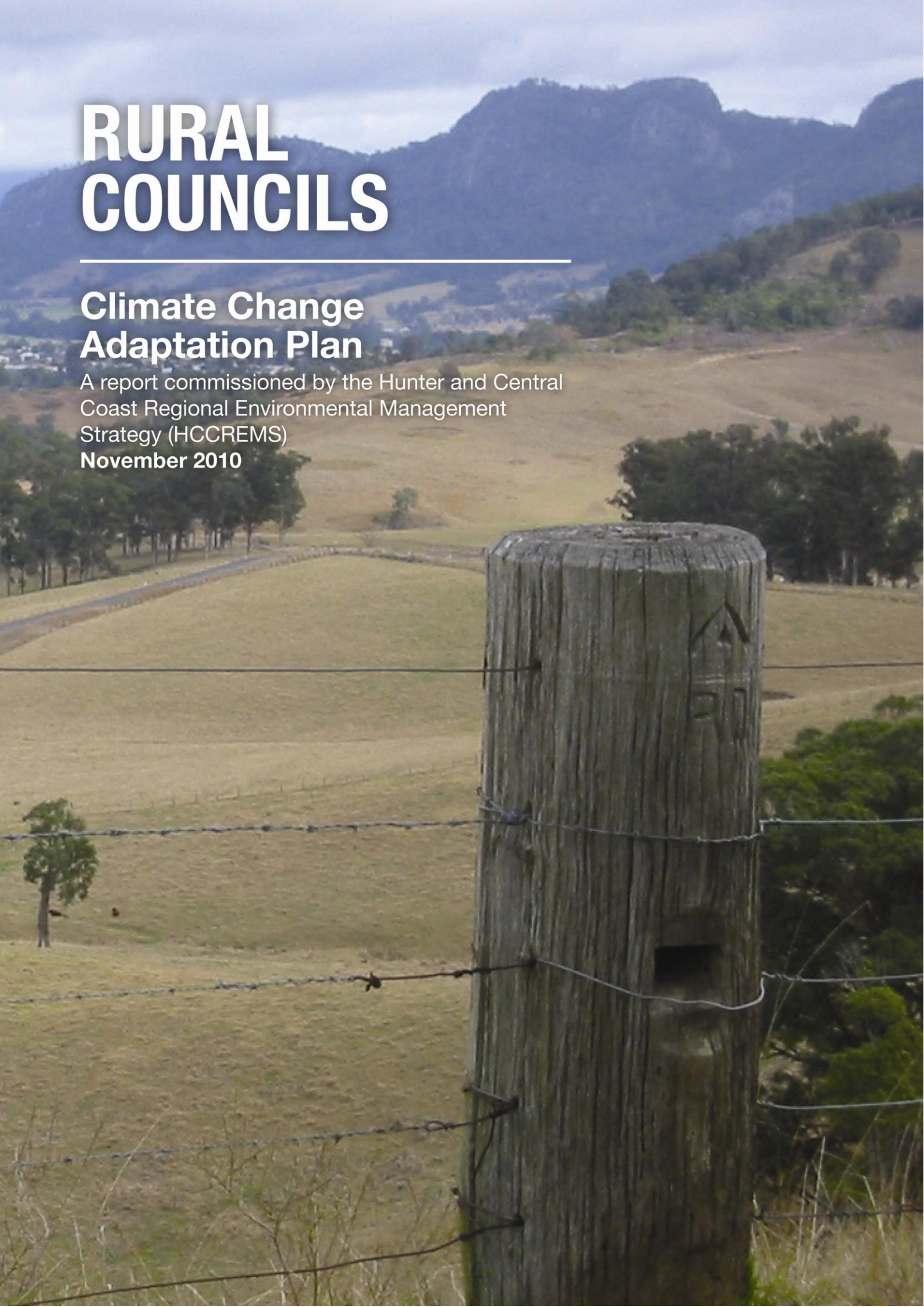


RURAL COUNCILS

Climate Change Adaptation Plan

A report commissioned by the Hunter and Central
Coast Regional Environmental Management
Strategy (HCCREMS)

November 2010



This report is delivered under the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS): a program of the Environment Division of Hunter Councils



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HCCREMS Rural Councils



TABLE OF CONTENTS

	Page
Executive Summary	i
1. Introduction	1
1.1.Climate Change Risk Assessment and Adaptation Planning by HCCREMS	1
1.2.Regional Analysis of Climate Change Impacts	1
1.3.Rural Councils' Climate Change Risk Assessments and Adaptation Plan	2
1.4.Report Outline	4
2. Risk Assessment and Review	5
2.1.Risk Assessment Process.....	5
2.2.Risk Review Process.....	6
3. Climate Change Adaptation	8
3.1.Climate Change Adaptation Defined	8
3.2.Principles and criteria underpinning recommended adaptation actions.....	9
3.3.Adaptation Planning Process	10
4. Adaptation Actions for Priority Risks	12
4.1.Overview.....	12
4.2.Protecting Infrastructure, Assets and Associated Services	16
4.3.Land Use Planning	33
4.4.Emergency Management and Corporate Services	37
4.5.Environmental Management and Protection	46
4.6.Economic Development	62
5. Conclusion	65
5.1.Risk Assessment and Adaptation Plan Review	65
5.2.Next Steps	67
References	71
Glossary	72
Appendix I: Climate Change Scenarios for Rural Councils	73

Executive Summary

INTRODUCTION

Climate change is emerging as a vital issue for Australian communities. Even with international action to reduce greenhouse gas emissions, the global climate is projected to undergo significant change in the 21st century, with the potential to create many risks as well as opportunities. It is important that the impacts of climate change are addressed at the local level, since local attributes including socio-economic characteristics and the physical environment will significantly determine the extent of the risks, as well as the nature of adaptation responses.

The need for local action on climate change has been recognised by Councils in the Hunter, Central and Lower North Coast region in partnership with the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS). Significant resources have been directed to improving Council and community understanding of climate change.

This is a report of actions that have been developed in response to the risks of climate change to HCCREMS member Rural Councils (Cessnock, Dungog, Gloucester, Greater Taree, Maitland, Muswellbrook, Singleton, Upper Hunter). In particular, the report builds on the adaptation actions identified by individual councils through identification of regional opportunities for collaboration across these councils for responding to climate change.

RISK ASSESSMENT PROCESS

Climate change risk assessments were completed for each of the eight Rural Councils in early to mid 2010. The purpose of each risk assessment was to explore the full range of potential risks posed by climate change to the relevant council and to prioritise those risks. The risk assessment process varied between Rural Councils, but all assessments were carried out using the method described in the AGO publication, *Climate Change Impacts and Risk Management: A Guide for Business and Government*¹, based on the Australian standard for Risk Management AS/NZS4360 (2004).

All of the roles and responsibilities of councils that may be affected by climate change were addressed through the assessments. These risk assessments focused on council organisational assets, operations and liabilities. They did not focus on broader scale community risk arising from climate change.

PRIORITY CLIMATE CHANGE RISKS

In total, the eight risk assessments identified dozens of climate change risks for each Rural Councils. While many of the risks are similar for some Councils, others are very specific to the particular Rural Council. In order to create a manageable list of risk manageable list of risks for carrying forward to the regional adaptation planning process, priority risks were developed. The principal basis for selecting priority risks is their overall risk rating. Generally, a risk has been classified as a priority risk if it has been rated as 'High' in the current period or medium term (2050) or 'Extreme' in the long term (2100) by a number of Rural councils.

Using this approach, a total of 22 priority risks were selected for assessment by rural councils at the adaptation workshops. The priority risks form the basis of this adaptation plan (see Table 4, section 4.1).

¹ Available at: <http://www.climatechange.gov.au/community/local-government/risk-management.aspx>

REGIONAL CLIMATE CHANGE ADAPTATION

Climate change adaptation can be defined as ‘actions taken in response to actual or anticipated climate change impacts that lead to a reduction in risks or realisation of benefits’ Adaptation represents a planned, proactive response to climate change and, as such, can be distinguished from reactive adjustments to climate change impacts after they have occurred.

Actions considered for this Adaptation Plan are broadly based, including revised strategies and plans, changes to regulations and standards, revised internal procedures, research and data collection, training, on-ground works and education.

If Rural Councils are to realise the potential benefits of climate change adaptation, it is important that their adaptation actions are well considered and designed prior to implementation. The following generic principles underpin adaptation actions proposed for the Council:

- focus on priority climate change issues;
- use an adaptive management approach (i.e. flexible, incremental changes);
- focus on cost effective actions;
- achieve balance between climate and non-climate risks; and
- avoid adaptation constraining decisions or maladaptation.

An additional, more specific principle, which underpins this Adaptation Plan, is a distinction between actions that Rural Councils can implement internally and actions with the opportunity for region wide collaborative action by councils and other key stakeholders. In this regard, this adaptation report specifically addresses risks that have been commonly identified by at least three of the rural councils.

The adaptation planning process for the Adaptation Plan centred on cross council workshops attended by staff from across HCCREMS member councils. The planning process entailed five major steps:

- i. priority risk selection;
- ii. grouping of priority risks into subsets to enable risks that have significant similarities to be considered collectively in the adaptation planning process;
- iii. identifying and reviewing existing controls;
- iv. identifying and assessing new and revised actions; and
- v. follow up analysis.

ADAPTATION ACTIONS FOR REGIONAL PRIORITY RISKS

Infrastructure and assets

Eight priority infrastructure and asset risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing those risks. The detailed adaptation actions are discussed in Section 4.

**Table ES.1 Infrastructure and Assets -
Priority Risks and Recommended Actions**

Priority Risks	Recommended Actions
Subset A – Council buildings and facilities	
<ul style="list-style-type: none"> ▪ Increased damage to council buildings and structures due to wind and storm damage ▪ Increased damage to council buildings and structures due to inundation 	<p>Region wide actions</p> <p>A1. HCCREMS Councils, in conjunction with the LGSA should approach the state government should clarify and simplify natural disaster relief declarations and funding arrangements</p> <p>A2. HCCREMS Councils, in conjunction with the LGSA should approach Statewide Mutual should provide consistent advice and application of insurance cover in relation to flooding</p> <p>A3. Guidelines should be developed that establish standard procedures for asset condition assessment and reporting by councils</p> <p>Council specific actions</p> <p>A4. Councils should review their asset bases and level of service requirements</p> <p>A5. Councils should review their asset maintenance and planning schedules</p> <p>(Councils identifying risk – Gloucester, Greater Taree, Muswellbrook, Singleton)</p>
Subset B – Stormwater	
<ul style="list-style-type: none"> ▪ Stormwater and drainage systems overwhelmed or damaged ▪ Stormwater treatment systems (biological or non-biological) overwhelmed 	<p>Region wide actions</p> <p>B1. HCCREMS Councils, with other agencies should model changes to extreme rainfall intensities</p> <p>B2. Regional guidelines should be developed for the design and management of new and upgraded drainage assets and for the retrofitting of existing assets</p> <p>B3. A region wide stormwater and professional capacity building program should be developed</p> <p>B4. HCCREMS and Councils should seek funding from federal and state governments to implement stormwater adaptation priorities.</p> <p>B5. HCCREMS and Councils should undertake a regional communications and information campaign on stormwater and flood management</p> <p>Council specific actions</p> <p>B6. Councils should revise local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling</p> <p>B7. Councils should revise stormwater and drainage technical engineering standards and development controls</p> <p>B8. Councils should prioritise upgrade of vulnerable stormwater assets at an LGA scale drawing on outputs of actions B1 and B7</p>

Priority Risks	Recommended Actions
----------------	---------------------

(Councils identifying risk - all)

Subset C – Transport infrastructure

- | | |
|--|---|
| <ul style="list-style-type: none"> ▪ Increased damage to roads (incl. gravel roads), causeways, bridges and footpaths due to increased rainfall intensity or flooding leads to higher maintenance costs | <p>Region wide actions</p> <ul style="list-style-type: none"> C1. Guidelines should be developed for incorporating climate change adaptation into design criteria for new roads and bridges C2. HCCREMS and Councils should seek to commission region wide modelling of changes to extreme rainfall intensities and duration and then review design criteria for new and upgraded roads and bridges based on the projections C3. See recommendation A1 C4. HCCREMS should establish a panel of key experts on regional transport research and programs C5. A region wide professional training / capacity building could be developed and implemented <p>Council specific actions</p> <ul style="list-style-type: none"> C6. Councils should revise their design and construction standards & forward works programs for transport infrastructure to incorporate outcomes from actions C1 and C2 C7. Councils should seek professional training on climate change and asset planning |
|--|---|

(Councils identifying risk - all)

Subset D – Water supply

- | | |
|---|--|
| <ul style="list-style-type: none"> ▪ Existing water supplies become unreliable | <p>Region wide actions</p> <ul style="list-style-type: none"> D1. Councils and state water authorities should consider funding modelling of down-scaled regional, climate change and associated hydrological projections D2. Councils and state water authorities should collaboratively review their drought management plans to take account of climate change projections/scenarios D3. Water authorities should collaborate in strengthening and promoting consistency across jurisdictions in regard to water demand management initiatives |
|---|--|

(Councils identifying risk – Singleton, Upper Hunter)

Subset E – Waste water treatment

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Flooding/ inundation of low lying waste water facilities ▪ Sewerage treatment system overloaded/fails due to intense rainfall / infiltration or loss of power | <p>Region wide actions</p> <ul style="list-style-type: none"> E1. HCCREMS Councils, with other agencies should undertake regional modelling of changes to extreme rainfall intensities under climate change scenarios; and use outputs of modelling to revise flood hazard mapping E2. Develop an analytical tool for prioritising key infrastructure treatments <p>Council specific actions</p> <ul style="list-style-type: none"> E3. Councils should identify and prioritise critical infrastructure exposed to flooding |
|--|--|

(Councils identifying risk – Muswellbrook, Singleton, Upper Hunter)

Land use planning

One priority land use planning risks is addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing that risk.

**Table ES.2 Land Use Planning -
Priority Risks and Recommended Actions**

Priority Risks	Recommended Actions
Subset F – Land use planning in flood prone areas	
<ul style="list-style-type: none"> ▪ Flood modelling and planning scheme fail to reflect the extent of inundation under climate change scenarios 	<p>Region wide actions</p> <ol style="list-style-type: none"> 1. HCCREMS Councils, with other agencies should model changes to extreme rainfall intensities to inform flood modelling 2. Drawing on output from F1, HCCREMS Councils, in conjunction with state government agencies should develop guidelines for integrating climate change projections into council flood modelling 3. Councils should undertake a regional communications and information campaign to advise the community on climate change impacts on flood modelling, management and planning processes (see also recommended action A5) <p>Council specific actions</p> <ol style="list-style-type: none"> 4. Councils should undertake site specific hydrological / flood modelling of local priority areas where the perceived risk is high and new flood management studies do not fully reflect region wide rainfall intensity projections <p>(Councils identifying risk – Cessnock, Dungog, Greater Taree, Upper Hunter)</p>

Emergency management and corporate services

Five priority emergency management and corporate services risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing these.

**Table ES.3 Emergency Management and Corporate Services -
Priority Risks and Recommended Actions**

Priority Risks	Recommended Actions
Subset G – Traffic management	
<ul style="list-style-type: none"> ▪ Increased flooding of low lying roads and other transport corridors leads to disruption to traffic ▪ Increased flooding of bridges (in particular timber bridges) and causeways leads to disruption to traffic 	<p>Region wide actions</p> <ol style="list-style-type: none"> G1. Councils, in conjunction with the RTA and regional emergency service agencies should update local and regional traffic plans to identify alternative transport options during extreme events G2. Councils, with the support of the RTA, should identify and upgrade vulnerable roads and bridges G3. Councils should undertake an education campaign to promote increased households' preparedness for floods and other emergencies <p>Council specific actions</p> <ol style="list-style-type: none"> G4. Drawing on outcomes from recommendation G2, Councils should identify adaptation strategies / works programs for key vulnerable local transport infrastructure

Priority Risks	Recommended Actions
(Councils identifying risk - all)	
Subset H – Emergency response and recovery	
<ul style="list-style-type: none"> ▪ Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN ▪ Council unable to meet demand for recovery services 	<p>Region wide actions</p> <p>H1. HCCREMS member councils and regional emergency service agencies should consider conducting emergency preparation exercises combining multiple events, multiple agencies and across zones</p> <p>H2. A review of existing emergency response frameworks and relationships should be conducted</p> <p>H3. A central access point for all regional information on emergency management procedures should be established</p> <p>H4. See recommended action A1.</p> <p>H5. Councils should consider training of staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN</p> <p>Council specific actions</p> <p>H6. See recommended action A5.</p> <p style="text-align: center;">(Councils identifying risk – Cessnock, Dungog, Greater Taree)</p>
Subset I – Business continuity	
<ul style="list-style-type: none"> ▪ Exhaustion of Council's capacity to deliver services due to staff responding to emergencies arising from extreme weather events 	<p>Region wide actions</p> <p>I1. See recommended action A1</p> <p>I2. Regional training, capacity building and implementation program to promote implementation of business continuity plans by councils.</p> <p>Council specific actions</p> <p>I3. Councils should develop and implement business continuity plans to provide strategies to follow in the event of crises.</p> <p style="text-align: center;">(Councils identifying risk – Cessnock, Dungog, Greater Taree)</p>

Environmental management

Six priority environmental management and protection risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing those risks.

Table ES.4 Environmental Management and Protection - Priority Risks and Recommended Actions

Priority Risks	Recommended Actions
Subset J – Pollution of waterways	
<ul style="list-style-type: none"> ▪ Increased pollution of waterways and estuaries ▪ Increased incidence of algal blooms in waterways and estuaries 	<p>Region wide actions</p> <p>J1. See Action D1</p> <p>J2. State, regional and local plans should be reviewed to reflect the potential impacts of climate change and to achieve greater consistency between state and local planning and environmental management objectives</p> <p>J3. A regional water quality monitoring strategy should be established</p> <p>J4. Regional modelling to identify water and nutrient runoff should be</p>

Priority Risks	Recommended Actions
	<p>undertaken</p> <p>Council specific actions</p> <p>J5. Councils should prepare and implement management strategies for high risk septic systems</p> <p>(Councils identifying risk - Cessnock, Dungog, Greater Taree, Maitland, Singleton, Upper Hunter)</p>
Subset K – Remnant vegetation	
<ul style="list-style-type: none"> ▪ Loss of remnant vegetation as a result of water and heat stress 	<p>Region wide actions</p> <p>K1. HCCREMS, in partnership with member councils, and relevant government agencies should commission research to identify potential impacts on endangered species and communities arising from climate change.</p> <p>K2. Drawing on outputs of action K1, HCCREMS should develop planning tools, facilitate education and assist councils to target conservation incentive programs</p> <p>Council specific actions</p> <p>K3. Councils should update planning tools and frameworks to improve conservation of regionally vulnerable ecosystems and target education and conservation incentive programs</p> <p>(Councils identifying risk – Cessnock, Singleton)</p>
Subset L – Pests and weeds	
<ul style="list-style-type: none"> ▪ Increased incidence of pests and weeds due to altered climate regime 	<p>Region wide actions</p> <p>L1. HCCREMS and regional weed management groups / authorities should commission research to identify projected changes in climate on likely future terrestrial weed distribution</p> <p>L2. Existing policies in the Hunter and Central Coast, and Lower North Coast Weed Management Strategies should be reviewed; a regional education strategy to raise community awareness of the issues / problems of climate change for regional weed distribution should also be implemented</p> <p>L3. HCCREMS member councils and the Hunter-Central Coast CMA should approach the NSW Livestock and Pest Authority to consider establishing a regionally coordinated approach to pest animal control</p> <p>(Councils identifying risk – Cessnock, Dungog)</p>
Subset M – Solid waste management	
<ul style="list-style-type: none"> ▪ CPRS or other carbon pricing instrument affects the operations of solid waste 	<p>Region wide actions</p> <p>M1. Rural Councils that are not currently members of MIDWASTE, should consider establishing a regional waste managers' network</p> <p>M2. MIDWASTE and the regional waste managers' network should undertake surveys to identify regional volumes of specific waste types as a basis for improving regional waste separation</p> <p>M3. The regional waste managers' network and MIDWASTE should lobby the Australian government to clarify local council reporting requirements under the NGER Act</p> <p>M4. The regional waste managers' network and MIDWASTE should consider developing an education campaign to raise community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees and the costs associated</p>

Priority Risks	Recommended Actions
	with illegal dumping.
	M5. The regional waste managers' network and MIDWASTE should investigate options by member councils to increase diversion of organic waste from landfills
	(Councils identifying risk – Dungog, Gloucester, Greater Taree, Maitland, Singleton, Upper Hunter)

Subset N – Energy management

<ul style="list-style-type: none"> ▪ CPRS or other carbon pricing instrument increases fuel and energy costs 	<p>Region wide actions</p> <p>N1. HCCREMS member councils, should seek funding for a regional energy and water efficiency and emissions reduction strategy</p> <p>Council specific actions</p> <p>N2. Councils should establish an assessment and implementation framework for proposed energy efficiency and emissions reduction programs</p> <p>(Councils identifying risk - Dungog, Muswellbrook, Singleton, Upper Hunter)</p>
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Economic development

Two priority economic development risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing those risks.

**Table ES.5 Economic Development -
Priority Risks and Recommended Actions**

Priority Risks	Recommended Actions
Subset O – Viability of mining	
<ul style="list-style-type: none"> ▪ Decline in viability of regional mining sector linked to climate change policy 	<p>Region wide actions</p> <p>O1. Implement strategies developed by the Upper Hunter Diversification Project</p>
Subset P – Viability of agriculture	
<ul style="list-style-type: none"> ▪ Decline in viability of regional agricultural sector linked to changed climate 	<p>Region wide actions</p> <p>P1. Undertake agricultural industry and climate change case studies</p> <p>P2. Prepare a Regionally Significant Agricultural Lands Map</p> <p>P3. Seek funding from State Government for regional projects to demonstrate low carbon agricultural practices</p>

CONCLUSION

Risk assessment and adaptation plan review

Climate change poses a number of challenges for Rural Councils. Twenty two priority climate change risks are addressed in this adaptation plan including eight risks to infrastructure and assets, one to land use planning, five to emergency management and

corporate services, six to environmental management and protection and two to economic development.

Section 4 of this report contains 57 actions for addressing the priority risks. When implemented together, the actions will provide Rural Councils with an initial response to the challenges of climate change.

A review of proposed actions reveals:

- the wide spectrum of action types;
- the need to improve vertical and horizontal integration within councils, between councils, and between councils and other stakeholder organisations in order to effectively respond to climate change; and
- the substantial numbers of actions in the community education, research and training categories, highlighting the need to build knowledge and understanding of climate change in the region and to enhance the capacity of councils, other agencies and the broader community to respond effectively to the risks posed by climate change

Next steps

It is unlikely that any severe risks have been overlooked or that risks have been seriously misrated during the local and regional risk assessment processes. Nevertheless, it is important that the local and regional scale risks that have been identified are reviewed on a regular basis. This will ensure that the relative importance of these risks remains accurate so that adaptation responses are effectively and efficiently addressing those risks of most importance. Councils should also maintain a ‘watching brief’ on non-priority risks as part of the review process.

As has been identified within the individual risk and adaptation reports prepared for each rural council, it is important that the outcomes of the local and regional risk assessment processes are integrated with other aspects of council strategic risk assessment and planning. To that end, the following recommendations are made in relation to the next steps of implementation for rural councils:

1. Establishment of a regional technical reference group co-ordinated by HCCREMS to oversee prioritisation, implementation and evaluation of regional adaptation actions identified for Rural Councils
2. Engagement of key external stakeholders identified in the regional plan to encourage their participation and support in implementing the regional adaptation actions that have been identified.
3. The regional adaptation plan should be reviewed on a regular basis (e.g. every 5 years), including a review of all risk ratings and consideration of new climate change risks in the light of new scientific information and changing circumstances in the region.
4. A regional approach to communicating the outcomes of climate change risk assessment should be developed to ensure that the community is properly informed in a timely manner and does not misinterpret, understate or over state, the risks of climate change to the region.

1. Introduction

“... adaptation is crucial to deal with the unavoidable impacts of climate change to which the world is already committed” (Stern, 2006).

“... the benefits from mitigation occur on a global scale, whereas adaptation generally results in localised benefits” (Cimato & Mullan, 2010).

“Adaptation to climate change is likely to benefit from experience gained in reaction to extreme climate events, by specifically implementing proactive climate change risk management adaptation plans” (IPCC, 2007).

1.1. Climate Change Risk Assessment and Adaptation Planning by HCCREMS

Climate change is emerging as a vital issue for Australian communities. Even with international action to reduce greenhouse gas emissions, the global climate is projected to undergo significant change in the 21st century, with the potential to create many risks as well as opportunities. It is important that the impacts of climate change are addressed at the local level, since local attributes including socio-economic characteristics and the physical environment will significantly determine the extent of the risks, as well as the nature of adaptation responses.

The need for local action on climate change has been recognised by councils in the Hunter, Central & Lower North Coast region in partnership with the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS). Significant resources have been directed to improving councils’ and communities’ understanding of climate change.

This report is part of a region wide project that aims to assist HCCREMS member councils to assess and manage climate risks both individually and collaboratively across the region. The project has comprised three major steps:

- The first step consisted of a region wide analysis of climate change impacts (presented in a region wide report).
- The second step consisted of climate change risk assessments conducted separately for each council.
- The third step (detailed in part in this report), involved identifying high priority risks to ‘rural’ and ‘coastal’ councils in the Hunter and Central Coast region and developing, in turn, local and region wide adaptation actions for the two groups of councils.

The project has been funded by the Commonwealth Government through the Local Adaptation Pathways Program (LAPP) and through the NSW Environmental Trust. It builds upon individual council risk assessments that were undertaken through LAPP or had previously been completed through Statewide Mutual.

1.2. Regional Analysis of Climate Change Impacts

As a preceding step to the risk assessments and the adaptation planning, the report *‘Impacts of Climate Change on the Hunter, Central and Lower North Coast of NSW’* has been prepared. This report provides background information on potential climate change impacts in the region that can be used to help HCCREMS and Councils to likely impacts of climate change and resulting risk, and to assist them in the adaptation planning process.

Exposure and sensitivity information is presented in relation to five major climate change variables or hazards:

- coastal inundation and recession associated with sea level rise and storm surges;
- extreme rainfall, flooding and storms;
- changes to fire weather conditions;
- changes to average rainfall and water availability; and
- changes to average and extreme temperatures.

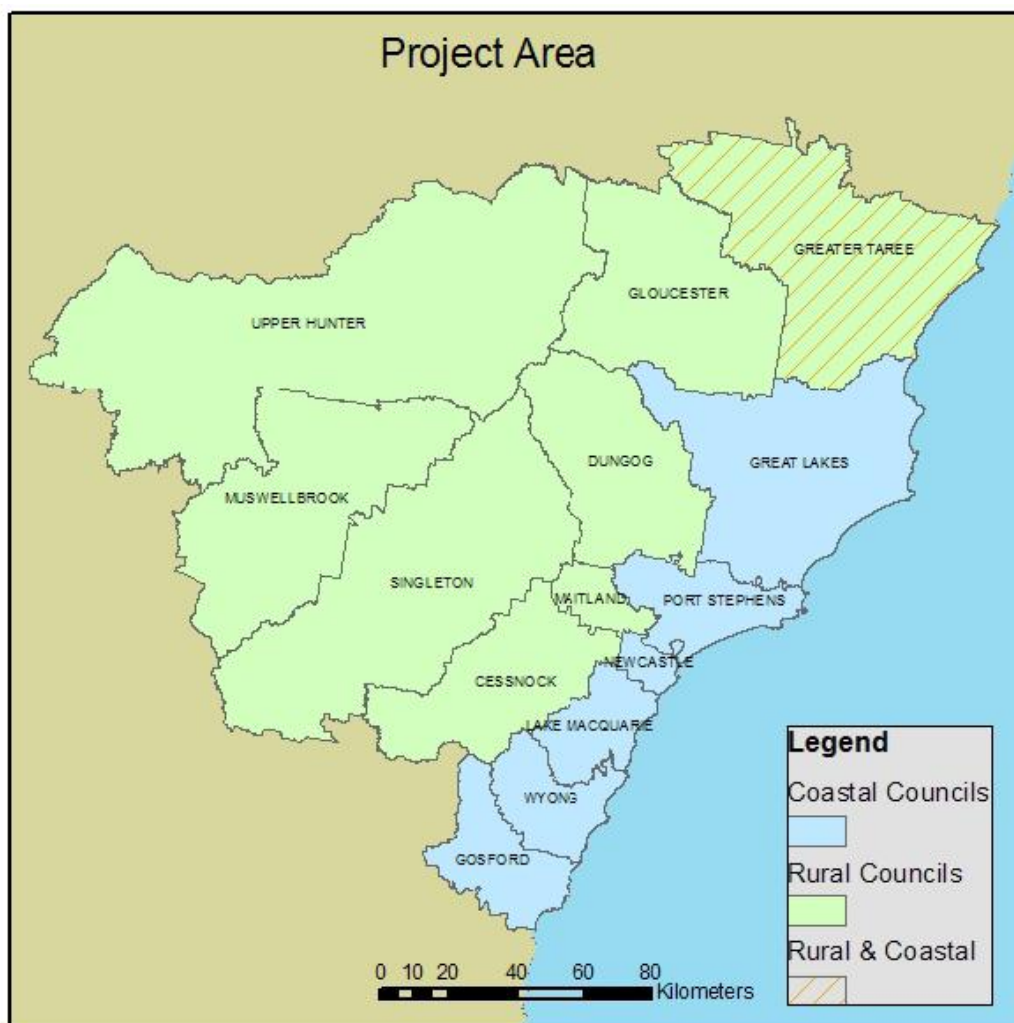
The report then provides an overview of potential impacts that exposed and sensitive communities and systems could face as a consequence of the relevant climate change variable.

1.3. Rural Councils' Climate Change Risk Assessments and Adaptation Plan

This report details actions that have been developed in response to high priority climate change risks to HCCREMS member Rural Councils. In particular, it focuses on regional scale risks and opportunities for collaborative action by councils and other stakeholders to manage these risks. The report should also be read in conjunction with risk assessment and adaptation plan reports produced for individual Rural Councils and an '*Adaptation Plan for Coastal Councils*' report. Councils covered in this plan include the Rural Councils of Cessnock, Dungog, Gloucester, Greater Taree², Maitland, Muswellbrook, Singleton and Upper Hunter (referred to hereafter as 'Rural Councils' - see Figure 1).

² Greater Taree has been classified as both a 'coastal' and 'rural' council.

Figure 1: Project Area Indicating 'Coastal' and 'Rural' Councils



The selection of priority risks addressed in this report was based on a number of criteria, notably their initial risk rating and also the regional significance of the risks. The rationale for this focus is that, given resource constraints, Councils' climate change response efforts are best targeted in the short term at issues that matter most to it. Nevertheless, risks that are not addressed in the adaptation plan should not be ignored by Rural Councils or other agencies, a point discussed later in this report. Also underpinning this rationale is recognition that the capacity of each rural council will be enhanced through collaborative action. Particular benefits arising to councils include:

1. Sharing of costs and resources to deliver identified adaptation responses
2. Greater consistency in adaptation responses being implemented by councils. This provides greater certainty to the community, and can assist in reducing legal and liability risks to individual councils
3. Greater capacity to attract external stakeholders and funding to assist with the implementation of adaptation responses

Notwithstanding the collaborative regional basis for actions proposed in the Adaptation Plan, it is acknowledged that implementing all of the actions in the plan will be likely to require significant resources by individual Rural Councils. For this reason, a process to prioritise adaptation actions is strongly recommended (see section 5.2.2).

Response actions proposed in this plan are broad ranging and include research and evaluation, communication and education, changes to councils' assessment and decision making practices, as well as numerous actions benefiting from or requiring a coordinated regional response with other agencies. Nevertheless, the actions should only be viewed as initial steps in Rural Councils' climate change response program. Thus the plan should be reviewed on a regular basis (e.g. every five years – see section 5.2).

1.4. Report Outline

The remaining sections of the Climate Change Adaptation Plan are as follows:

Section 2 details the framework and approach that was applied to identify high priority risks for Rural Councils.

Section 3 discusses the concept of climate change adaptation, outlines principles underpinning adaptation actions proposed in the report and the process that was used to identify them.

Section 4 reviews current policies, programs and measures relevant to the Council's priority risks and recommends new adaptation planning measures for Council and other regional agencies.

Finally, section 5 provides general conclusions and recommendations on next steps.

2. Risk Assessment and Review

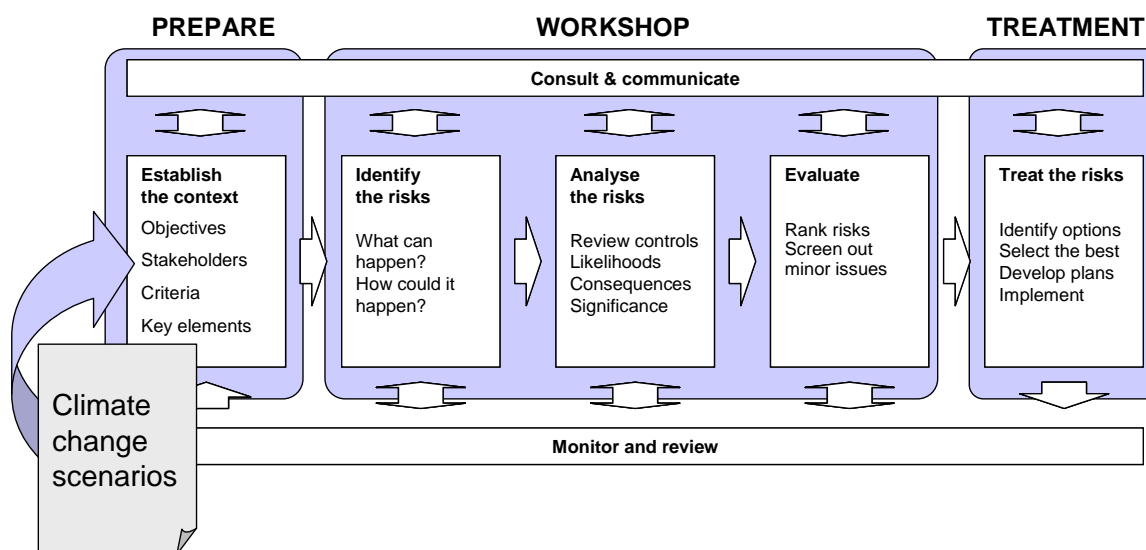
2.1. Risk Assessment Process

Climate change risk assessments were completed for each of the eight Rural Councils. The purpose of each risk assessment was to explore the potential risks posed by climate change to the relevant council and to prioritise those risks. The scope of each risk assessment addressed the full range of a council's operations and service delivery including:

- infrastructure and assets;
- land use planning;
- emergency management;
- community services;
- environmental protection;
- economic development; and
- corporate services.

All risk assessments were undertaken using a qualitative risk evaluation framework that closely follows the Australian and International Standard AS/NZS ISO 31000:2009 and a process established in the report *Climate Change Impacts and Risk Management: A Guide for Business and Government*³ (Figure 2).

Figure 2: Risk assessment process steps



The rating scales that were used to evaluate risks are substantially the same for all eight Rural Councils, that is:

- a scale to describe the likelihood of experiencing that level of consequence;
- a scale to describe the level of consequence of a risk, if it should happen⁴; and

³ Available at: <http://www.climatechange.gov.au/community/local-government/risk-management.aspx>

⁴ There were some small differences in criteria and weightings of the consequences scales between councils, reflecting differences in councils' operations and budgets.

- a scale to assign a priority rating to each risk, given its consequences and likelihood (Table 1 and Table 2).

Table 1. Priority Rating

Likelihood	Consequences				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (A)	Medium	High	High	Extreme	Extreme
Likely (B)	Medium	Medium	High	High	Extreme
Possible (C)	Low	Medium	High	High	High
Unlikely (D)	Low	Low	Medium	Medium	High
Rare (E)	Low	Low	Medium	Medium	High

Table 2. Priority Interpretation

Priority	Interpretation
Extreme	Immediate action required and formal risk management plans will be prepared
High	Senior management attention needed and formal risk management plans will be prepared
Medium	Management responsibility must be specified and risk management tasks integrated with general plans
Low	Manage by routine procedures with no additional tasks or changes to routine procedures

The climate change scenarios that were used to inform the risk assessments were also broadly similar between the Councils (see Appendix 1).

Overall therefore, the approach that was used to assess the risks of climate change was very consistent between the eight Rural Councils, although there were some small differences in detail.

2.2. Risk Review Process

In total, the eight risk assessments identified approximately 60 climate change risks to Rural Councils. The significant number of risks necessitated the use of a bridging step to obtain a regionally consistent and manageable list of regional ‘priority risks’ for carrying forward to the adaptation planning process. This was done via a review and rationalisation process that involved three main steps:

1. **Identify risks rated ‘High’ or ‘Extreme’.** Risks that are rated ‘High’ in the ‘current period’ or ‘medium term’ (2050) or ‘Extreme’ in any time period in each of the individual Rural Councils’ risk assessments were identified from the Rural Councils’ risk registers.
2. **Group risks into subsets.** Risks in the ‘High’ and ‘Extreme’ list were grouped into subsets of one or more risks; the basis for these groupings is that risks in a subset have significant commonality in terms of their nature and drivers.
3. **Select regionally significant risk subsets and group into categories.** Risk subsets were then selected as ‘priority risk’ subsets if at least three rural councils had given one or more risks in

the subset a rating of ‘High’ or ‘Extreme’⁵. Priority risk subsets were then further grouped under broad council functions, namely:

- ***Infrastructure and assets***
subsets:
 - *buildings & facilities*
 - *stormwater*
 - *transport infrastructure*
 - *traffic management*
 - *water supply*
 - *waste water treatment*
- ***land use planning***
subset:
 - *flood modelling*
- ***emergency management and community wellbeing***
subsets:
 - *emergency management*
 - *business continuity*
 - *community anxiety and stress*
- ***environmental management and protection***
subsets:
 - *waterways*
 - *remnant vegetation*
 - *pests & weeds*
 - *solid waste management*
 - *energy management*
- ***economic development***
subsets:
 - *viability of mining*
 - *viability of agriculture and tourism.*

Based on the process outlined above, a manageable list of 22 priority risks in 17 subsets was developed. They form the basis of the rural councils’ adaptation plan (see Table 4, section 4.1).

It is important to note that the risk assessment focused on council operations, assets and liability. It did not focus on broader scale community risks.

⁵ Exceptions to this rule were the ‘water supply’ and ‘environmental protection’ subsets which required a ‘High’ or ‘Extreme’ rating of only two rural councils. In the case of water supply, this reflects the fact that only half of the councils have responsibility for water supply. In the case of environmental protection, this reflects the high level of uncertainty pertaining to councils’ role in environmental protection, as identified in individual risk assessments.

3. Climate Change Adaptation

3.1. Climate Change Adaptation Defined

There is no universally agreed definition of climate change adaptation. For the purpose of this Action Plan however, climate change adaptation can be defined as ‘actions taken in response to actual or anticipated climate change impacts that lead to a reduction in risks or realisation of benefits’⁶. Adaptation represents a planned, proactive response to climate change and, as such, can be distinguished from reactive adjustments to climate change impacts after they have occurred.

Actions in this Adaptation Plan have been defined to include any policy, program or measure that, once implemented, will work to reduce the financial, social or environmental costs stemming from a climate change impact, either:

- directly, by reducing the magnitude or likelihood of an impact occurring - i.e. by reducing the risk; or
- indirectly, by increasing the capacity of vulnerability communities and systems to respond to an impact should it occur - i.e. by enhancing adaptive capacity.

As outlined in Table 3, actions considered for this Adaptation Plan are broadly based, including changes to institutional and management frameworks, revised strategies and plans, changes to regulations and standards, revised internal procedures, research and data collection, on the ground works and education. Actions have been tailored to specifically address the risks that were rated ‘High’ or ‘Extreme’ by Rural Councils in their climate change risk assessments (see previous chapter).

⁶ This is an abridged version of a definition provided by the IPCC (Parry et al. 2007).

Table 3: Types of Adaptation Measures Considered for the Adaptation Plan

Control category	Description and examples
Coordinated, regional approach	Coordinated, regional approaches to managing an issue: <ul style="list-style-type: none"> - Regional institution or organisation - Regional alliance or network - Shared regional framework or approach
Strategies and plans	Local strategies and plans: <ul style="list-style-type: none"> - Strategic plans - Management plans
Regulations / standards	Regulations, standards and statutory planning frameworks: <ul style="list-style-type: none"> - Local planning schemes - Building design standards - Planning provisions that prevent new infrastructure from being built in high risk areas - Council by-laws
Internal procedures	Practices and procedures at an organisational level: <ul style="list-style-type: none"> - Improve decision making processes - HR management practices - OH&S practices
Data collection / information / research	Information / data collection or research that improves understanding of relationship between climate change and risk: <ul style="list-style-type: none"> - Research on relationship between past and potential future variations in climate and performance of economic, social and environmental systems - Research on relationship between changes to frequency and magnitude of extreme events and critical thresholds - Assessment of adaptation options
Structural or 'on-ground' works	Engineering solutions and practices: <ul style="list-style-type: none"> - Infrastructure protection measures - Inherent design of infrastructure maximises resilience - Environmental protection or remediation works - Energy / water efficient design
Education, behavioural	Educate and inform community about climate change risks and adaptation measures Educate community about approaches to and benefits of changing behaviour
Spread or displace risk	Insurance and diversification strategies: <ul style="list-style-type: none"> - Use of insurance products to off-lay the risk - Risks shared between different agencies / entities - Geographical diversification (e.g. of raw materials)

3.2. Principles and criteria underpinning recommended adaptation actions

3.2.1. Generic principles

If Rural Councils are to realise the potential benefits of climate change adaptation, it is important that their adaptation actions are well considered and designed prior to implementation. This means that actions should be consistent with relevant government legislation, policies and guidelines.

As well, generic principles of good practice climate adaptation have been established in the climate change literature over recent years. In the process of producing this Adaptation Plan, efforts have been made to ensure those principles are adhered to. Principles include:

1. **Focus on priority climate change issues.** Rural Councils' climate change risk assessments have provided them with a process for identifying and prioritising climate change issues. As discussed in section 2.2, the Action Plan focuses on a defined list of priority risks, ensuring that it is targeted at the issues most important to Rural Councils.
2. **Use an adaptive management approach.** Adaptive management is an important strategy for dealing with climate change uncertainties. It is the process of putting into place small, flexible, incremental changes based on regular monitoring and revision of plans using information available at the time rather than relying on new, large-scale measures. At a general level, this Rural Councils' adaptation plan incorporates the principle of adaptive management, since it largely builds on existing measures and has a strong focus on improving information and decision making processes.
3. **Focus on cost effective actions.** It is important that Rural Councils have a clear understanding of the costs and benefits and likely effectiveness of alternative adaptation options. To that end, an initial qualitative assessment has been undertaken of the effectiveness and costs of current and proposed new adaptation actions (see section 3.3). As discussed further in section 5.2 though, more detailed assessment of many of the measures in this Action Plan is likely to be required.
4. **Achieve balance between climate and non-climate risks.** Implementing a climate change adaptation Action Plan is not itself risk free. Rural Councils need to take a balanced approach to managing climate and non-climate risks. This is best achieved by each Council integrating its climate change risk assessment with its broader risk management processes. Priority should also be given to actions that have 'win-win' outcomes, i.e. they will have additional benefits to Rural Councils or the local community beyond climate change adaptation.
5. **Avoid adaptation constraining decisions or maladaptation.** Actions in this adaptation plan should not lead to the perverse outcome of constraining the ability of the Councils and local communities to adapt to climate change in the future. Other decisions of Rural Councils should also follow this principle.

3.2.2. Distinguish between 'Internal' and 'Region Wide' Actions

An additional, more specific principle, which underpins this Action Plan, is a distinction between actions that Rural Councils can implement internally and actions that will benefit from or require a region wide approach. In distinguishing between the two classes of action, it is important to note that Rural Councils, where feasible, should move to expedite implementation of internal actions (subject to meeting the generic principles discussed above), whereas region wide actions will require extensive dialogue and coordination with other councils and agencies. It is noted however, that for a number of actions, local council responses will require preceding rural actions to be completed.

3.3. Adaptation Planning Process

The adaptation planning process centred on workshops with staff of HCCREMS member Rural Councils. The process entailed five major steps, with steps 1 and 2 being undertaken prior to the workshops, steps 3 and 4 being completed at the workshops and step 5 following the workshops:

1. **Priority risk selection.** As discussed in section 2.2, the principal basis for selecting priority risks was their overall risk rating. Generally, a risk has been classified as a priority risk if it has been rated as 'High' or 'Extreme' by a number of Rural Councils. Using this approach, a total of 22 priority risks were selected for assessment by Rural Councils at the adaptation workshops. Those 22 priority risks are addressed in this Adaptation Plan (Table 4).

2. **Priority risk categories and subsets.** Priority risks were grouped into categories and subsets (see Table 4). The purpose of the grouping was to enable risks that have significant similarities (and likely therefore to require common adaptation responses) to be considered collectively in the adaptation planning process.
3. **Identification and review of existing controls.** Existing controls (policies, programs and measures) relevant to each priority risk subset were identified and then reviewed against a range of criteria, such as effectiveness, resourcing and flexibility, with the purpose of establishing where there are significant gaps or deficiencies with current controls.
4. **New and revised actions.** For each priority risk subset, actions necessary to overcoming gaps or deficiencies were identified. Both region wide actions and Council specific actions were identified. Noting the adaptation principles discussed in section 3.2, an initial assessment of the actions was undertaken against a range of criteria such as timeframe for implementation, budgetary implications, Councils' roles vis-à-vis other agencies and barriers to implementation.
5. **Follow up analysis.** The outputs have been refined and consolidated into climate change adaptation actions that are presented in the next section.

4. Adaptation Actions for Priority Risks

4.1. Overview

This section presents a review of existing controls and outlines recommended actions to deal with priority climate change risks to Rural Councils. As discussed in section 3.3, the full suite of risks identified through the risk assessment has been prioritised for adaptation planning. Risks rated 'High' or 'Extreme' by at least three Rural Councils (at least two Councils in the case of water supply and environmental protection risks) have been taken forward for adaptation planning. Priority risks addressed include:

- risks to infrastructure and associated services;
- risks to land use planning and management;
- risks to emergency management and corporate services;
- risks to environmental management and protection; and
- risks to economic development.

Table 10 details all priority risks considered for Rural Councils. In order to undertake efficient adaptation planning for the priority risks, the risks have also been grouped into alphabetically-numbered subsets. The purpose of the grouping was to enable risks that are closely related and likely therefore to require common adaptation responses to be considered collectively in the adaptation planning process.

Adaptation actions proposed for the priority risk subsets are detailed in sections 4.2 to 4.6.

In summary, 57 recommendations have been made for actions to address the risks of climate change to Rural Councils. Many of the actions (27) focus on research and information collection, community education or training, reflecting a need to improve understanding of the risks or potential adaptation responses. Other significant areas of proposed action include revised or new strategies and plans, improved decision making processes and increased funding (principally for on-ground works).

Approximately two thirds of all recommended actions (39) focus on region wide initiatives, an approach that will increase prospects for efficient and cost effective outcomes. The other third of actions are directed specifically at individual Rural Councils, although each council will also benefit from engaging with other councils and agencies to ensure effective implementation of these actions.

Indicative timeframes for implementation of recommended actions in the Adaptation Plan are:

- short term: 1-2 years;
- medium term: 2-5 years; and
- long term: more than 5 years.

Table 4. Priority risks addressed in the Adaptation Plan (clustered into categories and subsets)

Category / subset	Risk No.	Risk	Councils that rated risk as 'High' or 'Extreme'							
			Cessnock	Dungog	Glouces-ter	Greater Taree	Maitland	Muswell-brook	Single- ton	Upper Hunter
Infrastructure										
Subset A Council buildings & facilities	1	Increased damage to council buildings and structures due to wind and storm damage				✓		✓	✓	
	2	Increased damage to or destruction of council buildings and structures due to inundation			✓	✓		✓	✓	
Subset B Stormwater	3	Stormwater drains frequently overwhelmed or damaged	✓	✓	✓	✓	✓	✓	✓	✓
	4	Stormwater treatment systems (biological or non-biological), e.g. detention basins, overwhelmed							✓	✓
Subset C Transport infrastructure maintenance	5	Increased damage to roads (incl. gravel roads), causeways, bridges and footpaths, due to increased rainfall intensity and flooding, leads to higher maintenance costs	✓	✓	✓	✓	✓	✓	✓	✓
Subset D Water supply	6	Existing water supplies become unreliable							✓	✓
Subset E Waste water treatment	7	Flooding of low lying waste water facilities						✓	✓	
	8	Sewerage treatment system overloaded due to intense rainfall or loss of power						✓		✓
Land Use Planning										
Subset F Flood modelling	9	Flood modelling and planning scheme fail to reflect the extent of inundation under climate change scenarios	✓	✓		✓				✓

Category / subset	Risk No.	Risk	Councils that rated risk as 'High' or 'Extreme'							
			Cessnock	Dungog	Gloucester	Greater Taree	Maitland	Muswellbrook	Singleton	Upper Hunter
Emergency management and corporate services										
Subset G Traffic management	10	Increased flooding of low lying roads and other transport corridors leads to disruption to traffic	✓	✓	✓	✓	✓	✓	✓	
	11	Increased flooding of bridges (in particular timber bridges) and causeways leads to disruption to traffic		✓		✓	✓	✓	✓	✓
Subset H Emergency management	12	Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN	✓	✓		✓				
	13	Council unable to meet demand for recovery services	✓			✓				
Subset I Business continuity	14	Exhaustion of Council's capacity to deliver services due to staff responding to emergencies arising from extreme weather events	✓	✓		✓				
Environmental management & protection										
Subset J Water quality	15	Increased pollution and silting of waterways, estuaries and groundwater due to storms and flooding, as well as pollution through leachate from waste facilities, septic tanks other sewage systems	✓	✓		✓			✓	✓
	16	Increased incidence of algal blooms in waterways and estuaries					✓		✓	
Subset K Remnant	17	Loss of remnant vegetation and habitat as a result of water and heat stress	✓						✓	

Category / subset	Risk No.	Risk	Councils that rated risk as 'High' or 'Extreme'							
			Cessnock	Dungog	Glouces-ter	Greater Taree	Maitland	Muswell-brook	Single- ton	Upper Hunter
vegetation										
Subset L Pests & weeds	18	Increased incidence of pests and weeds due to altered climate regime	✓	✓						
Subset M Solid waste management	19	CPRS or other carbon pricing instrument affects the operations of solid waste and/or waste water facilities		✓	✓	✓	✓		✓	✓
Subset N Energy management	20	CPRS or other carbon pricing instrument increases fuel and energy costs		✓	✓		✓			✓
Economic Development										
Subset O Viability of mining	21	Decline in viability of regional mining sector linked to climate change policies						✓	✓	✓
Subset P Viability of agriculture & tourism	22	Decline in viability of regional agricultural sector linked to changed climate		✓				✓	✓	✓

4.2. Protecting Infrastructure, Assets and Associated Services

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority infrastructure risks. Priority risks addressed in this section are:

- Subset A: Increased damage to council buildings and structures due to wind and storm damage (risk 1); Increased damage to or destruction of council buildings and structures due to inundation (risk 2).
- Subset B: Stormwater and drainage systems overwhelmed or damaged (risk 3); Stormwater treatment systems (biological or non-biological) overwhelmed (risk 4).
- Subset C: Increased damage to roads (incl. gravel roads), causeways, bridges and footpaths, due to increased rainfall intensity and flooding, leads to higher maintenance costs (risk 5).
- Subset D: Existing water supplies become unreliable (risk 6).
- Subset E: Flooding/ inundation of low lying waste water facilities (risk 7); and Sewerage treatment system overloaded/fails due to intense rainfall / infiltration or loss of power (risk 8)

4.2.1. Damage to council buildings and structures due to inundation and storms

Subset A Buildings	<p>Increased damage to council buildings and structures due to wind and storm damage (risk 1)</p> <p>Increased damage to or destruction of council buildings and structures due to inundation (risk 2)</p>
Focus	All council owned and operated buildings and facilities, particularly assets located in flood prone areas and older buildings and structures.
Councils identifying risk	Gloucester, Greater Taree, Muswellbrook, Singleton
Context	<p>To varying degrees, Rural Councils have major assets located in flood prone areas including recreation and entertainment centres, administration centres and community halls. These have been affected by floods as recently as 2007, resulting in substantial costs to councils. A few councils also have assets located in bushfire prone areas, although these tend to be less substantial. Older buildings owned by councils, such as community halls, are also frequently affected by wind and storm events.</p> <p>Projections of an increase in the frequency and magnitude of extreme rainfall events and storms point to greater exposure of these facilities to flooding and storm damage in the future.</p>
Existing controls	<p>Asset management</p> <p>Councils have implemented a range of measures aimed at maintaining or improving the condition and structural integrity of assets in the face of storms, floods and other climate related impacts. Measures include:</p> <ul style="list-style-type: none"> ▪ condition assessment reports and an assets maintenance program to

prioritise maintenance work and ensure that established buildings and other assets are kept serviceable and safe over the long term;

- structural integrity certification to ensure the structural integrity of buildings in flood prone land and from storms and hail; and
- Asset Management Plans to assess risks to council assets and plan for new, improved or upgraded or community facilities when existing facilities have passed their useful life and /or to improve service levels – new buildings generally are required to meet the Australian Building Code (Building Council of Australia), which establishes minimum design requirements including for the protection from wind, storm and flood damage.

Flood planning management

Councils have in place Development Control Plans that generally include Floodplain development provisions, applied through Floodplain Management Plans. The provisions generally (although not always) apply to areas subject to a 100 ARI flood. Most Rural Councils have undertaken flood hazard mapping as part of their Floodplain Management Plans in accordance with the NSW Floodplain Development Manual. The mapping identifies Council buildings and facilities that are located in flood prone land. New buildings and facilities in flood prone land are subject to the same principles and codes as private developments.

In some cases, flood mitigation works have also been implemented to protect infrastructure.

Minimising the costs of impacts

Councils also have access to measures that can have the effect of reducing costs of storm and flood damage to its infrastructure. They include:

- insurance (covers storm, hail and fire damage but not flooding); and
- the Natural Disaster Relief Fund (NDRF), funded through the NSW Department of Commerce, which assists with emergency response costs and with cost recovery for uninsured items.

Regional responses and networking

Extreme storms and floods experienced in the region during 2007 have provided rural councils with a clearer understanding of the potential nature and extent of damage caused by such events. Considerable reflection on these events and their impact on council facilities, and networking to share this knowledge has been completed by councils across the region. This networking should assist with future regional responses to the issue.

Gaps and deficiencies

Asset management

Existing asset management programs generally provide a sound basis for asset planning and prioritising maintenance. Nevertheless, councils often confront significant shortfalls in funding and staff resources for asset maintenance and replacement – meaning that there is generally a gap

between what needs to be done and what can be done. The gap has worsened in recent years due to an ageing asset base, increasing community expectations on service delivery and cost shifting – councils taking on responsibility of managing assets previously managed by the community or crown land assets that had been the responsibility of other agencies. Rate capping restricts the capacity of some councils to respond to the shortfalls. In other words, councils are becoming increasingly ‘asset rich’ but ‘income poor’. Increased frequency and intensity of storm and/or flood damage will likely exacerbate this situation.

Minimising the costs of impacts

There are significant anomalies with administration of the NDRF as it is currently structured. Anomalies include:

- administrators of the fund being reluctant to fund response and recovery works by council staff work during normal working hours (but prepared to fund similar work by contractors); and
- a lag of a year or more between councils’ expenditure on response and recovery works (potentially millions of dollars) and reimbursement through the Fund.

As previously noted insurance does not cover damage from flooding or damage due to shifting foundations. Confusion over what constitutes ‘storm damage’ and what constitutes ‘flood damage’ exacerbates this problem.

Recommended region wide actions

Action A1 Clarified and simplified natural disaster declarations and relief funding

HCCREMS member councils, in conjunction with LGSA, should collectively approach / lobby the state government to ensure:

- clarified and simplified natural disaster declarations and relief funding arrangements from a central body;
- a more consistent and prompt payment schedule for natural disaster relief funding;
- council works (undertaken by council staff) are included in natural disaster relief funding;
- definitions of natural disasters and eligibility are clarified and take account of the changing climate.

This action can be implemented in the short term⁷ and should have only minor budgetary implications⁸ for councils.

(This action is also relevant to Risk Subsets C, H and I)

⁷ Indicative timeframes in the Adaptation Plan are: short term, 1-2 years; medium term, 2-5 years; long term > 5 years.

⁸ Indicative costs in the Adaptation Plan are: low, <\$50,000 p.a.; moderate \$100,000 – 250,000 p.a.; major >\$250,000 p.a.

Action A2 Consistent application of insurance cover

HCCREMS member councils, in conjunction with the LGSA, should approach / lobby Statewide Mutual to:

- clarify (for the purpose of insurance cover) the distinction between over flood and storm damage; and
- seek consistent application of insurance cover in relation to flooding.

This action can also be implemented in the short term and should have only minor budgetary implications for councils.

Action A3 Asset planning guidelines

HCCREMS member councils should approach and work with the Department of Local Government to develop guidelines that establish standard procedures for asset condition assessment and reporting by councils. The guidelines would cover:

- an assets register;
- asset condition standards;
- an audit process and hierarchy; and
- decision making on maintenance, upgrades and rationalisation, taking into account level of service requirements.

The guidelines would need to take account of regional differences, and differences between large and small councils. The guidelines could be undertaken in the short to medium term, with adoption by councils being a long term prospect (see Actions A4 and A5). Costs of developing the guidelines would be moderate.

Recommended actions for individual Rural Councils

Action A4 Review asset base and level of service requirements

To resolve the current gap between required asset management works and available resources Rural Councils should review their asset bases and levels of service requirements with a view to a possible rationalisation of assets. If available, councils would draw on guidelines discussed in Action A3.

Feasibly, this action can only be implemented over the medium to long term, given likely strong community resistance to asset or service rationalisation and the need therefore for effective consultation processes. However, budgetary impacts should be relatively minor. Indeed, effective implementation of the measure should increase resources available to the councils in the longer term.

Action A5 Review asset management plan and maintenance program

Councils should review their assets management plans, maintenance programs and funding allocations with a view to:

- i. prioritising asset maintenance works in the event of a major natural

- disaster; and
- ii. upgrading asset maintenance and design specifications for some categories of asset (with reference to the Building Code of Australia and tools and guides developed by relevant professional bodies).

When undertaking the review, particular attention should be given to adequate protection and maintenance of buildings that have been identified as Emergency Evacuation Centres or Neighbourhood Safe Places.

Part i) of this action can probably be implemented over the short to medium term and will involve minor budgetary impacts. Part ii) however, is a long term action and has the potential to have major budgetary impacts.

Councils would draw on guidelines established under Action A3, if available.

4.2.2. Stormwater and drainage systems overwhelmed

Subset B Stormwater	Stormwater and drainage systems overwhelmed or damaged (risk 3) Stormwater treatment systems (biological or non-biological) overwhelmed (risk 4)
Focus	All stormwater drains and other drainage systems managed by Rural Councils, especially older parts of the system. Low lying areas subject to flash flooding.
Councils identifying risk	All Rural Councils
Context	<p>Many parts of the stormwater system are aging. In most LGAs only relatively new underground components of the drainage system are designed for a 1:5 year peak flow ARI. Although a 1-in-5 year event does not generally cause major problems, low lying areas are often affected, as are many roads. Furthermore, rainfall projections for the region indicate that the intensity of extreme rainfall events could increase significantly over the coming decades. This will lead to increased peak flows and runoff, reduced drainage system performance and greater frequency and severity of flash flooding.</p> <p>An increased frequency or intensity of extreme rainfall events could also lead to an increase in environmental impacts from overwhelmed stormwater treatment systems.</p>
Existing controls	Stormwater and flood planning and management (new developments) Flood planning and stormwater management processes currently in place are set out in Local Environmental Plans (LEP) and Development Control Plans (DCP). Floodplain development provisions are applied through Floodplain Management Plans (produced in accordance with the

NSW Flood Plain Development Manual). These are aimed at reducing the impact of flooding and flood liability to property occupiers and occupiers and to public and private infrastructure by establishing siting and design controls for flood prone lands (areas subject to a 100 year ARI flood).

Stormwater and on-site detention guidelines, implemented through the DCPs and Stormwater Plans, aim to ensure stormwater is controlled and managed in a way that is consistent with the principles of integrated water cycle management (IWCM) and water sensitive urban design (WSUD) by:

- Reducing surface runoff during extreme rainfall events
- reducing flood risk in urban areas;
- reducing soil erosion and sedimentation; and
- minimising urban run-off pollutants to watercourses.

Relevant modelling and design guidelines available to Councils include:

- *Australian Rainfall & Runoff*, which provides the basis for flood modelling;
- *Engineering Guidelines for Subdivision & Development*, which establish minimum design requirements for stormwater drains in new developments and system capacity for stormwater treatment systems; and
- Water Sensitive Urban Design (WSUD) Guidelines, which provide guidance on reducing runoff from buildings/impervious surfaces in new developments.

Asset management (existing system)

Councils also have in place measures that have the objectives of maintaining and (where resources allow) upgrading the stormwater system. These include:

- a stormwater service charge, which councils levy in accordance with 1995 amendments to the Local Government Act (1993) implemented by Division of Local Government (DLG), Department of Premier & Cabinet – the levy helps to fund upgrades to stormwater and drainage infrastructure over the longer term (e.g. 30 years); and
- an assets management plan, which provides for a review of the existing capacity of system and guides the works program and procedures for infrastructure maintenance.

Community feedback/complaints also help to inform prioritisation and budget allocations for works, particularly in areas prone to flooding.

Capacity building, regional partnerships and networking

Over the past 10 years, councils and agencies in the Hunter and Central Coast region have been engaged in capacity building, data collation and partnerships promoting the implementation of Integrated Water Cycle Management and WSUD approaches. Due to this work there is considerable understanding and buy in by council and agency staff to

such approaches that can be capitalised on.

In addition, Hunter Councils is a core member of an existing National Water Sensitive Urban Design (WSUD) Practitioners Network, which includes the University of Southern Queensland, Melbourne Water and WSUD in Sydney. This network has the potential to provide expert input into future responses by Councils.

Gaps and deficiencies

Flood management and development control planning

Generally, planning and development controls in place are adequate for the current situation. Emerging information though, suggests that controls may need to be strengthened to take account of likely increases in rainfall intensity. There are significant barriers to this though, which add to existing systemic ‘weaknesses’ relating to Councils’ capacities to ensure that controls in place are effectively applied. Barriers include:

- Lack of State Government direction on development controls relating to flood and stormwater management in the context of climate change.
- The need for improved hydrological data and technical guidance from credible professional groups (e.g. revised Australian Rainfall & Runoff (AR&R) guidelines from Engineers Australia).
- The time required to get new policies and strategies approved by Council.
- Lack of resources and in house expertise to:
 - plan works and check Development Approvals (DAs);
 - enforce conditions of consent - at construction, development hand-over stage; and
 - ground truth works against design specifications.
- Section 94 requirements in the *Environment Planning & Assessment Act 1979* (with respect to developer contributions) are unlikely to be adequate to support increases in stormwater capacity (built system) or to fund acquisition of urban riparian land.
- Ineffective sediment and erosion control (particularly post construction and pre landscaping) - this sediment can enter built stormwater drains and reduce capacity (e.g. by up to 25%).

Asset management

Notwithstanding the stormwater service charge, there is an ongoing shortage of funds for infrastructure retrofits and maintenance works. Additionally, councils faces issues surrounding the management and maintenance of drainage areas on privately owned land.

There is also an ongoing need for improved assessment and information collation on stormwater asset condition.

Recommended region wide actions

Action B1 Model changes to extreme rainfall intensities

HCCREMS member councils, in conjunction with water utilities and

relevant government agencies, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration under climate change scenarios. This information, in conjunction with Australian Rainfall & Runoff (AR&R) Guidelines, can then be used in hydrological modelling to assess local and regional impacts of climate change to flood hazard and to stormwater and drainage systems. It would complement AR&R Guidelines that are currently being updated.⁹

This action can be implemented over the medium term and is likely to have quite moderate budgetary implications (if shared between councils and other agencies).

(See also actions in risk Subsets C, E and F)

Action B2 Regional guidelines for the design and management of new and upgraded drainage assets, and for the retrofitting of existing assets

Drawing on modelling outputs, revised AR&R guidelines, and WSUD technical design guidelines, HCCREMS member councils, in conjunction with other agencies, should consider developing:

- regional guidelines for the design and management of new and upgraded stormwater and drainage assets and for the retrofitting of existing assets - the proposed guidelines would be adapted to local circumstances by individual councils; and
- regionally consistent condition assessment tools for natural and built stormwater infrastructure.

Rural Councils could consider establishing a regional ‘technical/engineering’ job-share position to assist with technical engineering manual revision & provide some consistency between councils especially for development controls.

This action can be also implemented over the medium term and is likely to have only minor budgetary implications (if shared between councils).

Action B3 Stormwater professional capacity building program

A region wide stormwater professional capacity building program should be developed drawing on IWCM and WSUD approaches to managing stormwater and flooding. The focus of the program would include:

- managing projected changes in rainfall intensity and duration; and
- design / upgrade of new and existing stormwater and drainage systems to encompass IWCM / WSUD principles in the context of climate change.

This action can be implemented over the medium term and is likely to have minor budgetary implications (if shared between councils and other agencies).

⁹ Note AR&R is currently being revised. Part of the revision process will include development of rainfall ‘intensity duration frequency’ information for different regions in Australia based on updated historical data records for those regions and improved statistical techniques. The intensity duration frequency information will not incorporate regionally specific climate change projections however.

Action B4 Funding for stormwater adaptation priorities

HCCREMS and Councils, in conjunction with regional water management authorities, should lobby federal and state governments to provide funding to implement stormwater adaptation priorities.

This action can be implemented over the short term and is likely to have only minor budgetary implications.

Action B5 Stormwater communications and information campaign

HCCREMS and Councils should undertake a regional communications and information campaign targeting community expectations on levels of service and councils' ability to deliver with regards to stormwater and flood management.

This action can be implemented over the short to medium term and is likely to have minor budgetary implications (if shared between councils).

Recommended actions for individual Rural Councils

Action B6 Revise local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling

Councils should revise / update local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling outputs.

This is likely to be a long term action, requiring implementation of action B1 before it can proceed and support of the Department of Planning.

Action B7 Revise stormwater and drainage technical engineering standards

Drawing on outputs of action B2, Rural Councils should revise stormwater and drainage technical engineering standards and development controls (e.g. through a policy template / planning provisions / development consent conditions) to integrate WSUD and IWCM technical standards and to account for projected climate change impacts.

This is also likely to be a long term action, requiring implementation of action B2 before it can proceed.

Action B8 Prioritise upgrades of vulnerable stormwater assets

Drawing on outputs of actions B1 and B7, Rural Councils should prioritise management / upgrade of vulnerable stormwater assets at an LGA scale.

This is also a long term action and is likely to have major budgetary implications.

4.2.3. Increased maintenance costs associated with intense rainfall and flooding of low lying transport infrastructure

Note, there is considerable overlap between risks in this subset and the traffic management risks (subset G) discussed in the section 4.4.

<p>Subset C Transport infrastructure</p>	<p>Increased damage to roads (incl. gravel roads), causeways, bridges and footpaths, due to increased rainfall intensity or flooding, leads to higher maintenance costs (risk 5)</p>
<p>Focus</p>	<p>All Rural Council roads, bridges and causeways, especially those subject to frequent flooding, landslides and/or degradation due to extreme rainfall.</p>
<p>Councils identifying risk</p>	<p>All Rural Councils</p>
<p>Context</p>	<p>Repairs to roads, bridges and causeways damaged as a result of flooding or extreme rainfall are a major budget item for Rural Councils, with many having backlogs of road repairs. Most Rural Councils also manage older timber bridges that are at significant risk of being washed out by flooding. Even when damage costs are covered by natural disaster funding, councils often experience delays and other difficulties in accessing funding.</p> <p>Increases in the frequency and/or magnitude of extreme rainfall events and associated flooding in the future suggests that the difficulty councils currently faces in maintaining roads and other transport infrastructure to the required service level could worsen in the future.</p>
<p>Existing controls</p>	<p>Asset maintenance and upgrades</p> <p>Councils undertake ongoing roads and other transport infrastructure maintenance works to their rural, main and urban roads. Works are generally programmed through an assets management plan and forward works program and maintenance schedule that has been developed from inspections by council officers and requests from community that have been lodged with the relevant council. Works include upgrading of unsealed roads, pothole patching, sign replacement, maintenance of culverts and drains and sealing of road shoulders. Although much of the maintenance is reactive, it can also help to prevent further deterioration of road surfaces and other assets.</p> <p>Subject to funding, more substantial road and bridge upgrades are also undertaken from time to time on main roads and other state significant infrastructure through grants and regional strategies. Works are generally undertaken by the NSW Roads and Traffic Authority on shared funding basis between the Australian and State Governments and the relevant council. Upgrades are undertaken in accordance with various Australian Standards and Guidelines for road design and planning.</p>

Planning and development controls

Established planning and development controls and Section 94 requirements in the *Environment Planning & Assessment Act* (1979) provide design specifications and require developer contributions for road improvements relating to new developments.

Gaps and deficiencies

Resourcing for asset maintenance and upgrades

A shortfall in funds linked to ‘rate pegging’ and anomalies in natural disaster relief funding means that Rural Councils often face significant backlogs in their road maintenance and upgrade schedules. This problem is widespread amongst councils in the Hunter and Central Coast region and is likely to be exacerbated by an increase in the frequency and/or magnitude of extreme rainfall events and associated impacts to transport infrastructure.

An initial step therefore, towards developing an effective funding model for roads, incorporating climate related impacts, would be to remove existing anomalies in Natural Disaster Relief funding arrangements.

Design criteria for new infrastructure

Design standards and guidelines for the construction of new and upgraded roads and bridges don’t currently incorporate projected climate changes or provide any guidance on how asset managers should incorporate climate change adaptation requirements when designing and building new or upgrading existing roads and bridges. Guidelines are probably best developed at the national and state levels but will need to incorporate flexibility to provide for regional and local applications.

Recommended region wide actions

Action C1 Guidelines for incorporating climate change adaptation into design criteria for new roads and bridges, and for retrofitting existing transport assets

Councils, in conjunction with the RTA (and with support from the LGSA and Infrastructure Australia) should commission research from a suitable professional body (e.g. Institute of Public Works Engineers) to develop decision making frameworks / guidelines to assist asset managers incorporate climate change adaptation requirements when designing and building new, or maintaining or upgrading existing roads and bridges. These would include elements such as calculating impacts of rainfall intensity on asset lifespan and maintenance costs and options for adapting assets over time versus total replacement.

This action can be implemented over the medium term.

Action C2 Review design criteria for new and upgraded roads and bridges based on extreme rainfall projections

HCCREMS and Councils, in conjunction with water utilities and catchment management authorities, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration.

This information should then be used to review design criteria for new and upgraded roads and bridges.

This action can also be implemented over the medium term.

(See also Actions B1 and G2)

Action C3 Clarified and simplified natural disaster relief funding

See recommendation A1.

Action C4 Panel of key experts on regional transport research and programs

HCCREMS, in conjunction with regional transport planning agencies, should consider establishing a regional panel of key experts / stakeholders to strategically review and direct regional transport research and program implementation including region wide actions for risk Subsets C and G and development of a regional transport infrastructure plan.

This action can feasibly be implemented in the short term and should have relatively minor budgetary implications.

Action C5 Professional training on climate change and asset planning

A region wide professional training / capacity building could be developed and implemented to provide council staff with improved understanding and capacity to apply available research and tools to assist with integrating climate change considerations into asset planning, construction and maintenance processes.

This action can commence in the short term but is likely to be ongoing.

(This action is also relevant to Risk Subsets A and B)

Recommended actions for individual Rural Councils

Action C6 Revision of forward works programs for transport infrastructure

Drawing on outcomes from actions C1 and C2 , Rural Councils should seek to:

- apply the decision making frameworks to the development / revision of forward works programs for transport infrastructure, ensuring that climate change adaptation needs are considered during project planning and prioritisation processes; and
- integrate new design criteria into the planning and construction / upgrade of council roads and bridges.

This is a long term action, requiring implementation of actions C1 and C2 before it can proceed.

Action C6 Professional training on climate change and asset planning

Councils should seek professional training courses for relevant staff to promote understanding and application of available research and tools to assist with integrating climate change considerations into asset planning, construction and maintenance processes.

This action can commence in the short term but is likely to be ongoing.
(This action is also relevant to Risk Subsets A and B)

4.2.4. Water supply reliability

Subset D	Existing water supplies become unreliable (risk 6)
Water supply	
Focus	Singleton and Upper Hunter Councils' water supply districts
Councils identifying risk	Singleton, Upper Hunter
Context	Potable water supply and sewerage services in the Cessnock, Maitland and Dungog Local Government Areas are provided through Hunter Water Corporation, and in the Greater Taree and Gloucester LGAs through Mid Coast Water. Singleton, Muswellbrook and Upper Hunter Councils are each the local water authorities for their LGAs.

Singleton

Singleton Council operates a local water utility, providing water and waste services to approximately 5,200 residential customers. The major supply source is the Glennies Creek Dam operated by the State Water Corporation. The dam currently provides a highly reliable and secure source of water to Singleton.

Upper Hunter

Upper Hunter Shire Council operates a local water utility, providing reticulated water supply to the urban areas of Aberdeen, Cassilis, Merriwa, Murrurundi and Scone.

The major supply source is the Glenbawn Dam operated by the State Water Corporation. Further sources are the Pages River and Singles Creek and artesian and sub artesian bores. Overall, the dams, rivers and bores provide a highly reliable and secure source of water to the townships.

Nevertheless, both Upper Hunter and Singleton Councils had water restrictions in place for several years in the mid to late 2000s, with the lowest storage level being 27% for both Councils. Additionally, climate change projections of increased rainfall variability and potentially increased frequency or severity of droughts mean that water supplies may become less secure in the future.

Muswellbrook

Muswellbrook and Denman's water supply is drawn from the Hunter River, and Sandy Hollow's is drawn from bores situated on the bank of the Goulburn River. In areas of higher elevation in Muswellbrook, booster pumping stations are used to supply sufficient water pressure.

High elevation areas in south Muswellbrook are supplied from Acacia reservoir. Denman's Water Treatment Plant was officially commissioned in April 2008, to provide high quality water to the residents of Denman.

At Sandy Hollow Water Treatment facility, water is pumped from bores on the Goulburn River and recycled through an ozone treatment. This treated water is then pumped into reservoirs; from where it gravitates to consumers in town.

Existing controls

Security of water supply

Water from the dam and rivers is delivered in accordance with State government allocations with town water supplied to Scone and other townships being a High Security allocation and therefore having priority (over general security allocations) in drought conditions.

Glenbawn Dam, operated by the State Water Corporation, provides a highly reliable and secure supply source to Scone and Aberdeen. The current system, pumps and delivery main, are at capacity and require augmentation. Similarly, Glennies Creek Dam, provides a highly reliable and secure supply source to Singleton and a number of other towns in the municipality.

The flows of Pages River and Singles Creek are significantly affected by droughts, and can cease for long periods. Contingency measures include water restrictions and emergency bores.

Some smaller towns are supplied from the Hunter River.

Drought management plan

Councils have comprehensive Drought Management Plans. The Plans, which were introduced in 2008, consider a range of supply management and demand management options for dealing with severe droughts taking into account past drought experience and water consumption trends.

Demand management

Muswellbrook, Singleton and Upper Hunter Shire Council are working together through the Upper Hunter Water Alliance to establish common water demand management strategies across the three council areas, particularly in regard to the nature and implementation of community water restrictions.

Current demand management measures include:

- household water consumption targets;
- rainwater tank encouragement (requirement for new sub divisions);
- water restrictions, when required;
- quarterly billing and full pay-for-use pricing;
- leakage reduction program, and

- water savings information and education campaigns.

Gaps and deficiencies

As noted, Councils have Drought Management Plans in place which provide comprehensive drought management responses. Nevertheless, the Plans rely on historical drought experience and, as such, do not appear to take account of climate change projections for the region including for an increase in rainfall variability and increase in drought frequency and for a substantial stepwise reduction in water balance after about 2040.

There is significant potential for Councils to ramp up demand management strategies including through further education and water pricing.

Recommended region wide actions

Action D1

Regional climate change projections on rainfall and runoff

Councils, in conjunction with other regional water authorities (Hunter Water Corporation, MidCoast Water), and government agencies should consider funding modelling of down-scaled regional, climate change and associated hydrological projections considering relevant climate variables including:

- average annual and seasonal rainfall;
- runoff;
- potential evaporation;
- rainfall variability; and
- drought frequency and severity.

The modelling could build on the work completed for HCCREMS by the University of Newcastle and would compliment rainfall intensity modelling proposed in action B1.

This action can be undertaken in the short to medium term. Budgetary implications of the review should be moderate to major.

Action D2

Review Water Plans

Councils and state water authorities should collaboratively review their Drought management Plans to take account of climate change projections/scenarios developed through action D1.

This action can be undertaken in the short to medium term. Budgetary implications of the review should be minimal.

Action D3

Strengthen water demand management initiatives

Councils and state water authorities should collaborate in strengthening and promoting consistency in regard to water demand management initiatives across the region, including through:

- water pricing (e.g. inclining block tariffs);
- community information and education on the potential

implications of climate change for water availability;

- further community education on alternative water supply options – potable and non-potable.

4.2.5. Flooding and overload of waste water treatment facilities

Subset E	Flooding/ inundation of low lying waste water facilities (risk 7)
Waste water treatment	Sewerage treatment system overloaded/fails due to intense rainfall / infiltration or loss of power (risk 8)
Focus	Waste water treatment facilities, especially in low lying areas
Councils identifying risk	Muswellbrook, Singleton, Upper Hunter
Context	<p>Some Rural Councils provide sewerage reticulation and treatment services for residents through their water and waste water authorities (Muswellbrook, Singleton, Upper Hunter). Sewerage services consist of sewer main networks, pump stations and treatment facilities. Some of these are in flood hazard areas.</p> <p>If pumps are out of order due to power outages, effluent will flow back into the sewer system, causing a loss of service and leading to community outcry. Sludge can also flow into and cause pollution of waterways. Back-up power systems are designed to prevent the disruption of pumping when there is power loss. However, if a back-up system is also unable to work due to inundation, the problems will be significantly exacerbated.</p> <p>Projections of increased rainfall intensity and associated flooding increase the risk of flooding of treatment facilities, pump stations and/or the reticulation system.</p>
Existing controls	<p>Back-up power is generally provided to main pump stations and treatment plant.</p> <p>Live monitoring systems provide warning of pump failure.</p> <p>Some treatment plants in flood prone areas are protected by levees.</p> <p>In-system storages are designed to cope with power outages of varying durations.</p>
Gaps and deficiencies	<p>It is not clear whether all relevant plant are safe from very intense rainfall and associated flood events. These could cause major damage (e.g. shut down of plant), as well as environmental damage and back-flow into the sewage system. Problems tend to be magnified during major storm events.</p> <p>This points to a need for improved hydrological data - how climate change will impact on extreme rainfall intensities in the region and</p>

how changes to rainfall intensity will in turn, affect flood hazard areas and exposure of critical infrastructure including treatment facilities and waste water pump stations. This information could then be used to prioritise possible future asset protection works, including levees and back-up power generation.

Recommended region wide actions

Action E1 Model changes to extreme rainfall intensities; flood hazard mapping

HCCREMS councils, in conjunction with water utilities and other government agencies, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration under climate change scenarios. This information should then be used in hydrological modelling to inform regional and local flood hazard mapping.

This action can be implemented over the medium term and is likely to have moderate budgetary implications (if shared between councils and other agencies).

(See also action B1)

Action E2 Analytical tool for prioritising key infrastructure treatments

HCCREMS councils, in conjunction with water and other utilities and state government infrastructure agencies, should consider funding the development of a tool for assessing and prioritising treatments on key public infrastructure in the context of climate change and other drivers of risk. The tool should include a cost benefit analysis component and combine ‘importance of service’ hierarchies with ‘at risk communities’ and cost of treatment.

This action can be implemented over the medium term and is likely to have minor to moderate budgetary implications (if shared between councils and other agencies).

Recommended actions for individual Rural Councils

Action E3 Identify and prioritise critical infrastructure exposed to flooding

Relevant councils should integrate rainfall and hydrological modelling outputs (from E1) into revised flood hazard mapping and identification of critical infrastructure (including waste water infrastructure) exposed to flooding. Results of the assessment should be integrated into Floodplain Risk Management Plans.

Outputs from the assessment should then be used to prioritise potential protection works / treatments for waste water treatment and other critical assets (drawing on outputs of action E2 if available).

This is a medium to long term action.

4.3. Land Use Planning

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority land use management and planning risks. Priority risks addressed in this section are:

Subset F: Flood modelling and planning scheme fail to reflect the extent of inundation under climate change scenarios

4.3.1. Land use planning in flood prone areas

Subset F Planning in flood prone areas	Flood modelling and planning scheme fail to reflect the extent of inundation under climate change scenarios (risk 9)
Focus	Developments adjacent to waterways or other flood prone areas
Councils identifying risk	Cessnock, Dungog, Greater Taree, Upper Hunter
Existing controls	<p>Flood management and development control planning</p> <p>A comprehensive legislative and planning framework is currently in place at the state, regional and LGA levels that is designed to control development in flood prone areas.</p> <p><i>State level</i></p> <p>At the state level, the framework includes the following.</p> <ul style="list-style-type: none"> ▪ State legislation, including the <i>Environmental Planning and Assessment Act 1979</i>; ▪ State Environmental Planning Policies (SEPPs); and ▪ NSW Flood Management Manual and Guidelines. <p><i>LGA level</i></p> <p>State and regional policies and legislation are implemented at the LGA level through the Local Environmental Plan, Development Control Plans, and Local Area Plans and Floodplain Risk Management Plans, which provide guidance and establish controls on development in the LGA, including specific controls for flood prone areas. The Plans are aimed at protecting waterways and reducing the potential of flooding to occupiers and infrastructure, informing decision making in flood prone areas and ensuring future development in those areas is carefully controlled through siting and design criteria.</p> <p>Section 149 Planning Certificates are issued on individual properties to inform planning applicants of the development potential of a parcel of land including the planning restrictions that apply to the land (e.g. in relation to a flood hazard).</p>

Flood modelling and flood hazard mapping inform the above planning processes.

Gaps and deficiencies

Flood management and development control planning

Generally, planning and development controls in place are adequate for the current situation. Emerging information though, suggests that controls may need to be strengthened to take account of likely increases in rainfall intensity and resulting changes to floods levels and ARIs.

There are significant barriers to this though, which add to existing systemic ‘weaknesses’ relating to Councils’ capacities to ensure that controls in place are effectively applied. As noted in discussion in Subset A, barriers include:

- Lack of State Government direction on development controls relating to flood and stormwater management in the context of climate change.
- The need for improved hydrological data and technical guidance from credible professional groups (e.g. revised Australian Rainfall & Runoff (ARR) guidelines from Engineers Australia).
- The time required to get new policies and strategies approved by Council.
- Lack of resources and in house expertise to:
 - plan works and check Development Approvals (DAs);
 - enforce conditions of consent - at construction, development hand-over stage; and
 - ground truth works against design specifications.

Community education

Based on stakeholder engagement, it seems that more community education is required to overcome a lack of understanding within the community, and clarify and make clear the risks of flooding and extreme rainfall in particular in the face of climate change.

Recommended region wide actions

Action F1

Model changes to extreme rainfall intensities

HCCREMS councils, in conjunction with water utilities and government authorities, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration under climate change scenarios. This information should then be used in flood modelling to assess local and regional impacts of climate change to flood levels and Average Recurrence Intervals (ARI).

This action can be implemented over the medium term and is likely to have quite moderate budgetary implications (if shared between councils and other agencies).

(See also recommendation A1)

Action F2 **Integration of climate change scenarios in flood modelling / studies**

Drawing on outputs from F1, HCCREMS Councils, in conjunction with relevant government agencies, should develop regional guidelines for integrating climate change projections into council flood modelling, management and planning processes.

This will provide a consistent understanding and approach by councils to the integration of climate change scenarios / impacts within flood modelling, management and planning processes.

This action can be implemented over the medium term and is likely to have quite moderate budgetary implications (if shared between councils and other agencies).

Action F3 **Community Information package**

Drawing on outputs of F2, Councils should produce a regional information package to advise the community on how they are addressing climate change in flood modelling, management and planning processes.

This action can be implemented over the medium term and is likely to have quite moderate budgetary implications.

Recommended actions for individual Rural Councils

Action F4 **Hydrological / flood modelling**

Drawing on outputs from Action F1, Council should undertake site specific hydrological / flood modelling of local priority areas, particularly *where the perceived risk is high and new flood management studies (currently in development) do not fully reflect region wide rainfall intensity projections.*

This action can be implemented in the medium term. It is likely to entail moderate costs for Council.

Box 1: A regionally consistent approach to flood modelling

At least 39,000 people are currently exposed to a 1:100 year flood across the Rural Council LGAs (see Table 5).¹⁰ This data however, does not reveal the extent or frequency of exposure in the future given climate change. Although comprehensive hydrological and modelling and flood hazard mapping has been undertaken by all Rural Councils, data compiled for this project suggests there are some inconsistencies in methods applied to the mapping, most particularly in relation to whether and how climate change projections have been integrated into flood hazard modelling.

Thus it would be desirable to develop a regionally consistent approach to flood hazard modelling and mapping incorporating climate change projections. An initial step towards that end will be to undertake region wide modelling of changes to extreme rainfall intensities and duration under climate change scenarios. This regionally specific information would complement and build on Australian Rainfall & Runoff (AR&R) Guidelines for hydrological modelling that are currently being updated nationally by Engineers Australia.

A regionally consistent approach to flood hazard assessment and mapping will be important to informing decision making on key infrastructure issues such as stormwater and drainage, waste water management and transport, as well as emergency management and business continuity.

Table 5. People and Residential Areas Exposed to Flooding, Rural LGAs

<i>Category</i>	<i>Cessnock</i>	<i>Dungog</i>	<i>Gloucester</i>	<i>Greater Taree</i>	<i>Maitland</i>	<i>Muswellbrook</i>	<i>Singleton</i>	<i>Upper Hunter Shire</i>	<i>Total Rural Councils</i>
Exposed People	na	1,073	na	14,442	12,192	1,745	7,018	2,238	38,781
Exposed Residential Dwellings	na	410	na	5,715	4,243	637	2,525	869	14,424
Exposed Low Income Households	na	119	na	1,906	816	142	503	200	3,692
Exposed People > 65 years	na	171	na	3,275	1,387	204	1,012	340	6,397

na=not available

¹⁰ HCCREMS 2010. Potential Impacts of Climate Change on the Hunter, Central and Lower North Coast of NSW. Hunter Councils NSW.

4.4. Emergency Management and Corporate Services

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority risks relating to emergency management and corporate services. Priority risks addressed in this section are:

Subset G: Increased flooding of low lying roads and other transport corridors leads to disruption to traffic (risk 10); and Increased flooding of bridges (in particular timber bridges) and causeways leads to disruption to traffic (risk 11).

Subset H: Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN (risk 12); and Council unable to meet demand for recovery services (risk 13).

Subset I: Exhaustion of Council's capacity to deliver services due to staff responding to emergencies arising from extreme weather events (risk 14).

4.4.1. Increased flooding of low lying roads and other transport corridors (leads to disruption to traffic)

Subset G Traffic management	Increased flooding of low lying roads and other transport corridors leads to disruption to traffic (risk 10) Increased flooding of bridges (in particular timber bridges) and causeways leads to disruption to traffic (risk 11)
Focus	All highways, main roads, rural roads, causeways and bridges in the region subject to flooding, especially those providing sole or principal access route for communities.
Councils identifying risk	All Rural Councils
Context	<p>Flooding of roads, causeways and other transport corridors in the region can isolate significant sections of the community for extended periods, disrupt traffic movement, including emergency management and commercial vehicles, and create major safety hazards.</p> <p>Projections for an increase in the frequency and/or magnitude of extreme rainfall events and associated flooding indicate that the impacts of flooding on traffic movement could become more severe in the future.</p> <p>This issue has important emergency management implications.</p>
Existing controls	<p>Flood management planning and information</p> <p>Councils' flood hazard mapping and flood plans provide them with a good understanding of the roads and other transport corridors most at risk from flooding. This information, in turn, informs decisions on priorities for road upgrades and decisions on road, bridge and causeway closures and alternative transport routes in the event of a flood.</p> <p>Website information and other information services provided by Rural Councils, roadside signage and flood markers provide the community</p>

with information on road closures and flood levels.

Local emergency management

Local Emergency Management Committees (LEMC) link Rural Councils with emergency management agencies (SES, RFS, NSW Police, Ambulance Service), as well as relevant State government agencies. Each LEMC oversees implementation of the local DISPLAN, which sets out local emergency response to floods including in relation to road closures, emergency evacuation, flood gauges and reporting systems.

Regional partnerships

In some areas, Regional Emergency Management Risk Studies link a council's DISPLAN with other local DISPLANS.

Significant regional partnerships also exist between councils, the Department of Transport, the RTA and other relevant agencies to effectively manage traffic in the event of a major flood having regional implications. In particular, the Mid North Coast and Hunter Central Coast Emergency Management Districts provide hubs for coordinated responses to regional emergencies. Agencies are able to draw on shared experiences and knowledge gained from previous major floods in the region, such as the 2007 floods.

Gaps and deficiencies

Information on traffic routes

Local DISPLANS, implemented through LEMCs, provide a sound platform for emergency response in the region, including in relation to traffic management. Similarly effective regional coordination is provided through the Emergency Management District. Nevertheless, key transport information often resides with a few individuals in Councils and within other agencies, suggesting the need for better documentation of roads likely to be affected by floods and of alternative transport routes.

Community information

Similarly, based on stakeholder discussions, it is apparent that the broader community may not be fully and effectively informed and engaged in local and regional emergency response efforts particularly in relation to:

- alternative transport routes in the event of a flood (or other emergency such as a bushfire); and
- household preparedness in the event of being cut off from day to day services for prolonged periods due to road closures.

Resourcing

As discussed in relation to Subset C, sufficient and timely funding for transport route upgrades is an ongoing issue, likely to be exacerbated under a future climate regime.

Recommended region wide actions

Action G1 Update local and regional traffic plans

HCCREMS member councils, in conjunction with the RTA and local and regional emergency service agencies should:

- identify and document key local and regional traffic routes likely to be affected by flooding and also other extreme events such as bushfires, and identify alternative options during these events;
- update local and regional traffic plans to encompass alternative transport options during these events; and
- provide information to the community on alternative transport and evacuation routes in the event of a flood or other extreme events.

This action can be implemented in the medium term. With cost sharing, costs to Councils are likely to be minor to moderate.

Action G2 Identify and upgrade vulnerable roads and bridges

Drawing on research and guidelines of established professional bodies, Rural Councils, with the support of the RTA should:

- develop consistent criteria for quantitatively identifying vulnerability of major roads, bridges and other transport infrastructure to flooding and other climate extremes;
- identify and rank vulnerability of roads and bridges to flooding at a regional scale;
- research and provide recommendations for the development of new design standards to account for changed climate parameters in construction of new or upgrade works for roads and bridges; and
- actively seek funding from state and federal Governments for a program to upgrade vulnerable infrastructure.

This is a medium term action, requiring collaboration between councils, the RTA and other agencies.

(See also Action C2).

Action G3 Promote increased household preparedness for floods

Councils, in conjunction with regional emergency service agencies, should undertake an education campaign to promote increased household preparedness for floods (including, for example, decentralisation of power and water supplies) to reduce their short term dependence on mainstream services and the need for evacuation.

This action can be implemented in the short term. With cost sharing, costs to councils are likely to be minor.

Recommended actions for individual Rural Councils

Action G4 Adaptation strategies for key local transport infrastructure

Drawing on outcomes from action G1 & G2, Rural Councils should identify adaptation strategies / works programs for key vulnerable local transport infrastructure.

This is a long term action. Its implementation is dependent on Councils being able to access substantial new resources.

4.4.2. Emergency response and recovery

Subset H Emergency response & recovery	<p>Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN (risk 12)</p> <p>Council unable to meet demand for recovery services (risk 13)</p>
Focus	<p>Councils’ response and recovery obligations, as set out in local DISPLANs, including emergency accommodation and clean up. Coordination of Councils’ response in case of an emergency with other LEMC members.</p>
Councils identifying risk	<p>Cessnock, Dungog, Greater Taree, Gloucester</p>
Context	<p>The <i>State Emergency and Rescue Management Act</i> 1989 recognises that involvement of local government in all stages of an emergency is critical (including prevention, preparedness, response and recovery). Emergency management structures and arrangements at the local level are therefore based on local government boundaries. There is also strong community expectation regarding response and (especially) recovery services provided by Councils.</p> <p>The State Emergency and Rescue Management Act (SERM Act) mandates several council obligations, including financial (funding for RFS and SES) and in-kind support (e.g. staff and equipment). This can place a strain on the resources of Rural Councils. Similarly, there is strong community expectation regarding the provision of recovery services through councils (such as emergency accommodation, social services and welfare provision). Recovery operations can often be resource intensive and this limits resources available for regular council services.</p> <p>An increase in the frequency and/or severity of climate related emergencies over time could increase demand on emergency response and recovery resources including those provided by Rural Councils.</p>
Existing controls	<p>Local planning and emergency management</p> <p>Local flood and bushfire management plans set out procedures to assist councils to mitigate, prepare for and respond to flood and bushfire risks.</p> <p>As previously noted, coordinated local emergency response and recovery is implemented through local DISPLANs. DISPLANs are implemented through Local Emergency Management Committees (LEMC), which comprises council, emergency management agencies</p>

(SES, RFS, NSW Police, Ambulance Service NSW) and other agencies.

Regional partnerships

As also noted in the discussion in Subset G, strong partnerships currently exist between councils and between councils and emergency services organisations and at the regional level. Thus there is already significant experience of coordinated regional emergency responses and 'buy in' to programs that can enhance a regional approach.

Internal procedures

Internal procedures and insurance are designed to mitigate risks to councils that could arise from their emergency response and recovery commitments. Measures include:

- internal emergency management procedures; and
- internal procedures designed to ensure that requests to Rural Councils for recovery services are prioritised or referred to other agencies.

Natural Disaster Relief Funding

As noted previously noted, the Natural Disaster Relief Fund (NDRF), funded through the NSW Department of Commerce, assists councils with emergency response costs and with cost recovery for uninsured items.

Gaps and deficiencies

Local emergency management

DISPLAN has proven to provide an effective and strong platform for local emergency response. It should be noted however, that although plans have proven to be effective in multi-agency events they have not really been tested under multiple or frequent 'event' situations, especially given that key organisations are heavily reliant on availability of volunteers. Planning documentation and procedures also need to be more readily available to relevant agencies and the broader community.

Furthermore, local DISPLANS tend to deal less well with 'recovery' aspects of emergency management and are often not so well resourced, placing strains on councils and other agencies response for recovery operations (see below).

Council resources and facilities

Ultimately, Rural Councils are highly dependant upon adequate and timely state or federal funding to assist with disaster recovery and clean up. In that respect the NDRF assists councils with recovery in the case of State declared disasters. As noted previously however, there are anomalies with current funding arrangements.

Although resources are made available to councils for preparatory planning, contingency funding is not available for disasters that aren't state declared, meaning that councils' responses to local emergencies have a direct impact on their capacity to meet day to day (essential

and non essential) service requirements. Ultimately, the lack of contingency funding could also impact on a council's capacity to provide funding to emergency service agencies such as the RFS and SES.

Although councils and other emergency agencies' roles and responsibilities are set out in DISPLAN, roles and responsibilities within each council could be further clarified. In particular, there is scope through training to broaden the knowledge base within each council on its responsibilities regarding emergency management.

Rural Councils need to ensure that their emergency and recovery facilities and equipment (e.g. Neighbourhood Safe Places) are well maintained and located.

Community information and responsibilities

Finally, as noted in the discussion on Subset G, community education on emergency response needs to be improved. On the one hand the community expectations are high as to the role of councils and other agencies in responding to emergency situations. On the other hand, there needs to be improved community awareness and understanding of the importance of self preparedness, self responsibility and the ramifications of personal decisions (e.g. private land management).

Recommended region wide actions

Action H1

Emergency preparation exercises combining multiple events

HCCREMS member councils and regional emergency service agencies should consider conducting emergency preparation exercises combining multiple events, multiple agencies and across zones to test effectiveness of DISPLAN. This will improve preparedness and efficiency of councils, agencies and emergency management authorities when responding to extreme or multi-event natural disasters.

This action could be implemented in the short term. Costs to individual councils and agencies are likely to be minor.

Action H2

Review of emergency response frameworks and relationships

Councils and regional emergency service agencies and the state government should conduct a review of emergency services response frameworks and relationships. This would identify existing limitations and provide recommendations and tools to improve capacity to manage projected increases in extreme events from an emergency response perspective, particularly projected increases in the coincident occurrence of extreme events. It would also include a focus on the ability of key service providers to continue to deliver community services during and after extreme events.

This action could be implemented in the short term to medium term.

Action H3 **Central access point for information on emergency management procedures**

HCCREMS member councils and regional emergency service agencies should establish a central access point – including physical location and website - for all regional information on emergency management procedures, including response and recovery. They should also conduct an awareness campaign for community on their rights, roles and responsibilities in the event of a natural disaster such as a flood.

This action could be implemented in the short term. Costs to individual councils and agencies are likely to be minor.

(See also recommended action G3)

Action H4 **Clarified and simplified natural disaster declarations and relief funding**

See recommended action A1.

Action H5 **Council training**

Councils should consider delivery of a regional training program for staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN (including response and recovery).

This action could commence in the short term, although it is likely to be ongoing. Costs to the councils are likely to be minor to moderate.

Recommended actions for individual Rural Councils

Action H6 **Review asset management plan and maintenance program**

See recommended action A5.

4.4.3. Business continuity

Subset I Business continuity	Exhaustion of Council’s capacity to deliver services due to staff responding to emergencies arising from extreme weather events (risk 14)
Focus	Rural Councils’ service delivery
Councils identifying risk	Cessnock, Dungog, Greater Taree
Context	Most day to day council operations and services require ongoing and consistent involvement of staff and contractors if they are to be effectively delivered. When a major natural disaster occurs, delivery of key council services (e.g. waste management) could be directly

affected. As well, many council staff and resources are needed to respond to the disaster and to undertake recovery works. This can also affect delivery of routine services. Greater frequency and severity of extreme events (floods, storms) has the potential to increase service disruptions.

Existing controls

Work prioritisation process

Councils' maintain work schedules within different departments to ensure works and services are prioritised.

Coordination with emergency services and other agencies

Through their Local Emergency Management Committees, Rural Councils are able to coordinate and share emergency response actions with other agencies and, potentially, reduce the emergency response workload on council staff.

Use of contractors can also help to diminish work load on council staff.

Natural Disaster Relief Funding

Councils are reimbursed for (some) costs associated with responding to state declared natural disasters or for direct impacts of the disaster.

Gaps and deficiencies

Policies and procedures currently in place in most Rural Councils appear to provide an effective approach to dealing with short term staff shortages in relation to emergency responses. However, if extreme events occur more frequently and for longer time periods, the strain on Council resources is likely to increase, potentially affecting long term service delivery. Furthermore, a majority of Rural Councils do not appear to have a plan to deal with longer term disruptions to its services (e.g. lack of access to waste transfer station / landfill due to flooding). A business continuity plan needs to be developed and implemented to prepare for these eventualities.

As previously noted, councils often experience delays and other difficulties in accessing natural disaster relief funding.

Recommended region wide actions

Action I1

Clarified and simplified natural disaster relief funding

See recommended action A1

Action I2

Regional training, capacity building and implementation program

Councils should consider delivery of a regional training, capacity building and implementation program for councils on the importance and process of Business Continuity Planning.

This would address staff and financial barriers to developing Continuity Plans individually by councils and promote consistency in approach and standards across councils.

Recommended actions for individual Rural Councils

Action I3

Business Continuity Plan

Councils should develop and implement a business continuity plan consistent with Australian Standards and best practice on business continuity management as set out in:

- HB 221-2004 – *Business Continuity Management Handbook*;
- HB 292-2006 – *A practitioner's guide to business continuity management*; and
- HB 293-2006 – *Executive guide to business continuity management*

The business continuity plan would aim to provide procedures to ensure continuity of key council services in the event of crises including weather-related emergencies such as heat waves, floods, storms and fires and power and telecommunications outages. Issues associated with risks to staff and resourcing in the event of emergencies should be addressed in the plan.

This action can be implemented in the short to medium term. It is likely to entail moderate costs.

4.5. Environmental Management and Protection

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority risks relating to environmental management and protection. Priority risks addressed in this section are:

Subset J: Increased pollution and silting of waterways, estuaries and groundwater due to storms and flooding, as well as pollution through leachate from waste facilities, septic tanks other sewage systems (risk 15); and Increased incidence of algal blooms in waterways and estuaries (risk 16).

Subset K: Loss of remnant vegetation and habitat as a result of water and heat stress (risk 17).

Subset L: Increased incidence of pests and weeds due to altered climate regime (risk 18).

Subset M: CPRS or other carbon pricing instrument affects the operations of solid waste facilities (risk 19).

Subset N: CPRS or other carbon pricing instrument increases fuel and energy costs (risk 20).

4.5.1. Pollution of waterways

Subset J Pollution of waterways & algal blooms	Increased pollution and silting of waterways, estuaries and groundwater due to storms and flooding, as well as pollution through leachate from waste facilities, septic tanks other sewage systems (risk 15) Increased incidence of algal blooms in waterways and estuaries (risk 16)
Focus	All waterways in the region impacted by stormwater, siltation from roads and other development sites or leachate from sewerage and septic systems
Councils identifying risk	Cessnock, Dungog, Greater Taree, Maitland (Risk 16), Singleton, Upper Hunter
Context	<p>Councils and other agencies are under increasing community pressure to monitor and improve the quality of water in the region's waterways and estuaries. Community concerns stem from both public health and ecological impacts.</p> <p>Water quality is extremely significant to the health and wellbeing of the local community, with rivers, aquifers and estuaries being utilised for a wide range of purposes including swimming, diving, boating and fishing, aquaculture and other commercial production. The ecological viability of regional estuaries and waterways is also critically dependent on maintenance of water quality.</p> <p>Water quality of waterways and estuaries in the region is variable with some, especially in the north, being in relatively good condition compared with many other developed estuaries along the NSW coast. However, increased rainfall intensity that is projected for the region has the potential to worsen water quality stressors through increased runoff, erosion and flooding of wastewater systems.</p>

In recent years, the region has experienced significant outbreaks of blue-green algae (*Lyngbya majuscula*). As well as posing risks to human health and to water-based recreational activities, algal blooms can result in significant impacts to the aquatic ecology of estuaries and waterways. The potential for elevated water temperatures and increased rainfall variability associated with climate change, combined with an ongoing problem with nutrient run-off into waterways, poses the risk of an increase in the frequency or severity of algal blooms in the future.

Existing controls

Council level controls – planning and development

Council planning, development and environmental management controls implemented through the Rural Councils' Local Environmental Plans, Development Control Plans, Stormwater Plans and Environmental Management Plans are designed (in part) to limit impacts of developments on waterways and estuaries by:

- requiring Water Sensitive Urban Design;
- restricting the location of developments, especially in close proximity to waterways so as to maintain riparian corridors;
- minimising site impacts and associated runoff; and
- controlling septic system siting, design & maintenance.

Regional level controls – monitoring, waste water treatment and landholder practices

Effluent reuse schemes have been developed by Hunter Water Corporation and other regional water authorities. These divert effluent from discharging into waterways, with the effluent being used for other purposes such as watering of agricultural pastures and golf courses.

Catchment management strategies, developed and implemented through the Hunter-Central Rivers CMA, have objectives and a range of strategies aimed at enhancing water quality through improved landholder practices (e.g. fertilizer application and nutrient runoff).

State level controls – water pollution

Controls falling under state government jurisdiction include:

- a range of state legislation that are designed (in part) to achieve protection of waterways and aquatic ecosystems from pollution and other threats (e.g. *Water Management Act*, *Protection of Environment Operations (POEO) Act*, *Environmental Planning & Assessment (EP&A) Act*, 1979, *Threatened Species Conservation Act*, 1995, *Native Vegetation (NV) Act*, 2003);
- Environmental Protection Licences issued under the POEO Act, which control point source pollution from industrial premises to waterways, including wastewater treatment facilities. ;
- The NSW Monitoring, Evaluation and Reporting (MER) Strategy which coordinates monitoring, evaluation and reporting on

natural resource condition (including water quality and flows) by CMAs, councils, water agencies and landholders.

State level controls – water flows and algal blooms

- Water Sharing Plans, implemented under the *Water Management Act 2000*, which have been developed to establish rules for sharing water between the environmental needs of a waterway and other water users such as town water, industrial use and irrigation;
- NSW Algal Management Strategy, which is administered by the NSW Office of Water, State Algal Advisory Group and nine regional algal coordinating committees including the Hunter Regional Algal Coordinating Committee;
- Algal Watch, a program designed to encourage community members to report sightings of algae blooms; and
- Protocols between councils and the Department of Health, for dealing with algal bloom outbreaks including community information, media liaison and event control.

Gaps and deficiencies

Planning and management

Overall environmental planning and management frameworks appear to be sound in principle.

A review process is needed however, to ensure that the potential impacts of climate change on waterways, estuaries and water supply catchments are reflected in plans. Moreover, there appears to be some inconsistencies in the treatment of development planning and environmental management objectives between state / regional level plans (e.g. Lower Hunter Regional Strategy) and local level plans (e.g. LEPs and Estuary and Environmental Management Plans), with the result that objectives established in Councils' plans in relation to protection of waterways, estuaries and catchments are not always being met. This outcome could be exacerbated under climate change.

Water quality monitoring

Notwithstanding current monitoring programs, there are still significant information gaps in understanding of water quality in the region (partly reflecting inconsistent approaches to water quality monitoring between different agencies and groups) and understanding of factors affecting water quality.

For example, relatively little data currently exists on groundwater quality and on the impact of septic systems and other sources of pollution on groundwater quality.

Research

Improved information on the potential impacts of climate change on rainfall, runoff and water availability is required.

Recommended region wide actions

Action J1 **Regional climate change projections on rainfall and runoff**

See action D1

Action J2 **Review existing state, regional and local plans**

State, regional and local strategies and plans should be reviewed to ensure that they reflect the potential impacts of climate change on the condition of waterways and estuaries.

The review should also aim to achieve greater consistency between state and local planning and environmental management objectives (especially in relation to management of waterways and estuaries).

The review will require the coordinated involvement of state government (through the Department of Planning, Department of Local Government, Hunter-Central Rivers CMA and DECCW) and councils. It should be feasible to undertake the review in the medium term.

Action J3 **Regional water quality monitoring strategy**

A region wide water quality monitoring strategy should be established to overcome existing knowledge gaps on water quality in the region. The strategy would aim to establish a central database on regional water quality to support planning and management decision making.

The strategy should be implemented at the regional level with financial support provided by the state government (e.g. DECCW, Hunter-Central Rivers CMA, Industry and Investment NSW) and regional water agencies.

Implementation of this action should happen over the medium term.

Action J4 **Regional modelling to identify water and nutrient runoff**

HCCREMS, in partnership with state and federal government agencies, should implement regional modelling to identify water and nutrient runoff in basins and catchments under different rainfall scenarios. The modelling would build on work previously undertaken by Great Lakes Council and Hunter Water Corporation.

Research would then be undertaken to assess impacts of modelled outputs on wetlands, lakes and waterways.

This is a long term action, having moderate budgetary implications.

Recommended actions for individual Rural Councils

Action J5 **Management strategies for high risk septic systems**

Drawing on outputs from actions B1 and J2, Councils should identify the number, location and nature of vulnerable septic systems with high potential to contribute to water pollution under regional climate change scenarios. It should then prepare management strategies for these systems and implement them through its asset planning and

management and on site sewage management programs.

This is a long term action that will have minor to moderate budgetary implications.

4.5.2. Loss of remnant vegetation

Subset K Remnant vegetation	Loss of remnant vegetation and habitat as a result of water and heat stress (risk 17)
Focus	Vulnerable ecological communities throughout the region
Councils identifying risk	Cessnock, Singleton
Context	<p>The biome of the Hunter and Central Coast region generally is classified as being ‘subtropical moist’ (Dunlop & Brown, 2008). Nevertheless, the region is recognised as being at the intersection of a number of bioregions, where vegetation communities from the coast, the inland and the north and south all meet. Vegetation communities in Cessnock, for example, are dominated by dry forest and woodlands, with the LGA’s woodlands containing at least 29 species of Eucalypt, some of them vulnerable or endangered. Similarly, there are 22 endangered vegetation communities and species in the Singleton LGA, (e.g. Warkworth Sands and River Redgum communities).</p> <p>Increased temperatures and water stress associated with increased rainfall variability and more persistent and severe droughts may further reduce viability of these communities, adding to existing stresses associated with population growth and associated urban development, land clearing, fragmentation and pests and weeds.</p> <p>Shared management responsibilities between Rural Councils and other jurisdictions (e.g. DECCW) complicate potential approaches to protecting these communities, with Councils having direct responsibility for protection of communities only on roadside verges and through land use planning strategies and processes.</p>
Existing controls	<p>Legislative and planning frameworks</p> <p>A cascading suite of legislation, strategies and plans, designed to protect vulnerable and endangered ecological communities, are currently in place at the state, regional and local levels. State government legislation and plans include the following:</p> <ul style="list-style-type: none"> ▪ The <i>Threatened Species Conservation Act 1995</i> (administered by DECCW) is designed to identify and protect native plants and animals in danger of becoming extinct. ▪ ‘Threatened Species Priority Action Statements’ are required for

all threatened species listed under the Act.

- The NSW Government has adopted targets to maintain or improve the condition and trend of the State's natural resources including biodiversity.

Local and regional plans and strategies include:

- Councils' Local Environmental Plans and Development Control Plans. These establish conservation zones in respective LGAs and set requirements for the protection of native vegetation in relation to developments.
- A 'Catchment Action Plan' (Hunter-Central Rivers CMA) that sets management targets and investment priorities, including in relation to high conservation value ecological communities, in the Hunter-Central Rivers catchment.

Management and restoration programs

Regional and local management and restoration programs are implemented to give effect to the objective set out in the plans and strategies. These include:

- Land use planning processes and conservation plans
- collaborative roadside vegetation protection initiatives, between HCCREMS member councils, implemented through the 'Regional Roadside Environmental Management Program' (consistent with Catchment Action Plan priorities);
- Landcare initiatives; and
- incentive programs for biodiversity protection on private land (e.g. voluntary partnership agreements).

Research / data collection / monitoring

The Hunter Regional Biodiversity Conservation Strategy (HRBCS) commenced in 1998, to collect baseline data on the biodiversity of the Hunter and Central Coast region. Data collected through the plan is intended to guide land use and planning decisions in the region. Initiatives implemented through the plan include:

- region wide mapping of vegetation communities;
- flora and fauna surveys; and
- habitat modelling.

More recently, a natural resources Monitoring, Evaluation and Reporting (MER) has been initiated at the state level to collect data on the condition of assets covered by 13 natural resources target areas and the pressures on those assets (including native vegetation, native fauna, threatened species and invasive species). State of the catchment reports are to be produced through the MER, with a Hunter-Central Rivers State of the Catchment report due for release in 2010.

Gaps and deficiencies

Key deficiencies with existing frameworks and programs include:

- insufficient resources (financial and staff), with the result that strategies and plans are often not fully and effectively implemented at the local level;
- notwithstanding initiatives implemented through the HRBCS, there is insufficient data and other information on existing status and threats to endangered species and ecological communities and on changes arising from climate change;
- (at times) lack of integration between State, regional and local planning frameworks, a crucial issue given shared management responsibilities for protection of threatened species and communities; and
- the need for more effective community education and engagement on the impacts land use decisions on the viability of regionally and locally significant ecological communities.

Deficiencies are magnified by the potential impacts of climate change.

Recommended region wide actions

Action K1

Research into endangered species and communities risk factors and impacts of climate change

HCCREMS, in partnership with member councils, state and federal government agencies (e.g. Hunter-Central Rivers CMA, DECCW and Department of the Environment, Water & Heritage and the Arts (DEWHA)) should implement a research program aimed at:

- identifying key risk factors likely to impact on the long term conservation of Commonwealth and State threatened species and ecological communities located in the region arising from climate change;
- identifying projected changes to these communities and species arising from regional climate change scenarios;
- identifying projected spatial change to the location and extent of vulnerable communities (utilising region wide vegetation mapping); and
- developing a 'threat ranking' to assess the overall risk to vulnerable communities arising from climate change and other degrading / threatening processes to inform conservation planning priorities.

This action could be implemented in the short to medium term. Subject to funding, it is likely to have moderate budgetary implications.

Action K2

Planning tools, education and conservation incentives programs

Drawing on outputs of action K1, HCCREMS should:

- develop regional planning tools and frameworks to improve conservation of regionally vulnerable ecosystems (e.g. through land use zonings and development controls);
- facilitate enhanced education and engagement programs by councils with their local communities, highlighting the increasing importance of wildlife corridors / refugia for the long term viability of regionally significant ecological communities and the implications of land use decisions; and
- actively assist councils to target conservation incentive programs to vulnerable locations.

This action could be implemented in the medium term. It is likely to have minor to moderate budgetary implications.

Recommended actions for individual Rural Councils

Action K3

Planning tools , education and conservation incentives programs

Drawing on outputs of action K1 and K2, Rural Councils, should:

- update their planning tools and frameworks;
- enhance education and engagement programs with local communities,; and
- actively target conservation incentive programs to vulnerable locations within their council area

This action could be implemented in the medium term. It is likely to have minor to moderate budgetary implications.

4.5.3. Pests and weeds

Subset L Pests & weeds	Increased incidence of pests and weeds due to altered climate regime (risk 18)
Focus	Roadside verges, reserves and agricultural land
Councils identifying risk	Cessnock, Dungog
Context	Invasive weeds (both noxious and environmental) can be a serious threat to the natural environment, as they displace native species and reduce water quality, farm and forest productivity. Noxious weeds are a particular concern. The <i>Noxious Weeds Act 1993</i> requires control of noxious weeds by landholders and councils to reduce the threat they pose to human and animal health (e.g. allergies) and to control the potential for increased distribution and density.

Pests and weeds are usually opportunistic breeders with wide climatic tolerance. They have the potential to dominate ecological niches if native species are placed under stress as a result of climate change.

Existing controls

Legislative and planning frameworks

The Noxious Weeds Act, 1993 defines the roles governments, councils and private landholders in the management of noxious weeds and sets up control actions for the various noxious weeds, based on their potential to cause harm to the community and/or environment.

As noted in the discussion under risk Subset P, a MER has been implemented at the state level to collect data on the condition of natural assets and the pressures on those assets including from invasive species. A State of the Catchment report, to be produced through the MER, should contain updated information on threats to the Hunter-Central Rivers catchment from pests and weeds.

Regional management

Cessnock, Dungog and Maitland councils are all members of the Hunter and Central Coast Regional Weed Management Professional Team that comprises representatives from each of the Lower Hunter and Central Coast Councils and the Upper Hunter Weeds Authority. A regional weed management strategy has been developed that aims to provide the overriding framework to manage weeds on a strategic landscape scale through coordination in planning, investment and operational activities on a regional basis across landscapes, land management boundaries (irrespective of tenure) and local control authority jurisdictions.

Upper Hunter, Singleton and Muswellbrook Councils are members of the Upper Hunter Weeds Authority, while Greater Taree and Gloucester Councils are members of the Mid North Coast Weeds Advisory Committee. These organisations also have regional weed management strategies in place.

Most Rural Councils also have noxious weed officers, who are actively involved in the locating and eradication of declared noxious weeds on roadsides and other council land. The noxious weed officers are also responsible for inspections of private property for declared weeds under the *Noxious Weed Act*.

Gaps and deficiencies

Planning and management

Notwithstanding development and implementation of Regional Weeds Management Strategies, there are still significant gaps in pest and weed planning and management in the region. In particular, there is a need for improved regional coordination in the planning and management of pest animal threats to natural assets.

Furthermore, a review process is probably needed to ensure that the potential impacts of climate change on pests and weeds are reflected in plans / strategies. Moreover, extreme events, such as heavy rain and storms, prevent works in relation to pest and weed control and can contribute to the spread of weed species (e.g. aquatic weeds). This

needs to be reflected in plans and strategies.

Roles and responsibilities

It appears that there is a lack of communication and integration between agencies / councils and that roles and responsibilities at the state level and the regional/local level are not clearly defined. As a result, objectives established in Council and regional pest and weed control plans might not always being met. This outcome could be exacerbated under climate change.

Community awareness and education

Based on stakeholder discussions, it seems that the broader community is not being effectively informed and engaged in local and regional pest and weed management efforts. The success of Councils' weed management largely depends on the effective management of pests and weeds on private land, to control the spreading of weeds within the region.

Resources / funding

Sufficient (and timely) funding for pest and weed management is an ongoing issue and likely to be exacerbated, if climate regime impacts increase the occurrence of pest and weeds.

Recommended region wide actions

Action L1

Research and ecological niche modelling

HCCREMS, in partnership with councils and neighbouring weed authorities, should commission research that applies ecological niche modelling approaches to identify projected changes in climate on likely future terrestrial weed distribution and impact scenarios at regional / sub regional scales. Funding should be sought from Industry and Investment NSW and other relevant State and Commonwealth Government agencies.

This is a medium term action, requiring collaboration between councils and other agencies. Costs to councils are likely to be minor.

Action L2

Review existing policies and implement an education strategy

Once completed, outputs from L1 should be used to:

- review relevant policies and programs in existing regional weed management strategies;
- inform relevant staff in councils and other stakeholder organisations; and
- develop and implement a regional education strategy to raise community awareness of the issues / problems of climate change for regional weed distribution.

This action can be implemented in the medium term. With cost sharing and/or funding, costs to councils are likely to be minor.

Action L3 **Regional coordination of pest animal management**

Drawing on experiences of the regional approach to noxious weed control (through the Lower Hunter and Central Coast Weed Management Committee and Regional Weed Management Strategy), HCCREMS member councils and the Hunter-Central Coast CMA should consider approaching the NSW Livestock and Pest Authority to establish a regionally coordinated approach to pest animal control.

This action can be implemented in the short to medium term. With cost sharing, costs to individual councils are likely to be minor.

4.5.4. CPRS or other carbon pricing instrument increases cost of council waste services

Subset M Waste management	CPRS or other carbon pricing instrument affects the operations of solid waste facilities (risk 19)
Focus	Council operated landfill facilities
Councils identifying risk	Dungog, Gloucester, Greater Taree, Maitland, Singleton, Upper Hunter
Context	Costs associated with managing landfills have been increasing in response to community expectations and government policies requiring changes to waste disposal and waste management practices. These changes have been driven by general ‘sustainability’ objectives including the need to reduce Greenhouse Gas (GHG) emissions. In the medium to long term it is likely that a mechanism will be introduced that has the effect of pricing greenhouse gas emissions including emissions from landfills, a move that will accelerate the ongoing trend of increasing landfill management costs. Although Councils can pass on cost increases to users of landfill facilities, its capacity to do so can be constrained by social and political factors.
Existing controls	<p>Landfill levy</p> <p>Landfill levies applied and administered in NSW by the Department of Environment, Climate Change and Water encourage diversion of waste from landfills.</p> <p>MIDWASTE</p> <p>Greater Taree and Gloucester are members of MIDWASTE, a regional forum made up of eight member councils located on the Mid North Coast, whose focus is regional co-operation in waste management and waste minimisation. A major objective of MIDWASTE is to provide measurable diversion of waste from landfill. To that end, MIDWASTE has a three year ‘Regional Resource Recovery Strategy’, which establishes a range of measures to be implemented by councils</p>

to reduce waste going to landfill including through:

- a waste education strategy;
- monitoring of waste volumes and types diverted from landfill;
- regular reporting of waste diversion to DECCW.

The two councils have also established a partnership with Great Lakes to deliver more cost-efficient waste disposal services.

Waste management strategies

Other Rural Councils have individual waste management strategies in place. These generally cover:

- fortnightly, kerbside recycling programs;
- reprocessing of garden waste;
- participation in the Hunter Waste Education Group;
- various other information and education initiatives designed to encourage community waste minimisation, recycling and to discourage illegal dumping.

Emissions monitoring

Calculation of emissions using the Solid Waste Emissions Calculator provided by the Department of Climate Change and Energy Efficiency suggests that the emissions from most Rural Councils' landfills are currently below the annual statutory threshold of 25,000 tonnes that requires reporting. However, this may change in the future, either due to a lowered threshold or increased waste levels.

Gaps and deficiencies

NGER reporting

Currently, there is uncertainty as to whether The National Greenhouse and Energy Reporting (NGER) Act applies to "unincorporated entities" including local councils. Although, the Australian Government has stated that it intends to amend the NGER Act so that it will apply to unincorporated entities in the future, when these changes will take place and how they will affect local council reporting of landfill waste emissions is unclear.

Community education

Waste education strategies, pursued through MIDWASTE, the Hunter Waste Education Group and individual councils, have provided significant information to the community on the benefits of recycling. Nevertheless, it is apparent from waste monitoring data that considerable unseparated waste is still going to landfills in the region. It is also apparent from illegal dumping and other community practices that sections of the community still do not understand the purpose and benefits of landfill levies or the environmental costs associated with illegal dumping.

Green waste

Green waste separation and diversion is currently limited in the municipalities to garden waste and then only to townships/urban areas.

Recommended region wide actions

Action M1

Regional waste management network

Rural Councils that are not currently members of MIDWASTE, should consider establishing a regional waste managers' network (with support from the NSW Waste Association and DECCW). The purpose of the network would be to:

- share information and knowledge;
- develop a consistent approach to waste policy and management regionally; and
- actively identify and pursue regional / sub regional opportunities for reducing carbon emissions from waste (e.g. improved waste separation, composting, energy recapture etc).

The network could potentially build on the functions of the established Regional Illegal Dumping Working Group.

This action can feasibly be implemented in the short term and would have only minor budgetary implications for each council.

Action M2

Surveys to identify regional volumes of specific waste types

Proposed initial research by the regional waste managers' network would include surveys to identify regional volumes of specific waste types (organics, general waste, construction & demolition and dry recyclables), as a basis for improving regional waste separation and capturing opportunities to reduce carbon emissions from waste.

This action can be implemented in the short term and is likely to involve only minor costs to individual councils.

Action M3

Clarify NGER reporting requirements

The regional waste managers' network and MIDWASTE, with support from the LGSA, should lobby the Australian government to clarify as soon as possible local council reporting requirements under the NGER Act, particularly with respect to emissions from landfills.

This action can be implemented in the short term and will involve only minor costs.

Action M4

Community education on front end separation of waste, landfill fees and illegal dumping

The regional waste managers' network and MIDWASTE, with support from the NSW Waste Association, should consider extending its education campaigns to improve community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees (as a user pays mechanism, including for potential future carbon costs) and the costs associated with illegal dumping.

This action can be implemented in the short term and is likely to involve only minor costs to individual councils.

Action M5

Options to increase diversion of organic waste

The regional waste managers' network and MIDWASTE should investigate options by member councils to increase diversion of organic waste from landfills. Options include but are not limited to:

- investment in and provision of technology by operators on site or at centralised facilities to divert and treat and organic waste from landfill; and
- adjustments by councils to their waste collection regime to enable households to put organic food waste into 'green bins' along with garden waste, for regular collection.

Investigation of options can be undertaken in the short to medium term. Implementation of option(s) is a long term action and is likely to involve major costs.

4.5.5. Energy management

Subset N Energy management	CPRS or other carbon pricing instrument increases fuel and energy costs (risk 20)
Focus	Energy consumption by Rural Councils including in their buildings, transport fleet and for street lighting
Councils identifying risk	Dungog, Muswellbrook, Singleton, Upper Hunter
Context	Although energy costs account for a relatively small proportion of Councils' budgets, a significant increase in energy prices (e.g. due to the Carbon Pollution Reduction Scheme or other carbon pricing initiative), could have a significant financial impact on its budget bottom line.
Existing controls	<p>Emissions assessment and strategies</p> <p>A number of Rural Councils were members of the Cities for Climate Protection Program through the 2000s¹¹. Under the program, each council undertook a baseline assessment of its Greenhouse Gas (GHG) emissions and initiated a range energy savings and emission reduction initiatives.</p> <p>A number of Rural Councils have also developed an Energy Savings Action Plan, as required under the <i>Energy Administration Amendment</i></p>

¹¹ Cities for Climate Protection ceased providing support to councils after 2008/2009.

(Water and Energy Savings) Act 2005.

Community energy efficiency programs

Councils participate in a number of programs promoting energy efficiency and greenhouse gas emissions reduction in the community.

Gaps and deficiencies

Monitoring and benchmarking

At present, there is not a clear and consistent approach to monitoring and benchmarking of energy consumption and GHG emissions at either an individual council, regional or national level. Thus although councils are currently tracking their energy consumption, it is not clear how this information will be used to assess the effectiveness of current and future energy efficiency programs.

Council energy efficiency programs

Other than the current HCCREMS Focus on Facilities Program, there is not generally a coordinated program targeting energy efficiency and emission reductions within Rural Councils. Lack of such a program can in part be attributed to a dearth of resources for program implementation but also could reflect the absence of clear lines of responsibility, from senior management down, for implementing energy efficiency measures in councils.

Recommended region wide actions

Action N1 Funding for a regional energy efficiency and emissions reduction strategy

HCCREMS Councils should seek funding for a regional energy & water efficiency and emissions reduction strategy. The strategy would target council facilities across the region and involve:

- audits of energy consumption in facilities;
- energy efficiency measures for identified high priority facilities;
- an accurate and consistent approach to benchmarking energy consumption and emissions to ensure accurate monitoring and assessment of energy and emission reductions pursued through energy efficiency measures; and
- guidelines and design specifications for new (or upgraded) council buildings to ensure high levels of thermal comfort and energy efficiency.

Funding should be sought in the short term. Once funding has been obtained, program implementation would proceed over the medium to long term.

Recommended actions for individual Rural Councils

Action N2 Assessment and implementation framework for energy efficiency and emission reduction programs

Councils should establish an assessment and implementation framework for proposed energy efficiency and emission reduction programs. The framework should include:

- cost effectiveness assessment of programs;
- priority setting;
- clear lines of responsibility for implementation;
- a timeframe for implementation; and
- program monitoring.

This action would be implemented in the medium term consistent with outcomes of Action N1.

4.6. Economic Development

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority environmental management risks. Priority risks addressed in this section are:

Subset O: Decline in viability of regional mining sector linked to climate change policy (risk 21).

Subset P: Decline in viability of regional agricultural sector linked to changed climate (risk 22).

4.6.1. Decline in viability of regional mining sector linked to changed climate

Subset O Viability of mining	Decline in viability of regional mining sector linked to changed climate (risk 21)
Focus	Mining sector and associated economic development in the region
Relevant councils	Muswellbrook, Singleton, Upper Hunter
Context	<p>Mining is a key sector for a number of Rural Council LGAs.</p> <p>About 20% of all Singleton residents for example, are employed in the sector, principally in the coal mining industry. In Muswellbrook the equivalent figure is 16%. Although there are no coal mines in the Upper Hunter Shire, the mining industry is important for wealth generation in the Shire. About 7% of Upper Hunter residents are employed in the sector. International and national greenhouse emission mitigation policies have the potential to affect the long term viability of coal mining. This would have major economic and social impacts in these council areas and adversely affect the Council's rate base.</p>
Existing controls	<p>A number of strategies and programs are currently in place locally and at the regional level that aim to increase economic diversity and promote community resilience. They include:</p> <ul style="list-style-type: none"> ▪ land use planning through the LEP and DCP, to promote alternative land uses (to mining); ▪ the Upper Hunter Diversification Project, a joint initiative of Singleton, Muswellbrook, Upper Hunter, Dungog, Gloucester and Great Lakes councils to identify and promote alternative industry and investment strategies for the region. ▪ Council's own economic development and community strategies.
Gaps and deficiencies	The Upper Hunter Diversification Project is in an early phase. More resources are clearly needed if the strategy is to move into the next phase of strategy and program implementation.

Recommended region wide actions

Action O1 Implement strategies developed by the Upper Hunter Diversification Project

Councils, in partnership with regional industry associations, the Hunter Region Development Authority and Industry & Investment NSW, should implement strategies developed by the Upper Hunter Diversification Project that are aimed at achieving new / alternative industry investment and enhancing employment in the region. Implementation of the strategies will require:

- a strengthened project group with senior management support;
- state and federal government support (including funding from government income from mining sector and carbon credit receipts); and;
- industry representation from sectors being targeted.

4.6.2. Decline in viability of regional agricultural sector linked to changed climate

Subset P Viability of agriculture	Decline in viability of regional agricultural sector linked to changed climate (risk 22)
Focus	Agricultural sector and associated economic development in the region
Relevant councils	Dungog, Muswellbrook, Singleton, Upper Hunter
Context	Agriculture is a significant industry for the region, providing more than 20% of local employment in Upper Hunter Shire for example, and 13%, 9% and 5% in Dungog, Muswellbrook and Singleton respectively. Some agricultural industries in the region may become less viable as a consequence of climate change. This decline would have significant flow on affects to the local economy and to community and social networks.
Existing controls	A range of plans, strategies and programs are currently in place locally and at the regional level that aim to protect and enhance the resilience and viability of agriculture. These include: <ul style="list-style-type: none"> ▪ land use planning through the LEP and DCP, to protect prime agricultural land; ▪ ‘Crops for the Hunter’, a joint initiative of Muswellbrook, Singleton and Upper Hunter Shire Councils that supports agricultural diversification in the Upper Hunter through new methods of production and management, new produce and identifying new markets;

- the Farm Diversification Grant Scheme (through Crops for the Hunter), which provides an annual competitive grant scheme to encourage diversification throughout the agricultural production chain;
- farm based water efficiency programs, initiated through Industry & Investment and DECCW, which encourage water efficient agricultural practices.

Gaps and deficiencies

General programs to enhance the resilience of agriculture and to diversify the industry regionally are well targeted and quite effective. However, there are major gaps in understanding of:

- which agricultural industries in the region will be impacted by climate change;
- how they will be impacted; and
- options to increase their resilience in the face of impacts.

Recommended region wide actions

Action P1 Agriculture industry and climate change case studies

Councils, in partnership with regional industry associations, and support from Industry & Investment NSW, should seek to undertake agricultural industry and climate change case studies. Each case study will identify potential impacts of climate change on the relevant industry and examine strategies to build resilience of the industries to those impacts.

Action P2 Regionally significant agricultural lands map

Councils, in partnership with the agricultural industry, Industry & Investment NSW and the Department of Planning should prepare a Regionally Significant Agricultural Lands Map to identify agricultural land in the Hunter and Central Coast region that has high productive capacity but is potentially vulnerable to climate change. Councils and the State Government should apply outcomes of the mapping exercise to inform future land use planning decisions in the region – ensuring that regional agricultural land that has high productive capacity is protected in the face of changing climatic conditions.

Action P3 Demonstration of low carbon agricultural practices

Councils, in partnership with regional industry associations and the Hunter Region Development Authority should seek funding from State Government for regional projects to demonstrate low carbon agricultural practices.

5. Conclusion

5.1. Risk Assessment and Adaptation Plan Review

Climate change poses a number of challenges for Rural Councils. The climate change risk assessments undertaken for these councils identified more than 60 risks to their objectives and areas of operation. Twenty two of those risks were rated ‘High’ or ‘Extreme’ by a number of Rural Councils and, as such, have been identified as ‘priority risks’ for the purpose of adaptation planning by the councils. Of the 22 priority risks, eight relate to infrastructure and assets, one to land use planning and management, five to emergency management and corporate services, six to environmental management and protection and two to economic development.

Treatment of risks is an essential next step in the risk management process. In climate change parlance, the treatment of risks is generally referred to as ‘adaptation’. It is apparent from engaging with staff at workshops and subsequent analysis that Rural Councils already have in place many policies, programs and measures that are relevant to the priority risks. This is unsurprising given that many of the climate change risks to the Council add to or intersect with pre-existing risks. It is equally apparent, both from the risk assessment and adaptation planning processes that the councils will need to implement additional measures if the risks of climate change to the organisation and to its objectives are to be effectively addressed.

Section 4 of this report contains some 57 actions for addressing the priority risks. In particular, these actions identify collaborative opportunities for councils to respond to climate change. When implemented together, the actions will provide Rural Councils with an initial response to the challenges of climate change.

Table 8 provides an overview of the different types of actions proposed in the Action Plan.

Table 6. Categories of recommended adaptation actions

Category of action	Number of actions	
	Region wide	Council
Changes to legislation / regulations/ standards	1	1
New / amended strategies and plans	7	5
Improved decision-making processes	3	6
Research and information collection	12	2
Community education, engagement and capacity building	5	-
Training and information sharing	7	2
On-ground works (or associated funding)	3	2
Risk diversification /insurance	1	-

Information in the table reveals:

- the wide spectrum of action types; and
- the substantial numbers of actions in the community education, research and training categories, highlighting the need to improve knowledge and understanding of climate change

in the region and to enhance the capacity of Rural Councils, other agencies and the broader community to respond effectively to the risks posed by climate change (see Box 2).

Box 2: Knowledge and Capacity Building on Climate Change

A number of research and information collection requirements are identified in the Adaptation Plan, highlighting the need for building knowledge on climate change. In addition, numerous educations and training programs are recommended, emphasising that good information, while important, is not a sufficient condition for effective local and regional responses to the issue; capacity building - amongst Rural Council and other agency staff and amongst the broader community - is also crucial to ensure that available information on the impacts of climate change is well used.

The Adaptation Plan points to a need to improve our understanding of the impacts of climate change at the local and regional levels, especially in relation to the frequency and magnitude of flooding and environmental and economic development impacts. Education and training programs are especially pertinent to stormwater management and emergency management.

Research, education and training programs will tend to be more effective and efficient if they are implemented and coordinated at the regional level – hence actions in the Adaptation Plan tend to be listed as region wide actions. Actions are as follows.

Research, monitoring and data collection

- Guidelines should be developed that establish standard procedures for asset condition assessment and reporting by councils (Action A3)
- Councils and other agencies should model changes to extreme rainfall intensities (Action B1, E1, F1)
- Water authorities should consider funding modelling of down-scaled regional, climate change and associated hydrological projections (Action D1)
- Develop guidelines for integrating climate change projections into flood hazard models, maps and management (Action F2)
- Council should undertake site specific hydrological / flood modelling where the perceived risk is high and new flood management studies do not fully reflect region wide rainfall intensity projections (Action F4)
- Regional water quality monitoring strategy (Action J3)
- Regional modelling to identify water and nutrient runoff (Action J4)
- HCCREMS should commission research into endangered species and communities risk factors and impacts of climate change (Action K1)
- HCCREMS should commission research to identify projected changes in climate on likely future terrestrial weed distribution (Action L1)
- The regional waste managers' network should undertake surveys to identify regional volumes of specific waste types as a basis for improving regional waste separation (Action M2)
- The regional waste managers' network MIDWASTE should investigate options by member councils to increase diversion of organic waste from landfills (Action M5)
- Undertake agricultural industry and climate change case studies (Action P1)
- Prepare a Regionally Significant Agricultural Lands Map (Action P2)

Education and engagement, training, information sharing

- Regional guidelines should be developed for the design and management of new and upgraded stormwater and drainage assets (Action B2)
- A region wide stormwater and professional capacity building program should be developed

(Action B3)

- Councils should undertake a regional communications and information campaign on stormwater and flood management (Actions B5)
- Develop guidelines for incorporating climate change adaptation into design criteria for new roads and bridges (Action C1)
- Establish a panel of key experts on regional transport research and programs (Action C4)
- Council should seek professional training on climate change and asset planning (Action C6)
- Produce a regional information package to advise the community on how councils are addressing climate change in flood management processes (Action F3)
- Undertake an education campaign to promote increased households' preparedness for floods (Action G3)
- Conduct emergency preparation exercises combining multiple events, multiple agencies and across zones (Action H1)
- Establish a central access point for all regional information on emergency management procedures (Action H3)
- Training of staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN (Action H5)
- Rural Councils that are not currently members of MIDWASTE, should consider establishing a regional waste managers' network (Action M1)
- The regional waste managers' network MIDWASTE should develop an education campaign to raise community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees and the costs associated with illegal dumping (Action M4)

Another noteworthy aspect of the proposed actions is that some actions intersect different risk areas and subsets. Two intersecting actions worth noting are:

1. Natural Disaster Relief Funding

The need for clarified and simplified Natural Disaster Relief Funding arrangements is an important action in response to a number of risk Subsets in the infrastructure, emergency management and business continuity areas.

2. Modelling of extreme rainfall intensity

Modelling of extreme rainfall intensity is crucial to better understanding of risks and adaptation responses in a number of infrastructure and emergency management areas including stormwater management, transport infrastructure and traffic management and land use planning.

5.2. Next Steps

5.2.1. Risk Assessment Process

It is unlikely that any severe risks have been overlooked or that risks have been seriously misrated during the local and regional risk assessment processes. Nevertheless, it is important that the local and regional scale risks that have been identified are reviewed on a regular basis. This will ensure that the relative importance of these risks remains accurate so that adaptation responses are effectively and efficiently addressing those risks of most importance.

At an individual council level, it is important that the outcomes of the local and regional risk assessment processes are integrated with other aspects of council strategic risk management and

planning. Senior management should remain engaged with this process and remain responsible for maintaining the risk assessment and implementing treatments (adaptation actions) flowing from it, including actions recommended in this report.

5.2.2. Adaptation Planning Process

Prioritising adaptation actions

Consistent with the good practice principles of adaptation outlined in section 3.2 of this report, it is important that the process of adapting to climate change is not a resource intensive exercise for Rural Councils. That is why the actions identified in this report focus on regional opportunities for collaboration across councils and other stakeholders. As identified previously, a collaborative approach of this nature will significantly enhance the capacity of individual rural councils to effectively respond to climate change in a timely manner.

Additionally, many of the recommended actions in this report are intended to build on existing measures. Many others aim to improve understanding of the potential impacts of climate change and potential adaptation responses and designed therefore to prevent pre-emptive actions that lead to ‘maladaptation’ or ‘over adaptation’¹². This approach is consistent with the concept of ‘adaptive management’, which is about small-scale, incremental responses, rather than major, resource intensive new programs or investments.

Prioritisation of actions is another aspect of the adaptive management approach. Before implementing recommended measures therefore, it is essential that the measures are prioritised, both within each risk subset and between risk subsets. Thus precedence would normally be given to measures that:

- have low budgetary implications;
- can be implemented in the short to medium terms;
- are not likely to be administratively burdensome;
- are not likely to face other significant barriers to implementation such as institutional or political constraints; and
- are likely to have benefits beyond addressing the direct impacts of climate change (i.e. ‘win-win’ outcomes).

In some instances, recommended measures may meet most of the above criteria except the first listed. In those instances, HCCREMS and Rural Councils should consider undertaking more detailed analysis of the measures, using cost benefit analysis or cost effectiveness for example.

Coordinated implementation

Most actions identified in the Adaptation Plan will require a coordinated approach across councils and other agencies to achieve effective implementation (see Table 6). Other actions, directed at individual councils, will require effective internal coordination.

As well as undertaking direct dialogue with relevant stakeholder agencies in the region, HCCREMS and its member Rural Councils should be mindful of climate change adaptation priorities identified by federal and state governments. Three documents in particular have particular relevance in this regards:

¹² Maladaptation is an action that leads to perverse outcomes (e.g. reduce the community’s ability to adapt in the long term). Over adaptation is an action that is inefficient or proves to be unnecessary.

- **National Climate Change Adaptation Framework.** The Council of Australian Governments (COAG) has developed the framework as part of its Plan of Collaborative Action on Climate Change. The framework outlines the future agenda of collaboration between governments to address climate change impacts. A key focus of the framework is to “... support decision-makers understand and incorporate climate change into policy and operational decisions at all scales and across all vulnerable sectors”. Priorities identified in the framework that are of particular relevance to Rural Councils’ priority climate change risks include infrastructure & planning; natural disaster management and tourism.
- **Adapting to Climate Change in Australia.** In 2010, the Australian government released a position paper on Adapting to Climate Change in Australia. The position paper identifies six national priority areas for action, two of which – infrastructure and natural disaster management – very relevant to Rural Councils’ adaptation plan.
- **NSW Climate Change Action Plan.** This is currently under development through the NSW Department of Environment, Climate Change and Water.

Response to non-priority risks

As previously noted, the adaptation plan addresses 22 ‘priority risks’. Nevertheless, risks that are not addressed in this adaptation plan should not be ignored. HCCREMS and its member Rural Councils should maintain a ‘watching brief’ on non-priority risks as a part of the review process outlined above. This means:

- reviewing the ratings of non-priority risks as new information comes to light;
- upgrading a risk to ‘priority’ should new information indicate a ‘high’ or ‘extreme’ risk rating in the short to medium terms and an ‘extreme’ rating in the longer term;
- identifying adaptation actions for the upgrades risks.

5.2.3. Look for Opportunities

The focus of the adaptation plan is on addressing risks of climate change. Climate change however, is likely to create opportunities for Rural Councils; some for the Councils and their objectives and some for the broader community. Certain opportunities could stem from favourable climate changes while others could stem from international, national and local responses to the impacts of climate change (e.g. improved building design). HCCREMS and its member Rural Councils should investigate these opportunities and incorporate measures aimed at realising them into its climate change response.

5.2.4. Recommendations for Implementing the Action Plan

A key means through which the outcomes of this report can be progressed at the individual Council level is through integration of its recommendations within Council’s strategic planning processes. As stipulated in the Planning and Reporting Guidelines for local government in NSW (NSW Division of Local Government, 2010), the Community Strategic Plan is now the highest level plan that councils are required to prepare.

1. On that basis, it is recommended that in the process of formulating their Community Strategic Plan Rural Councils should consider integrating the outcomes of this Climate Change Adaptation Plan (including proposed actions and other recommendations).

Additionally, the following recommendations are made for implementing this Action Plan at the regional level:

2. Establish a regional technical reference group, co-ordinated by HCCREMS, to oversee prioritisation, implementation and evaluation of regional adaptation actions identified for Rural Councils
3. Engage key external stakeholders identified in the regional plan to encourage their participation and support in implementing the regional adaptation actions that have been identified.
4. The regional adaptation plan should be reviewed on a regular basis (e.g. every 5 years), including a review of all risk ratings and consideration of new climate change risks in the light of new scientific information and changing circumstances in the region.
5. A regional approach to communicating the outcomes of climate change risk assessment should be developed to ensure that the community is properly informed in a timely manner and does not misinterpret, understate or overstate the risks of climate change to the region.

References

- Blackmore, K.L. & Goodwin, I.D. (2010a). *Historic and Projected Impacts of Climate Change on the COASTAL Climatic Zone of the Hunter, Central and Lower North Coast*. Hunter and Central Coast Regional Environment Management Strategy (HCCREMS), NSW
- Blackmore, K.L. & Goodwin, I.D. (2010b). *Historic and Projected Impacts of Climate Change on the CENTRAL Climatic Zone of the Hunter, Central and Lower North Coast*. Hunter and Central Coast Regional Environment Management Strategy (HCCREMS), NSW
- Blackmore, K.L. & Goodwin, I.D. (2010c). *Historic and Projected Impacts of Climate Change on the WESTERN Climatic Zone of the Hunter, Central and Lower North Coast*. Hunter and Central Coast Regional Environment Management Strategy (HCCREMS), NSW
- Cimato, F. and Mullen, M. (2010). *Adapting to Climate Change: Analysing the Role of Government*, Department of Environment, Food and Rural Affairs, UK (2010).
- CSIRO (2007a). *Climate Change in the Hunter-Central River Catchment*, prepared for the New South Wales Government, NSW
- CSIRO & Bureau of Meteorology (2007b). *Climate Change in Australia – Technical Report 2007*, Melbourne
- Intergovernmental Panel on Climate Change (IPCC) (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report, Summary for Policy Makers, IPCC, Geneva.
- Macadam, I., McInnes, K. & O’Grady, J. (2007). *Climate Change Projections for the Woolli Woolli Estuary and Batemans Bay*, A report for the New South Wales Department of Environment and Climate Change, NSW.
- NSW Division of Local Government, Department of Premier and Cabinet (2010). *Planning a Sustainable Future: Planning and Reporting Guidelines for local government in NSW*, Division of Local Government, Sydney.
- Stern, N. (2006). *Stern Review on the Economics of Climate Change*, HM Treasury, London.

Glossary

ARI	Average Recurrence Interval
AR&R	Australian Rainfall and Runoff
DCCEE	Department of Climate Change and Energy Efficiency (Australia)
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water
DISPLAN	Disaster Plan
DLG	Division of Local Government, NSW Department of Premier & Cabinet
HCCREMS	Hunter and Central Coast Regional Environmental Management Strategy
IWCM	Integrated Water Cycle Management
IPCC	Intergovernmental Panel on Climate Change
LAPP	Local Adaptation Pathways Program
LEMC	Local Emergency Management Committee
LEP	Local Environmental Plan
LGA	Local Government Area
LGSA	Local Government and Shires Association, NSW
LIDAR	Light Detection and Ranging
MER	(natural resources) Monitoring Evaluation and Reporting
NDRF	Natural Disaster Relief Fund
RFS	Rural Fire Service
RTA	Roads and Traffic Authority, NSW
SEPP	State Environmental Planning Policy
SES	State Emergency Service
WSUD	Water Sensitive Urban Design

Appendix I: Climate Change Scenarios for Rural Councils

Table 7. Climate change scenarios Central zone

Climate Variable	Current ¹ (indicative)	Indicative change ² (relative to current)		Comments
		2050	2100	
1. Sea level rise and storm surge				
Sea level		↑ 0.4m	↑ 0.7–1.8m	State planning level is currently 0.9 metres, consistent with IPCC AR4 projections
Storm tide – max height, 1:100 ARI (average recurrence interval)	1.4m	1.8m	2.3m	Based on NSW design still water levels - excludes wave setup
Storm tide – ARI (1.4 m)	1:100	1:1	na	Limited regional modelling of recurrence intervals has been undertaken to date
2. Extreme rainfall, flooding and storms				
24 hr rainfall intensity (max)	190mm	↑ up to 20%	↑↑	Based on NSW models - Hunter region not well represented. Greatest intensity increases likely in Summer
Extreme rainfall frequency (95th %ile)		↑	↑↑	Increases in Summer and Autumn
Flooding – Annual Exceedance Probability (AEP)		↑ flash	↑↑ flash	Specific projections not available
		↑ riverine	↑↑ riverine	
Maximum wind gust intensity	122 km/hr	↑↓	na	Possible increase in Spring and decrease in Winter
Frequency of high wind gusts (95 th %ile)		↑↓	na	Possible increase in Summer, and decrease in Winter
3. Fire weather				
Number of very high and extreme fire danger days	16	↑ up to 24	na	Based on CSIRO projections for one site (Williamtown). Regionally specific projections are not as conclusive, although they do indicate an increase in fire danger for autumn
Length of fire season		↑	na	Fire season extends further into Autumn
4. Average and extreme temperatures				
Average annual maximum temperature	25	↑ up to 2.0 °C	↑ up to 4.0 °C	Greatest increases in autumn and winter
Days per year > 37 °C	7	↑	↑↑	Specific projections not available

Climate Variable	Current ¹ (indicative)	Indicative change ² (relative to current)		Comments
		2050	2100	
Days per year < 0 °C	6	no change	na	Decrease in winter, increases in autumn and spring
5. Average rainfall and water availability				
Average annual	810 mm	↑ 7%	na	Increases in Summer, Winter and Spring, decrease in Autumn
Summer	220 mm	↑ 20%	na	
Autumn	250 mm	↓ 12%	na	
Winter	150 mm	↑ 24%	na	
Spring	190 mm	↑ 5%	na	
Number of rainy days per year	120	↓	↓	Specific projections not available
Average water balance (rainfall less evaporation)		no change	na	Moister in spring and summer, drier in autumn
Annual stream flows		↓ 5-10 %	na	Regional projections not available - based on 'mid' scenario for Namoi catchment modelled for the MDB Sustainable Yields project
Drought frequency	10-20% of months	↑ to 24-28% of months	na	Regional projections not available - based on projections for NSW central-north coast

Table 8. Climate change scenarios Western zone

Climate Variable	Current ¹ (indicative)	Indicative change ² (relative to current)		Comments
		2050	2100	
1. Sea level rise and storm surge				
Not applicable				
2. Extreme rainfall, flooding and storms				
24 hr rainfall intensity (max)	118mm	↑ up to 20%	↑↑	Based on NSW models - Hunter region not well represented. Greatest intensity increases likely in Summer
Extreme rainfall frequency (95th %ile)		↑	↑↑	Increases in Summer and Autumn, decrease in Winter.
Flooding – Annual Exceedance Probability (AEP)		↑ flash	↑↑ flash	Specific projections not available
		↑ riverine	↑↑ riverine	

Climate Variable	Current ¹ (indicative)	Indicative change ² (relative to current)		Comments
		2050	2100	
Maximum wind gust intensity	na	↑↓	na	Possible increase in Spring and decrease in Winter
Frequency of high wind gusts (95 th %ile)		↑↓	na	Possible increase in Summer, and decrease in Winter
3. Fire weather				
Number of very high and extreme fire danger days	16	↑ up to 24	na	Based on CSIRO projections for one site (Williamstown). Regionally specific projections are not as conclusive, although they do indicate an increase in fire danger for autumn
Length of fire season		↑	na	Fire season extends further into Autumn
4. Average and extreme temperatures				
Average annual maximum temperature	24	↑ up to 2.0 °C	↑ up to 4.0 °C	Greatest increases in autumn and winter
Days per year > 37 °C	5 (elevated) 15 (other)	↑	↑↑	Specific projections not available
Days per year < 0 °C	22	no change	na	Possible decrease in winter, increases in autumn and spring
5. Average rainfall and water availability				
Average annual	690 mm	↑ 17%	na	Increases in all seasons
Summer	230 mm	↑ 25%	na	
Autumn	145 mm	↑ 22%	na	
Winter	125 mm	↑ 20%	na	
Spring	190 mm	↑ 2%	na	
Number of rainy days per year	106	↓	↓	Specific projections not available
Water balance (rainfall less evaporation)		↓	na	Moister in spring, drier in autumn and winter - significant reduction after 2040
Annual stream flows		↓ 5-10 %	na	Regional projections not available - based on 'mid' scenario for Namoi catchment modelled for the MDB Sustainable Yields project

Climate Variable	Current ¹ (indicative)	Indicative change ² (relative to current)		Comments
		2050	2100	
Drought frequency	10-20% of months	↑ to 24-28% of months	na	Regional projections not available - based on projections for NSW central-north coast