at the local level and the implementation of adaptation measures to treat risks has flow on effects that builds adaptive capacity for the future and enables an environment where Local Government and the community are better able to withstand climate change impacts.

2 The Program is conducted in a risk and strategic management environment to enable Local Government to make adjustments based on an awareness that climate conditions have changed or are about to change.

3 A consistent National approach has been adopted through the application of:

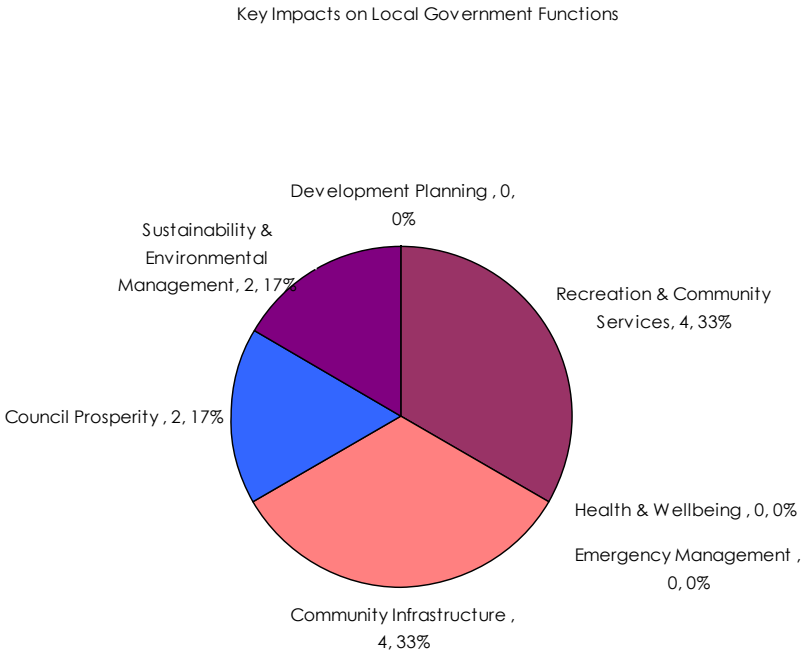
- *Climate Change Impacts and Risk Management: A Guide for Business and Government*, Australian Greenhouse Office, 2006 and the Australian Standard AS/NZS 4360, Risk Management;
- *Climate Change Adaptation Actions for Local Government,* Department of Climate Change 2009;
- Climate change Variables for South Australia identified in the *Climate Change in Australia: Technical Report* 2007 and endorsed by the Bureau of Meteorology, South Australian Regional Office, Climate Section.

4 The risk management results are a reflection of the dynamic engagement undertaken with the City of Norwood, Payneham and St Peters. This specialist information, coupled with 20 years Local Government risk management experience and an extensive body of claims management data of the LGA Mutual Liability Scheme and partnerships with the Bureau of Meteorology has resulted in the delivery of sound Program outcomes. In addition, the outcomes have taken into consideration the lessons learned and risk trends from an analysis of the data from the numerous Metropolitan and Country Councils that have undertaken the Local Government Climate Change Adaptation Program.

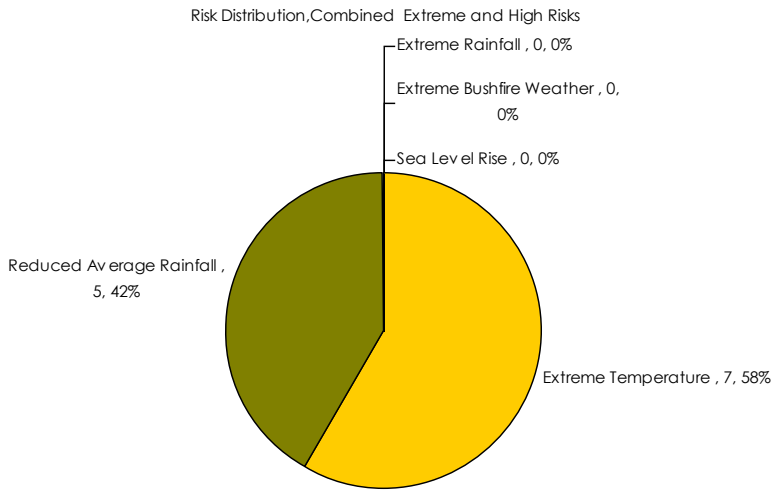
5 The Key Impact Areas for the City of Norwood Payneham & St Peters are:

- Long term management of public open space;
- Increased management of pest plants and animals;
- Increased infrastructure management costs;
- Streetscape management;
- Business Continuity Planning.

Key Impacts on Local Government Functions, City of Norwood Payneham & St Peters



Risk Distribution, Combined Extreme and High Risks, City of Norwood Payneham & St Peters



Recreation and Community Services		
Extreme Temperature (No. Days >35˚C) Risks		
Rating	**Risk**	**Adaptation Measures**
High	Increased cost to manage the community expectation for the provision of artificial shade structures at Council owned facilities.	• Review the Council Playground Strategy and initiate a market research project to determine community perceptions, values and social norms with regards to natural and artificial shade structures at public open space, playgrounds, sporting fields and key Council facilities; • Adjust Council consultant briefs to include urban design principles for Extreme Heat; • Review Council participation in Cancer Council of SA "Sunsmart" program and explore opportunities for integration into Council operations.
Reduced Average Rainfall Risks		
Rating	**Risk**	**Adaptation Measures**
High	Increased costs to maintain water supply and soil structure of public open space and sporting grounds so that they remain fit for use.	• Review and update Council Service Level Standards for Sporting surfaces, District parks, Local parks and Neighbourhood parks and establish methodology and specifications for the prioritisation of soil treatment works; • Develop and implement a coordinated works program for upgrading soil structure and irrigation for public open space; • Develop and implement a community awareness strategy to inform of the impacts of climate change on Council open space and adaptation actions implemented.
High	Reduced amenity and aesthetics of Council open space and loss of trees leads to increased management and costs.	• Undertake continuous improvement of Council's Vegetation Selection Guidelines by monitoring ongoing condition and growth of existing plants and investigating further application of arid zone plants; • Undertake a review of Council's Planting Policy to include an impact assessment of surrounding heat absorbing structures that have the potential to increase mortality of new plantings; • Undertake research into Commonwealth and State Government trials on horticultural techniques for the Adelaide Plains and Mt Lofty Ranges; • Incorporate a non potable water irrigation system into the Landscape Framework; • Develop a community engagement and education strategy to inform of the impacts of climate change on Council open space and adaptation actions implemented.

Sustainability and Environmental Management		
Extreme Temperature (No. Days >35˚C) Risks		
Rating	**Risk**	**Adaptation Measures**
High	Increased management and costs to deal with pest plants, animals and disease.	• Continually engage with the Adelaide and Mount Lofty Ranges Natural Resources Management Board to develop regional prevention and preparedness plans for the management of pests and diseases; • Identify Natural Resource Assets that have a high vulnerability to invasive pests and pathogens; • Develop and implement a pest and pathogen control plan, based on an analysis of climate-induced trends; • Develop a long-term pest plant and animal control program, resource plan and budget.

Community Infrastructure		
Extreme Temperature (No. Days >35˚C) Risks		
Rating	**Risk**	**Adaptation Measures**
High	Increased costs and resources to meet inspection and maintenance of trees which have the potential to cause damage to people and all property as a result of invasive roots.	• Develop a community education strategy to inform of the benefits of street trees in adding value to properties, reducing the urban heat island effect and enhancing urban biodiversity, together with measures that have been implemented to mitigate effects of invasive trees.
Reduced Average Rainfall Risks		
Rating	**Risk**	**Adaptation Measures**
High	Increased requirement to review Councils maintenance operations and service levels in regards to public open space and infrastructure.	• Undertake a review of asset management plans and make adjustments to reflect the change to useful life of public open space and infrastructure, taking into consideration a higher frequency of damage caused by extreme heat and drought; • Review and update the Council's infrastructure design standards to enhance the resilience of natural assets and physical structures.

Council Prosperity		
Extreme Temperature (No. Days >35˚C) Risks		
Rating	**Risk**	**Adaptation Measures**
High	Interruption of power supply to critical locations compromises Council service delivery.	• Review and update the Council Business Continuity Plan to include critical function sub-plans that consider sustained power loss to Council facilities; • Review and upgrade the Council's Asset Management Plans to include infrastructure and equipment to support emergency power supply; • Establish prioritisation methodology for the upgrading of electrical infrastructure and provision of uninterrupted emergency power supply; • Engage with SA Government emergency services sector to garner information regarding the construction of infrastructure resilient to power loss.
High	Loss of service delivery and productivity as a result of Council staff being interrupted due to heat events.	• Review and update the Council's inclement weather policy to establish a coordinated redirection of outdoor staff to cool locations to undertake alternative work; • Consider the development of a spring/summer outdoor staff training program, with packaged modules that can be successively implemented on extreme heat days; • Review Outdoor Staff Personal Protective Clothing to ensure cool comfort during spring/summer periods.

7 RECOMMENDATIONS

- Raise awareness of climate change risks with the Council and the community to enhance decision-making and build community resilience as part of communication and consultation;

- Incorporate adaptation strategies and adaptation measures identified in Section 5 of this Report into Strategic Management planning;

- Include climate change risk management results into the Council's risk management database;

- Monitor and review risk management context with regard to changes to climate variables, operating environment, key business drivers, strategic management, capacity, capabilities and other relevant factors to identify new climate change risks and reanalyse all existing risks.

1 Introduction

1.1 Background

There is an extensive body of peer-reviewed scientific research that the earths climate is changing. The Fourth Assessment Report of the IPCC 2007a, indicates that warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising average sea level. Global greenhouse emissions have grown since pre-industrial times, with an increase of 70 percent between 1970 and 2004, and a very high confidence that this warming has occurred as a result of human activities (IPCC 2007a).

Adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions (IPCC 2007b). There is no alternative but to undertake adaptation planning, even in an environment of extensive mitigation. It is not a case of planning for a different stable climate future, but of building the capacity and flexibility to cope with whatever evolving climate may bring (Lemmen et al 2008).

Adaptation has the benefit of reducing damages and increasing community resilience (Fankhauser 1998, Smit et al 2001). It is a sensible and attainable planning strategy that is based on an understanding of climate change science and on a rigorous assessment of the impacts various climate change variables will have on Local Government business.

The nature of Local Government, its services and functions, means it will feel the impacts of climate change considerably. Potential Strategic Risks to the Local Government Sector include:

- Increased public liability exposure exacerbated by climate change impacts;
- Inadequacy of land use planning, development assessment and building regulation;
- Increased costs associated with the management of assets;
- Public safety and health issues caused by extreme weather events and temperatures;
- Higher insurance costs as a result of increased claims;
- Poor reputation as a result of failing to manage community expectations;
- Increased Resource management issues to meet statutory responsibilities.

Risk management is an effective tool for dealing with climate change as it offers the flexibility and robustness to deal with levels of uncertainty (Jones 2003). Responding to climate change involves an iterative risk management process that includes both mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity and attitudes to risk (IPPC 2007b). It is a system, governed by a recognised Australian Standard (AS/NZS 4360) which has long been established within Local Government and is supported by a best practice database specifically designed for managing risk.

1.2 Scope

The purpose of the Local Government Climate Change Adaptation Program ('the Program') is to enhance resilience through the development and integration of adaptation strategies and measures into Council's Strategic Management Plans. A resilient social-ecological system in a desirable state has a greater capacity to continue providing us with the goods and services that support our quality of life while being subjected to a variety of shocks (Walker and Salt 2006). This has particular relevance to Local Government as the assessment of risks at the local level and the implementation of adaptation measures to treat risks has flow on effects that builds adaptive capacity for the future and enables an environment where Local Government and the community are better able to withstand climate change impacts.

The Program is a Key Area of Focus defined in the South Australian Local Government Sector Agreement pursuant to the *Climate Change and Greenhouse Emissions Reduction Act 2007*, 4 June 2008.

1.3 Objectives

- Facilitate the climate change risk assessment process for Councils, based on AS/NZS 3460
- To integrate adaptation strategies and measures into Council's Strategic Management Plans;
- Undertake a climate change risk management process for Council, based on Australian Standard AS/NZS 4360;
- Provide council with a Climate Change Risk Management and Adaptation Report.

1.4 Assumptions and Limitations

The LGA Mutual Liability Scheme acknowledges that there is a level of uncertainty regarding climate change projections for South Australia. The best data available at the time has been used for risk management and continues to be validated by the Bureau of Meteorology, Climate Section, South Australia Regional Office.

The Program is conducted in a risk and strategic management environment to enable Local Government to make adjustments based on an awareness that climate conditions have changed or are about to change.

Mitigation strategies, including the activities associated with the Carbon Pollution Reduction Scheme are out-of-scope of this Program.

It is acknowledged that the Program will benefit the continual improvement of sustainability and environment objectives of the Local Government Sector.

1.5 Relevance to Legislation and State Policy

The following subsections of the *Local Government Act 1999* are linked to Climate Change Risk Management and Adaptation:

Section 6 Principal Role of Council

6 c) to encourage and develop initiatives within its community for improving the quality of life of the community

Section 7 Functions of Council

7 (a) to plan at the local and regional level for the development and future requirements of its area;

(c) to provide for the welfare, well-being and interests of individuals and groups within its community;

(d) to take measures to protect its area from natural and other hazards and to mitigate the effects of such hazards;

(e) to manage, develop, protect, restore, enhance and conserve the environment in an ecologically sustainable manner, and to improve amenity;

(f) to provide infrastructure for its community and for development within its area (including infrastructure that helps to protect any part of the local or broader community from any hazard or other event, or that assists in the management of any area)

Implementation of adaptation measures by Local Government will play a part in meeting the South Australian Government's Greenhouse Strategy (2007 – 2020) objectives:

2.1 To increase our understanding of risks, vulnerabilities and opportunities;

2.2 To build resilient communities;

2.3 To improve hazard management and minimise risks.

1.6 Liability

Climate Change is not necessarily a liability risk to Local Government. However failure to consider and assess the possible implications of Climate Change, against the key functions of a Council, could lead to major liability exposures. Local Government is responsible for many decisions, policies and programs that may be effected by the impacts of Climate Change. The relevant risk therefore is a Council's failure to reasonably take into account the likely effects of Climate Change. Such an action – or inaction – may result in a person, company or community suffering some form of financial loss, asset loss, personal injury, etc that leads to a negligence based claim.

2 Overview of Council

2.1 About the Council

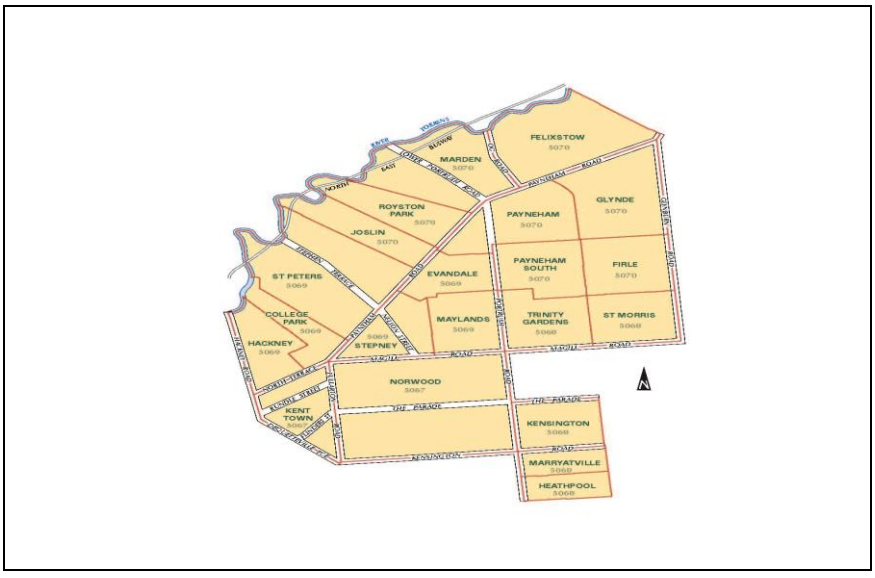
The City of Norwood Payneham & St Peters is located immediately east of the parklands of the Adelaide CBD and is a well established, inner metropolitan area extending over 15.1 square kilometres on land originally inhabited by the Kaurna Aboriginal people. The Council was formed following the amalgamation of the City of Kensington and Norwood, the Town of St Peters and the City of Payneham in 1997. The surrounding Councils are the Adelaide City Council to the west, the Town of Walkerville and City of Port Adelaide Enfield to the north, the City of Campbelltown to the east and the City of Burnside to the south. The River Torrens forms a boundary in the west and north.

The City of Norwood Payneham & St Peters has a culturally diverse population of more than 36,600 which spans 21 suburbs; College Park, Evandale, Felixstow, Glynde, Hackney, Heathpool, Joslin, Kensington, Kent Town, Marden, Marryatville, Maylands, Norwood, Payneham, Royston Park, Stepney, St Morris, St Peters, Trinity Gardens, Firle and Payneham South.

The geography of the council area ranges from the gentle slopes of the east Adelaide foothills across the Adelaide plains and along the banks of the River Torrens, four meandering natural creeks and over 180 hectares of open space, encompassing 69 parks and reserves.

The City contains many excellent intact examples of South Australia's residential and commercial built heritage from the Victorian era and beyond. This built heritage features 73 state and 667 local heritage places, as well as nearly 1,500 contributory Items across the City.

While predominantly residential, the City features professional, manufacturing and light industry business precincts and contains more than 6,000 home-based businesses, all significant contributors to both the state and local economy. The main commercial precincts are located around The Parade, Norwood, Magill Road, Payneham Road and Glynde Corner.



The City of Norwood Payneham & St Peters

2.2 Council Structure

The elected Councillors of the City of Norwood Payneham & St Peters, as a body, are responsible for identifying community needs, setting policy and objectives to meet those needs, and establishing priorities based on competing demands and available resources. Decisions are made at full Council meetings, and may be based on recommendations from the Council Committees, which are established to consider the various aspects of Council's range of responsibilities.

It is the responsibility of the Council's Chief Executive Officer, together with Council staff, to implement the Council's policy framework and strategic plans into an ongoing program of activities for the management and operation of Council's responsibilities.

The Council is administered through four key areas being Urban Services, Corporate Services, Urban Planning and Environment, Governance and Community Affairs & Library Services.

2.3 Framework for Climate Change Strategy development in Council

The City of Norwood Payneham & St Peters has developed and implemented aspects of the Greenhouse Strategy Plan (October 2002). This strategy is primarily focused on the reduction in greenhouse emissions and achieving mitigation targets for Council operations and the community. Council's Strategic Management Plan, *City Plan 2030, Shaping Our Future*, has identified the future state of the City through a vision of, "A City which has cultural diversity, sense of place and natural environment. A progressive City which is prosperous, sustainable and socially cohesive, with strong community spirit". The achievement of this vision will not be attainable without careful consideration of the long term impacts of climate change and making adjustments to Council's business operations. The principle of 'integration' as identified in the city Plan's Sustainability Principles is a key factor in ensuring that Council is able to adapt to climate change. Climate change adaptation is not function specific and applies to all areas of Council business, planning and decision making.

The Council's Environment Policy, developed and certified in accordance with the AS NZS ISO 14001:2004, Environmental Management systems, provides an additional tool for dealing with climate change impacts and integration of action into planning. Key principles include:

1. Value and protect diversity and local distinctiveness and strengthen local community and cultural identity;
2. All aspects of Council operations characterised by conservation and recycling and the minimisation of adverse impacts on the environment;
3. The integration of sustainability into all levels of planning and decision making;
4. The Council will become a leader in environmental management at the local level;
5. Specific relevance to Council's activities, products and services
6. Ownership by staff
7. Working collaboratively with relevant key stakeholders;
8. Consistency with government [policy
9. Value and protect diversity;
10. Commitment to intergenerational equity.

3 Program Methodology

3.1 Project Overview

The Program has adopted a consistent National approach through application of the following:

- Climate Change Risk Management aligned to *Climate Change Impacts and Risk Management: A Guide for Business and Government*, Australian Greenhouse Office, 2006 and the Australian Standard AS/NZS 4360, Risk Management;

- *Climate Change Adaptation Actions for Local Government,* Department of Climate Change 2009;

- Climate change Variables for South Australia identified in the *Climate Change in Australia: Technical Report* 2007 and endorsed by the Bureau of Meteorology, South Australian Regional Office, Climate Section.

The methodology is consistently applied to all Councils participating in the Program.

3.2 Risk Management and Adaptation

The Australian Standard: Risk Management, AS/NZS 4360:2004 was selected as the preferred framework for assessing climate change risks, (Appendix 1). The standard has the benefit of dealing with climate change uncertainty, together with providing a framework that is not only mainstreamed within Council's, but a framework which has the capacity to deal with new climate change information with efficiency and accuracy. The strengths of the standard's application to climate change adaptation are described in Table 3.2. It is important to note the relationship between AS/NZS 4360:2004 and *Climate Change Impacts and Risk Management: A Guide for Business and Government* - the principle guidance for Climate Change Risk and Adaptation in Australia. In particular, the guide specifies nationally consistent consequence and likelihood scales, together with the risk priority matrix used for risk analysis and evaluation.

To determine the City of Norwood, Payneham & St Peters' climate change risk priorities, workshops were held which engaged a diverse cross-section of the Council staff.

The deliverables for the workshops were to:

- Identify risks for the climate change variables of Extreme Temperature, Reduced Average Rainfall, Extreme Rainfall and Extreme Bushfire Weather (refer Section 4.1)associated with each Business Unit;

- Describe the Consequence and Likelihood the risk would have given the current control measures in place by Council, assign a priority level based on the likelihood and consequence of the risk; and

- Develop potential adaptation measures and strategies to treat the intolerable or unacceptable risks – Extreme and High Risks.

Following the workshops Extreme and High risks and their treatments (adaptation measures) were aligned to the outcome areas of the Council's Strategic Plan and the functional areas

of Development Planning, Recreation and Community Services, Health and Wellbeing, Emergency Management, Sustainability and Environmental Management, Community Infrastructure and Council Prosperity. Key Recommendations have also been identified.

The following table summarises the engagement undertaken with Council:

City of Norwood Payneham & St Peters Program Summary		
Activity	Milestones & Activity Measures	Date Undertaken
Workshop 1	Context (Basic science, Legal, Adaptation Principles)	23 October 2009
Workshop 2	Risk Identification	11 November 2009
Workshop 3	Risk Analysis, Evaluation and Treatment (Adaptation)	26 November 2009

The risk management results are a reflection of the dynamic engagement undertaken with the relevant Council. This specialist information, coupled with 20 years Local Government risk management experience and an extensive body of claims management data of the LGA Mutual Liability Scheme and partnerships with the Bureau of Meteorology has resulted in the delivery of sound Program outcomes. In addition the outcomes have taken into consideration the lessons learned and risk trends from an analysis of the data from the numerous Metropolitan and Country Councils that have undertaken the Local Government Climate Change Adaptation Program.

Figure 3.2, Climate Change Risk Management Framework

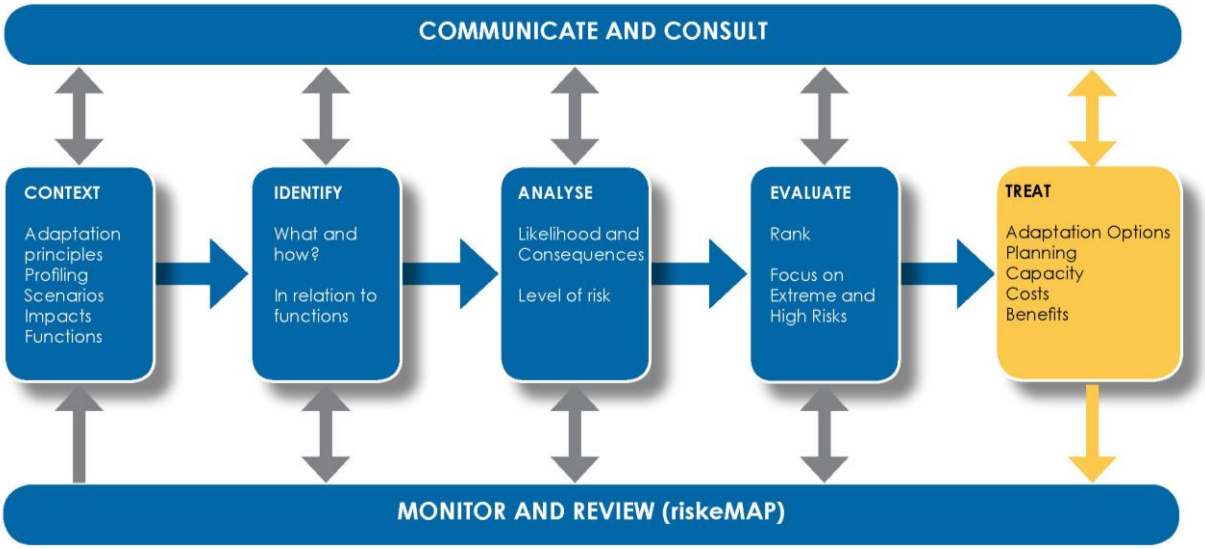


Table 3.2, Strengths of applying the Australian Standard: Risk Management to Climate Change Risk Assessment and Adaptation

Australian Standard: Risk Management AS/NZS 4360:2004	
Strengths - Climate Change Risk Assessment and Adaptation	
Recommended by the Department of Climate Change	Currently used by Council for other business such as emergency management, bushfire management and Occupational, Health and Safety
Identified as a option by the Climate Change in Australia: Technical Report 2007	Dynamic, responsive to change and incorporates mechanisms to treat uncertainty
Promotes mainstreaming of climate change adaptation as part of enterprise risk management	It is the best practice Australian Standard that has formed the basis for the Draft International Standard of Risk Management (ISO 31000)
Accounts for new information	Robust framework supported by a best practice online risk management assessment tool and data base
Minimal training requirements	Allows for consistency
Integrates with quality management, business continuity and management and business excellence	Facilitates continual improvement of an organisation

4 Climate Change

4.1 Climate Change Variables for South Australia

The variables listed in Table 4.1 were selected as the most appropriate for application to Local Government climate change adaptation. The best estimate of change based on the Climate Change in Australia, Technical Report 2007 modelling have been adopted. Changes (relative to 1990) except for days over 35˚C, are shown for Adelaide, South Australia, as per CSIRO, 2007, *Climate Change in Australia: Technical Report 2007*. Sea level rise is calculated from A1B 2100 on the assumption that there is a 0.32 cm rise per year.

Bushfire weather change is for 2030 relative to 1973-2007 as per *Bushfire weather in Southeast Australia: Recent trends in projected climate change impacts* (Lucas et al 2007).

Information has been independently verified by the Bureau of Meteorology, South Australia, Regional Office, Climate Section. Climate Change variables are applied to individual Councils based on geographical location and an assessment of relevant hazards. A more detailed account of the predicted changes to the South Australia Climate can be found in Appendix 2.

Table 4.1, Climate Change Variables, Adelaide, South Australia

Variable		Current	2030 A1B Change (best estimate)
Adelaide			
Extreme Temperature	No. days over 35˚C	17 days	23 days
Rainfall	Annual average rainfall	553.4 mm	- 4 %
Extreme Rainfall	Daily rainfall intensity (1 in 20 year event)	n/a	+ 3 %
Sea Level	Sea level rise	n/a	+ 18 cm
Bushfire Weather	No. days Very High – Extreme Fire Weather	19.5 days	24.1 days

4.2 Climate Change Variables for the City of Norwood Payneham & St Peters

The following Climate Change Variables were selected for undertaking the Climate Change Risk Management process with Council.

- Extreme Temperature
- Reduced Average Annual Rainfall
- Extreme Rainfall
- Extreme Bushfire Weather

4.3 Sensitivity Assessment for Sector

The following table shows is an assessment of the factors that influence the Sensitivity of the Local Government Sector to climate change:

Sensitivity Assessment	South Australian Local Government
Council are required to undertake varied roles and responsibilities defined in South Australian Legislation including, but not limited to: ▪ *Local Government Act 1999* ▪ *Food Act 2001* ▪ *Public and Environmental Health Act 1987* ▪ *Fire and Emergency Services Act 2005* ▪ *Development Act 1993* ▪ *Environment Protection Act 1993*	
Primary responsibility for making decisions rests with the Council's Elected Members.	
Expectations, perceptions, values and beliefs of the community are major elements of the Council's Community Leadership function. Furthermore, local government and companies in general are susceptible to shifts in the social trends of media coverage and public opinion that drive policy agendas (TCIA 2006).	
Council financial management is influenced by rate-based revenue.	
Council are responsible for land use planning and are the relevant authority for development planning and building assessment.	
Council owns and manages a range of community infrastructure and assets of varying condition and age.	
Councils construct, own and maintain a sealed and un-sealed road network.	
Council owns and manages stormwater and drainage systems.	
Council are responsible for the care and maintenance of parks, reserves, sporting fields and other recreation facilities.	
Home and community care services for elderly and other vulnerable people are delivered by Council.	
Council is responsible for natural resource and environmental management.	
Food and public health inspections are undertaken by Council resources.	
Council provides an approval system for the management of events within the Council area.	
Council is involved in the promotion of economic development.	
Water availability is influenced by the state of the Murray Darling Basin System and Reservoir catchments in the Mount Lofty Ranges.	

4.4 Adaptive Capacity of the Sector

Local Government is in a strong position to effect adaptation measures through its Strategic and Business Planning processes and because it has established standards, systems and information to manage climate change risks and legislative responsibilities that demand action. There is scope for modifying systems to increase Local Government capacity to cope with changes in climate conditions.

Adaptive Capacity	South Australian Local Government
The roles, responsibilities and objectives of Councils, established in the *Local Government Act 1999* are compatible with and enhance climate change risk management and adaptation planning.	
Council has the ability to guide development by making amendments to zones, maps and policy in Development Plans and Planning Amendment Reports, established under the *Development Act 1993*.	
Councils understand the values, beliefs, expectations and socio-economic profile of the community.	
Councils have established consultation and communications plans for the collection and dissemination of information within the community.	
Opportunities exist for mainstreaming climate change into Strategic Management Plans, established under Section 122 of the *Local Government Act 1999*.	
The LGA Mutual Liability Scheme supports Councils in a comprehensive Risk and Claims Management Program.	
Councils are supported by the Local Government Association and a State network of Councils to provide leadership and to advocate and guide legislative change.	
Councils are supported by the LGA Asset Mutual Fund for damage and loss to Council Assets in accordance with the fund rules.	
Councils have Emergency Management experience in undertaking prevention, preparedness, response and recovery for a range of hazards, especially bushfire and flood.	

4.5 Potential Impacts for Local Government

The following table of potential impacts on Local Government relevant to each of the Climate Change Variables considered during the risk management process:

Extreme Temperature	Potential Impacts
Increase in heat related health issues of the elderly, sick and economically disadvantaged	
Increase in dog and cat management issues	
Increased visitation to swimming pools, beaches and council–owned infrastructure that provides cooling	
Change in community behaviour where less business is undertaken during normal business hours or increase in preference to utilise information technology	
Cancellation of community and sporting events	
Increased security and vandalism issues during summer	
Increase in health issues and incidence where stop-work criteria are met for local government employees and contractors	
Decrease in the integrity of exposed building materials, increasing maintenance and replacement costs	
Decrease in the integrity of road pavement, increasing maintenance and replacement costs	
Overheating of local government equipment (fixed and mobile), increasing maintenance and replacement costs	
Increased incidence of falling tree limbs from large Eucalyptus species	
Increase in peak demand for energy for cooling during summer	
Potential for power black-outs and implementation of business continuity plans	
Increase in food and water-borne diseases	
Dams, lakes and other water bodies susceptible to algal blooms	

Reduced Average Rainfall	Potential Impacts
Decrease in availability and quality of water supply	
Increase in maintenance and replacement costs for recreation reserves and playing fields (turf, water supply, irrigation equipment)	
Closure of playing fields due to damage to turf	
Emergency management for distribution of alternative water supply	
Increase cracking damage to buildings when combined with temperature	
Increased cracking damage to water and sewerage infrastructure leading to contamination and pollution	
Loss of reserve and roadside vegetation	

Extreme Rainfall	Potential Impacts
Flooding of council buildings and infrastructure	
Flooding of council facilities and recreation areas	
Damage to council buildings and infrastructure (stormwater, roads, bridges)	
Increased incidence of Ross River Virus	
Emergency management for flooding events	
Development planning in flood prone areas	

Extreme Bushfire Weather	Potential Impacts
Damage to local government infrastructure, parks and recreational facilities	
Use of local government infrastructure and facilities for response and recovery of bushfire	
Business continuity planning during bushfire incidents due to interruptions to business and employees undertaking response and recovery functions	
Currency of Bushfire Risk Management Planning including currency of plans and obligations under the *SA Fire and Emergency Services Act*	
Use of high bushfire risk equipment by local government and contractors on days of a Total Fire Ban	
Management of barbeques located on local government reserves	
Increase in number of permits for lighting and maintaining fire issued by Local Government Authorised Officers	
Increase in volume of Hazard Assessment under the *SA Fire and Emergency Services Act*	
Replenishment of local government water supplies following bushfire	
Management of park and roadside vegetation	
Development Planning under the Bushfire Management Planning Amendment Report	

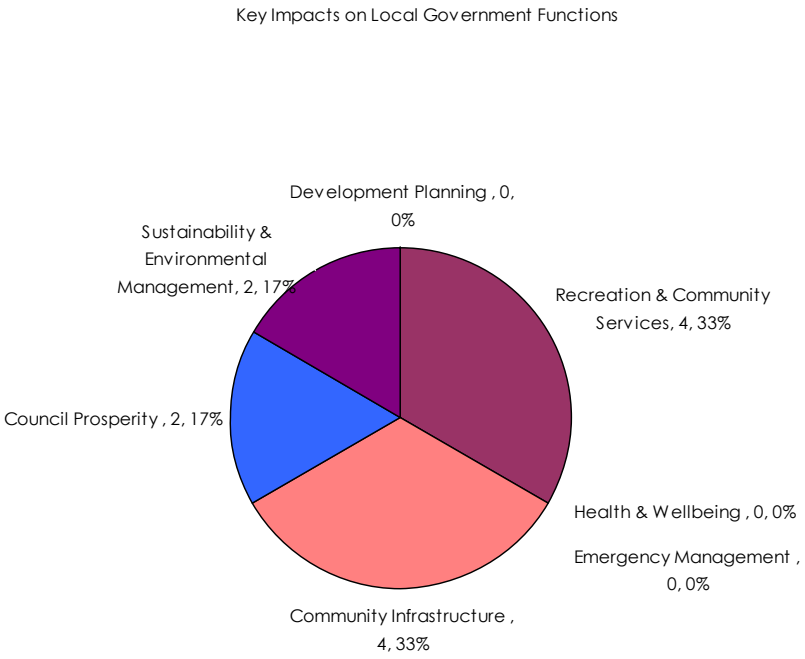
5 Climate Change Risk Management Results

High climate change risks are presented as they demand to be urgently addressed as part of the Council's strategic management planning. Risks and their treatments (adaptation measures) have been aligned to the City of Norwood Payneham & St Peters City Plan 2030. A total of sixty three (63) Climate Change Risks were identified by the City of Norwood Payneham & St Peters. Of the total risks identified, twelve (12) were classified as High climate change risks. Just over half (58 percent) of the High Risks can be attributed to potential impacts arising from extreme heat

The Lower priority risks (classified as low or medium) are included in Appendix 3. These risks are considered to be acceptable and do not need further treatment at this stage.

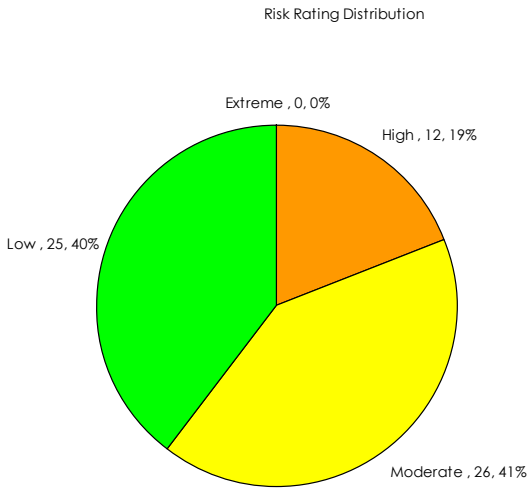
The results of the Climate Change Risk Assessment have been uploaded in the online Local Government risk management data management system, to achieve a consolidated South Australian Climate Change Risk Management database and provide a foundation for the development of sector approaches to adaptation in South Australia.

Figure 5.1, Key Impacts on Local Government Functions, City of Norwood Payneham & St Peters



***** Figure 5.1 analyses those risks identified as 'High' and 'Extreme' from the seven functions of Local Government. Every risk is accounted for as a entirely new risk when assessed by a new Perspective or 'Success Criteria' of Public Safety, Local Economy, Sustainability and Environment, Structures and Lifestyle and/or Admin and Governance.

Figure 5.2, Climate Change Risk Ratings, City of Norwood Payneham & St Peters



** Figure 5.2 analyses those risks identified all risks identified by Council during the climate change program. Every risk is accounted for as a entirely new risk when assessed by a new Perspective or 'Success Criteria' of Public Safety, Local Economy, Sustainability and Environment, Structures and Lifestyle and/or Admin and Governance.

Figure 5.3, Risk Distribution, Combined Extreme and High Risks, City of Norwood Payneham & St Peters

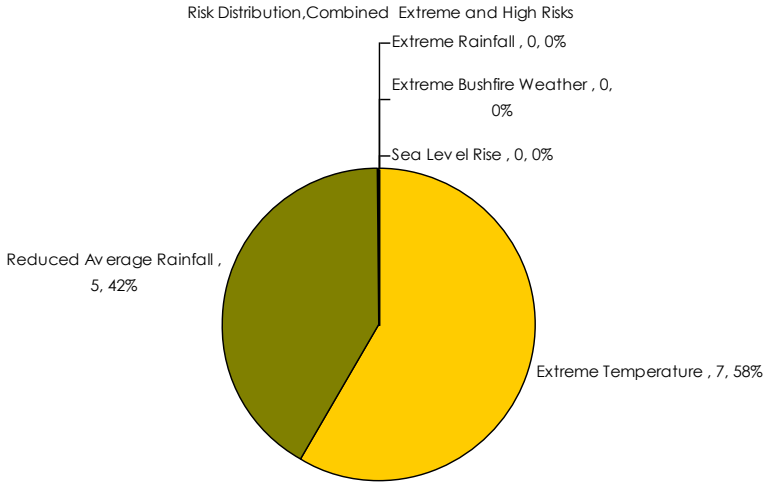


***Figure 5.3 analyses those risks identified as 'High' and 'Extreme' from the Climate change scenarios determined by the Bureau of Meteorology. Every risk is accounted for as a entirely new risk when assessed by a new Perspective or 'Success Criteria' of Public Safety, Local Economy, Sustainability and Environment, Structures and Lifestyle and/or Admin and Governance.

5.1 Recreation and Community Services

5.1.1 Risks and Adaptation

Alignment with Strategic Management Plan

Outcome 1: Social Equity
A connected, accessible and pedestrian friendly community.
Objectives
- An engaged and participating community;
- More community life in public places;
- Healthy and active community.

Outcome 2: Cultural Vitality
A culturally rich and diverse City, with a strong identity, history and 'sense of place'.
Objectives
- A visually interesting, artistic and creative city;
- Pleasant, well designed, sustainable urban environments;
- Dynamic mix of uses and activities in selected precincts.

Outcome 4: Environmental Sustainability
A leader in environmental sustainability.
Objectives
- Sustainable and efficient management of water, energy and other resources;
- Healthy watercourses;
- Sustainable quality streetscapes and open spaces;
- Thriving habitats for native flora and fauna

Extreme Temperature (No. Days >35˚C) Risks

Rating	Risk	Current Controls	Adaptation Measures
High	Increased cost to manage the community expectation for the provision of artificial shade structures at Council owned facilities.	The Council's Playground Strategy identifies action for including natural shade to provide comfort.	• Review the Council Playground Strategy and initiate a market research project to determine community perceptions, values and social norms with regards to natural and artificial shade structures at public open space, playgrounds, sporting fields and key Council facilities; • Adjust Council consultant briefs to include urban design principles for Extreme Heat; • Review Council participation in Cancer Council of SA "Sunsmart" program and explore opportunities for integration into Council operations.

Reduced Average Rainfall Risks			
Rating	**Risk**	**Current Controls**	**Adaptation Measures**
High	Increased costs to maintain water supply and soil structure of public open space and sporting grounds so that they remain fit for use.	Undertaking pilot studies on soil treatment techniques to improve soil structure; Adoption of an Irrigation Management Plan.	• Review and update the Council Service Level Standards for Sporting surfaces, District parks, Local parks and Neighbourhood parks and establish methodology and specifications for the prioritisation of soil treatment works; • Develop and implement a coordinated Works Program for upgrading soil structure and irrigation for public open space; • Develop and implement a community awareness program to inform the community of the impacts of climate change on Council open space and adaptation actions implemented.
High	Reduced amenity and aesthetics of Council open space and loss of trees leads to increased management and costs.	Eastern Region Alliance Working Party - Drought Proofing Urban Forest.	• Undertake continuous improvement of the Council's Vegetation Selection Guidelines by monitoring ongoing condition and growth of existing plants and investigating further application of arid zone plants; • Undertake a review of the Council's Planting Policy to include an impact assessment of surrounding heat absorbing structures that have the potential to increase mortality of new plantings; • Undertake research into Commonwealth and State Government trials on horticultural techniques for the Adelaide Plains and Mt Lofty Ranges; • Incorporate a non potable water irrigation system into the Landscape Framework; • Develop a community engagement and education strategy to inform of the impacts of climate change on Council open space and adaptation actions implemented.

5.2 Sustainability and Environmental Management

5.2.1 Risks and Adaptation

Alignment with Strategic Management Plan			
Outcome 4: Environmental Sustainability A leader in environmental sustainability. **Objectives** • Sustainable and efficient management of water, energy and other resources; • Healthy watercourses; • Sustainable quality streetscapes and open spaces; • Thriving habitats for native flora and fauna.			
Extreme Temperature (No. Days >35˚C) Risks			
Rating	**Risk**	**Current Controls**	**Adaptation Measures**
High	Increased management and costs to deal with pest plants, animals and disease.	The Council's Biodiversity Strategy; Adelaide and Mount Lofty Ranges Natural Resources Management Board engagement; Environmental Health Authority.	• Continually engage with the Adelaide and Mount Lofty Ranges Natural Resources Management Board to develop regional prevention and preparedness plans for the management of pests and diseases; • Identify Natural Resource Assets that have a high vulnerability to invasive pests and pathogens; • Develop and implement a pest and pathogen control plan, based on an analysis of climate-induced trends; • Develop a long-term pest plant and animal control program resource plan and budget.

5.3 Community Infrastructure

5.3.1 Risks and Adaptation

Alignment with Strategic Management Plan

Outcome 1: Social Equity
A connected, accessible and pedestrian friendly community.
Objectives
- An engaged and participating community;
- More community life in public places;
- Healthy and active community.

Outcome 2: Cultural Vitality
A culturally rich and diverse City, with a strong identity, history and 'sense of place'.
Objectives
- A visually interesting, artistic and creative city;
- Pleasant, well designed, sustainable urban environments;
- Dynamic mix of uses and activities in selected precincts.

Outcome 4: Environmental Sustainability
A leader in environmental sustainability.
Objectives
- Sustainable and efficient management of water, energy and other resources;
- Healthy watercourses;
- Sustainable quality streetscapes and open spaces;
- Thriving habitats for native flora and fauna.

Extreme Temperature (No. Days >35˚C) Risks

Rating	Risk	Current Controls	Adaptation Measures
High	Increased costs and resources to meet inspection and maintenance of trees which have the potential to cause damage to people and property as a result of invasive roots.	Root directors for selected street trees; Section 245 process; Water Sensitive Urban Design trials for watering street trees.	• Develop a community education strategy to inform the community of the benefits of street trees in adding value to properties, reducing the urban heat island effect and enhancing urban biodiversity, together with measures that the Council have been implemented to mitigate effects of invasive trees.

Reduced Average Rainfall Risks			
Rating	**Risk**	**Current Controls**	**Adaptation Measures**
High	Increased requirement to review Councils maintenance operations and service levels in regards to public open space and infrastructure.	Asset Management Plans.	• Undertake a review of asset management plans and make adjustments to reflect the change to useful life of public open space and infrastructure, taking into consideration a higher frequency of damage caused by extreme heat and ongoing drought; • Review and update the Council's infrastructure design standards to enhance the resilience of natural assets and physical structures.

5.4 Council Prosperity

5.4.1 Risks and Adaptation

Alignment with Strategic Management Plan			
Outcome 1: Social Equity A connected, accessible and pedestrian friendly community. **Objectives** • Convenient and accessible services; • An engaged and participating community. **Outcome 3: Economic Prosperity** A dynamic and thriving centre for business and services. **Objectives** • A local economy supporting and supported by its community.			
Extreme Temperature (No. Days >35˚C) Risks			
Rating	**Risk**	**Current Controls**	**Adaptation Measures**
High	Interruption of power supply to critical locations compromises Council service delivery.	Business Continuity Plan - Information Technology.	• Review and update the Council Business Continuity Plan to include critical function sub-plans that consider sustained power loss to Council facilities; • Review and upgrade Asset Management Plans to include infrastructure and equipment to support emergency power supply; • Establish prioritisation methodology for the upgrading of electrical infrastructure and provision of uninterrupted emergency power supply; • Engage with SA Government emergency services sector to garner information regarding the construction of infrastructure resilient to power loss.
High	Loss of service delivery and productivity as a result of Council staff being interrupted due to heat events.	Inclement Weather Policy	• Review and update Council inclement weather policy to establish a coordinated redirection of outdoor staff to cool locations to undertake alternative work; • Consider the development of a spring/summer outdoor staff training program, with packaged modules that can be successively implemented on extreme heat days; • Review Outdoor Staff Personal Protective Clothing to ensure cool comfort during spring/summer periods.

6 Key Recommendations

- Raise awareness of climate change risks with the Council and the community to enhance decision-making and build community resilience as part of communication and consultation;
- Incorporate adaptation strategies and adaptation measures identified in Section 5 of this Report into Strategic Management planning;
- Include climate change risk management results into the Council's Risk Management database;
- Monitor and review risk management context with regard to changes to climate change variables, operating environment, key business drivers, strategic management, capacity, capabilities and other relevant factors to identify new climate change risks and reanalyse all existing risks.

7 Glossary

IPCC 2007b

Adaptation

Adjustment in natural or *human systems* in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Planned adaptation – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Adaptation assessment

The practice of identifying options to adapt to *climate change* and evaluating them in terms of criteria such as availability, benefits, costs, effectiveness, efficiency and feasibility

Adaptive capacity (in relation to climate change impacts)

The ability of a system to adjust to *climate change* (including *climate variability* and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Anthropogenic

Resulting from or produced by human beings.

Climate change

Climate change refers to any change in *climate* over time, whether due to natural variability or as a result of human activity. This usage differs from that in the *United Nations Framework Convention on Climate Change (UNFCCC)*, which defines 'climate change' as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global *atmosphere* and which is in addition to natural climate variability observed over comparable time periods'.

Climate (change) scenario

A plausible and often simplified representation of the future *climate*, based on an internally consistent set of climatological relationships and assumptions of *radiative forcing*, typically constructed for explicit use as input to climate change impact models. A 'climate change scenario' is the difference between a climate *scenario* and the current climate.

Erosion

The process of removal and transport of soil and rock by weathering, mass wasting, and the action of streams, *glaciers*, waves, winds and underground water.

Extreme weather event

An event that is rare within its statistical reference distribution at a particular place. Definitions of 'rare' vary, but an extreme weather event would normally be as rare as or rarer than the 10th or 90th percentile. By definition, the characteristics of what is called 'extreme weather' may vary from place to place. Extreme weather events may typically include floods and *droughts*.

Greenhouse effect

The process in which the absorption of infrared radiation by the *atmosphere* warms the Earth. In common parlance, the term 'greenhouse effect' may be used to refer either to the natural greenhouse effect, due to naturally occurring *greenhouse gases*, or to the enhanced (*anthropogenic*) greenhouse effect, which results from gases emitted as a result of human activities.

Habitat

The locality or natural home in which a particular plant, animal, or group of closely associated organisms lives.

(climate change) Impacts

The effects of *climate change* on natural and *human systems*. Depending on the consideration of *adaptation*, one can distinguish between potential impacts and residual impacts: Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation.

Invasive species and invasive alien species (IAS)

A species aggressively expanding its range and population density into a region in which it is not native, often through out competing or otherwise dominating native species.

Mitigation

An *anthropogenic* intervention to reduce the anthropogenic forcing of the *climate system*; it includes strategies to reduce *greenhouse gas sources* and emissions and enhancing *greenhouse gas sinks*.

Mortality

Rate of occurrence of death within a population; calculation of mortality takes account of age-specific death rates, and can thus yield measures of life expectancy and the extent of premature death.

Resilience

The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.

Sea-level rise

An increase in the mean level of the ocean. *Eustatic sea-level rise* is a change in global average sea level brought about by an increase in the volume of the world ocean. *Relative sea-level rise* occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise and/or land level subsidence. In areas subject to rapid land-level uplift, relative sea level can fall.

Stakeholder

A person or an organisation that has a legitimate interest in a project or entity, or would be affected by a particular action or policy.

Sustainable development

Development that meets the cultural, social, political and economic needs of the present generation without compromising the ability of future generations to meet their own needs.

Vector-borne diseases

Disease that are transmitted between hosts by a *vector* organism (such as a mosquito or tick); e.g., *malaria*, *dengue fever* and leishmaniasis.

Vulnerability

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of *climate change*, including *climate variability* and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its *sensitivity*, and its adaptive capacity.

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9 Appendices

9.1 Appendix 1, Risk Management Framework

Climate scenarios are plausible descriptions, without ascribed likelihoods, of possible states of the world (IPCC 2007a). The mid range emissions scenario of A1B has been selected for the risk assessment process. It describes a world which has a peak in the population at 2050 and a balance between fossil energy sources such as oil and gas and renewable sources such as wind, solar and geothermal. It is a storyline that can reasonable expect success from the implementation on adaptation measures. The summary characteristics of this A1B storyline are found in the following Figure:

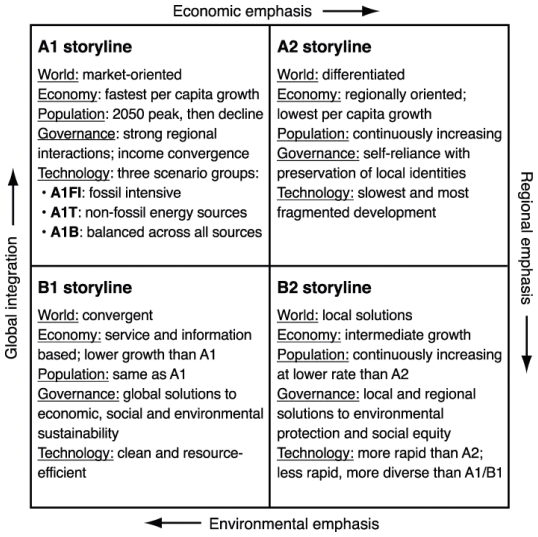

Figure 10.1, Characteristics of Climate Change Scenarios (IPCC 2007a)

Climate Change Variables

The variables listed in the following Table were selected as the most appropriate for application to Local Government climate change adaptation. The best estimate of change based on the Climate Change in Australia, Technical Report 2007 modelling have been adopted. Changes (relative to 1990) except for days over 35˚C, are shown for Adelaide, South Australia, as per CSIRO, 2007, *Climate Change in Australia: Technical Report 2007*. Sea level rise is calculated from A1B 2100 on the assumption that there is a 0.32 cm rise per year.

Bushfire weather change is for 2030 relative to 1973-2007 as per *Bushfire weather in Southeast Australia: Recent trends in projected climate change impacts* (Lucas et al 2007).

Information has been independently verified by the Bureau of Meteorology, South Australia, Regional Office, Climate Section. Climate Change variables are applied to individual Councils based on geographical location and an assessment of relevant hazards.

Variable		Current	2030 A1B Change (best estimate)
Adelaide			
Extreme Temperature	No. days over 35˚C	17 days	23 days
Rainfall	Annual average rainfall	553.4 mm	- 4 %
Extreme Rainfall	Daily rainfall intensity (1 in 20 year event)	n/a	+ 3 %
Sea Level	Sea level rise	n/a	+ 18 cm
Bushfire Weather	No. days Very High – Extreme Fire Weather	19.5 days	24.1 days

Success Criteria

Success criteria can be best described as long term objectives, and provide a perspective from which to conduct a risk assessment. In many cases a single climate change risk is assessed from a number of perspectives. The following success criteria linked directly to the *Local Government Act* and in accordance with AGO 2006 were adopted as part of the risk management framework:

- Maintain public safety;
- Protect and enhance the local economy;
- Protect existing community structures and the lifestyle enjoyed by the people of the region;
- Sustain and enhance the physical and natural environment;
- Ensure sound public administration and governance.

Risk Analysis

The Local Government Climate Change Adaptation Program Risk Management makes the assumption that the climate change variables will occur. The analysis of each risk takes into account all existing or current controls and treatment methods that may impact on the risk.

Consequence Table

Outcome or impact of an effect consistent with AGO 2006:

Consequence Rating	Maintain public safety	Protect and enhance the local economy	Protect existing community structures and the lifestyle enjoyed by the people of the region	Sustain and enhance the physical and natural environment	Ensure sound public administration and governance
Catastrophic	Large numbers of serious injuries or loss of lives	Regional decline leading to widespread business failure, loss of employment and hardship	The region would be seen as very unattractive, moribund and unable to support its community	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Public administration would fall into decay and cease to be effective
Major	Isolated instances of serious injuries or loss of life	Regional stagnation such that businesses are unable to thrive and employment does not keep pace with population growth	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and a danger of continuing environmental damage	Public administration would struggle to remain effective and would be seen to be in danger of failing completely
Moderate	Small numbers of injuries	Significant general reduction in economic performance relative to current forecasts	General appreciable decline in services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	Public administration would be under severe pressure on several fronts
Minor	Serious near misses or minor injuries	Individually significant but isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Minor instances of environmental damage that could be reversed	Isolated instances of public administration being under severe pressure
Insignificant	Appearance of a threat but no actual harm	Minor shortfall relative to current forecasts	There would be minor areas in which the region was unable to maintain its current services	No environmental damage	There would be minor instances of public administration being under more than usual stress but it could be managed

Likelihood Table

The framework of probability and frequency of the effect consistent with AGO 2006:

Likelihood Rating	Recurrent risks	Single events
Almost Certain	Could occur several time per year	More likely than not -Probability greater than 50%
Likely	May arise about once a year	As likely as not -50/50 chance
Possible	May arise once in ten years	Less likely than not but still appreciable - Probability less than 50% but still quite high
Unlikely	May arise once in ten to 25 years	Unlikely but not negligible -Probability low but noticeably greater than zero
Rare	Unlikely during the next 25 years	Negligible -Probability very small, close to zero.

This is a conditional likelihood and is used all assessments under the assumption that the climate change scenario will occur.

Risk Prioritisation Matrix

LIKLIEHOOD	CONSEQUENCE						
	0 – 10 Insignificant	11 – 30 Minor	31 – 50 Moderate	51 – 70 Major	71 – 100 Catastrophic	KEY	
71 – 100 Almost Certain						EXTREME	
51 – 70 Likely						HIGH	
21 – 50 Possible						MEDIUM	
11 – 20 Unlikely						LOW	
0 - 10 Rare							

Elements at Risk

Council will have the opportunity to define there own elements at risk. This may be in the form of the organisational structure or functional areas. As a default the following are suggested in accordance with AGO 2006:

- Infrastructure and Property Services
- Recreational Facilities
- Health Services
- Planning and Development
- Natural Resource Management
- Water and Sewerage Services

Adaptation Classification

According to the IPCC 2007, adaptation measures can be classified in terms of Policy, Managerial, Technological and Behaviour forms. To provide direction to adaptation planning within council, an adaptation framework has been developed, Figure 3.2.

Policy	Managerial	Technological	Behavioural
Legislation	Control	Infrastructure	Information
Regulation	Operations		Awareness
Policy	Planning		Education
Statutory Planning	Logistics		Public Warning
Compliance	Leadership		
Enforcement			

Typical information requirements for adaptation measures are described by Niang-Diop et al 2004. These include the following parameters:

- Description (Objectives, barriers to implementation, capacity to implement and sustain, social acceptance)
- Estimated Cost
- Benefits

RiskeMAP®

All risk management data (context, risks, consequence, likelihood and evaluation) will be recorded in RiskeMAP® to enable constant monitoring and review. This is important due to uncertainty surrounding climate change and the ever evolving information on scenarios and potential impacts.

During the implementation of this project the LGA Mutual Liability Scheme will establish a Climate Change Risk Management "Champion" with Council to ensure ongoing management of the data. This will be in most cases be the Risk Manager or Risk Officer.

9.2 Appendix 2, Predicted Changes to South Australian Climate

Temperature

South Australia is likely to see only marginal average annual temperature increases in the order of 0.9˚ C (CSIRO 2007). This is not likely to present significant issues for Local Government business. However, Extreme temperature will present some challenges with an increase in the number of days over 35˚ C and a 20-30 percent increase in the number of warmer nights during the summer months.

As a consequence of clearer skies during Autumn, Winter and Spring there is likely to be an increase in risk of frosts (pers. com. Ray, D, 4 September 2007).

Rainfall

Annual average rainfall is predicted to decline. It is expected that there will be significant seasonal variations with major declines occurring during Winter and Spring. In addition to this, rainfall decline in the Murray Darling Basin (Victoria and New South Wales) needs to be given recognition due to the contribution to the Murray river in-flows and subsequent river health in South Australia.

Extreme rainfall events are expected to increase by 3 percent by 2030, however this is not expected to change the Average Recurrent Intervals for stormwater design significantly.

Wind

Globally there is predicted to be an increase in wind speeds. However, in South Australia the magnitude of average wind speed increase is of little concern with minimal impact to Local Government. Climate change is likely to increase the incidence of and strength of sea breezes which may influence activities and operations for coastal Councils.

Sea Level Rise

Sea level rise is often considered as a long term problem. However the impacts may be experienced now as only small rises have the potential to impact on coastal flooding, erosion and sand drift. South Australian Councils have already experienced damage to infrastructure as a result of coastal inundation and erosion. What makes this climate change variable even more significant is the fact that it is difficult to measure and forecast. The IPCC 2007 gives a central estimate of global sea level rise of 35 cm by 2100 with a further additional contribution from the melting of land-based ice sheets, possibly 10 to 20 cm. This equates to an increase of 18 cm by 2030 for South Australia.

There is a high degree of uncertainty regarding the contribution that the large ice sheets of the Arctic and Antarctic, currently locked in place by floating masses of ice (ice shelves) will have on sea level rise. There is a potential for a further 50 to 100 cm rise as a consequence of accelerated thinning and melting of the ice shelves.

Minor rises in sea level (as predicted) are significant to coastal Councils as storm surge (increase in water level above the high tide mark during storm) will exacerbate the impacts.

Bushfire Weather

Very High and Extreme bushfire weather is of concern as should a fire ignite under these conditions, then the likeliness of control is poor and consequences to the community and the environment is severe. Analysis suggests that Very High and Extreme bushfire weather conditions may become a much more common event (Lucas et al 2007).

Severe Thunderstorm

The Bureau of Meteorology classifies severe thunderstorms as any storm which produces any of the following:

- Hail stones > 2 cm;
- Wind Gusts > 90 km/h;
- Flash flooding;
- Tornado.

South Australia has experienced cool season tornados (Cummins, Snowtown, Tarlee - 21 July 1995, Coulta, Wattle Park - 18 May 2002, Karoonda - 10 June 2005). Climate change projected to have positive impacts. There is likely to be a reduction in the number of tornados during the period, May to October, due to less favourable conditions for their formation (CSIRO 2007). Furthermore there is likely to be a decrease in the incidence of large hail.

9.3 Appendix 3, Moderate and Low Climate Change Risks

Extreme Temperature (No. Days >35˚C) Risks	
Moderate	Inefficient building being developed due to Development Plan & Building Code not reflecting best practice standards for reduced energy consumption & thermal protection.
Moderate	Increased management for Development Assessment for significant tree removal applications.
Moderate	The Council may not have considered the effects of extreme heat on the asset life of rubberised playground surfaces, which results in increased costs for maintenance.
Moderate	Increased costs and management to deal with expectations that Council provides cooling centres.
Moderate	Damage to people and property from trees shedding limbs.
Moderate	Increased costs associated with the maintenance and repair of buildings that do not adequately address increasing days of extreme heat.
Moderate	Increased flooding due to vegetation loss in the catchment area.
Moderate	Council facilities may not be able to be air conditioned appropriately due to current air-conditioning design.
Moderate	Increased costs and resources to meet inspection and maintenance of trees which have the potential to cause damage to people & all property as a result of limb drop.
Moderate	Increased management to clean up leaves in stormwater systems as a result of extreme temperature.
Moderate	Council budget does not appropriately consider cost of attaining building cooling standards.
Moderate	Reduction in aesthetics and amenity of parks, gardens and open space as a result of vegetation scorch.
Low	Poor public perception as a result of cancellation of events during extreme heat.
Low	Increasing costs for maintenance of Council swimming facilities due to increased patronage.
Low	Poor public perception of Council as a result of increase energy use compromising Council energy efficiency targets.

Reduced Average Rainfall Risks	
Moderate	Increased management to ensure that a WSUD culture is integrated into the community to maintain aesthetics and amenity.
Moderate	Increased management to undertake inspection and audit of Council owned sporting field surfaces.
Moderate	Increased management by the Council to adjust service models to meet expectations as a result of water restrictions.
Moderate	Increased management and costs to deal with increased cracking to heritage buildings as a result of soil movement.
Moderate	Increased expectation for environmental issues to be considered in asset management.
Low	Council unable to maintain its objectives for biodiversity due to species loss and/or population migration.

Extreme Rainfall Risks	
Moderate	Lost opportunity to capture rainfall at suitable sites for future use impacts on the Council's sustainability.
Low	Increased densities of development increasing impervious surfaces leads to higher more intense stormwater runoff.
Low	Costs to mitigate reduced capacity of existing stormwater infrastructure as a result of new developments.
Low	Increased cost and management to deal with movement of soil causing erosion.

Extreme Bushfire Weather Risks	
Moderate	Increased management to deal with higher number of issuing hazard reduction notices.
Low	Increased expectation, management and resources to deal with bushfire prevention and preparedness in Linear Park.