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Integrated Regional Vulnerability Assessment: Riverina Murray

Volume 2: Priority Sector Workshops – Summary Findings

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Introduction

From January to July 2012, the Office of Environment and Heritage conducted several sector-based workshops in the Riverina Murray, to assess the likely impacts and vulnerabilities of these sectors to climate change. NSW government agencies, local governments and government service providers were involved.

The workshops addressed the priority sector areas for the Riverina Murray that had been identified by the IRVA Steering group. The five priority sectors were:

1. landscapes and ecosystems
2. industries
3. settlements and infrastructure
4. human services
5. emergency management.

Workshops were grounded on a participatory approach and systems thinking, to enable workshop members to conceive of their role and organisation as a part of the wider regional dynamic.

Participants were presented with the projected changes to climate for the Riverina Murray region, then asked to collectively construct influence diagrams to show climate change impact pathways and relationships with other sectors.

Having established the context for changes to business operation and sectoral function as a consequence of these impacts, adaptive capacity was assessed. To determine sectoral indicators of adaptive capacity, the following questions were asked:

Given what we know are the likely effects of climate change in this region, for your sector:

1. ***What must change to service the community and why?***
2. ***What is needed to enable change?***
3. ***Where is change needed most / least?***

From this discussion, qualitative indicators of adaptive capacity were identified under the following categories: human, social, natural, physical, and financial.

The following sector reports present the outcomes of these workshops and background information about each of the sectors.

1 Landscapes and ecosystems sector

1.1 Background

Ranging from the inland foothills of the Great Dividing Range, through to fertile slopes and plains and arid landscapes of the Western Division, the Riverina Murray has an economy predominantly based on primary industries. The region lies in the drainage basin of the Murray and Murrumbidgee rivers and their tributaries, and includes extensive floodplains and wetlands that are internationally recognised. The region's biota is predominantly adapted to arid and semi-arid environments, with some eastern and cool-climate influences on the slopes and along major watercourses[1]. The region's river systems dominate both the landscape and land uses, with ecosystem health and economic productivity reliant on adequate water availability.

The River Red Gum forests of Millewa through Barmah in Victoria form the largest connected River Red Gum ecosystem in Australia which, in conjunction with the region's Ramsar wetlands and alpine areas, contribute to both conservation and tourism outcomes. The connectivity of conservation areas along the region's waterways provide biodiversity refugia and enhance ability for ecosystem adaptation.

The natural assets of the region have attracted major settlements along rivers at Albury-Wodonga, Wagga Wagga, Hay, Echuca–Moama, Mildura–Buronga and Wentworth. The river system has permitted the growth of irrigated agriculture and townships such as Griffith, Leeton, Coleambally and Deniliquin, and resulted in Australia's largest hydro-electric scheme in the Snowy Mountains with the specifically built townships of Khancoban and Cabramurra. The growth of Wagga Wagga, Albury and river townships is resulting in increased peri-urbanism.

There are three distinct sub-regions in the Riverina Murray: the Uplands and Slopes and Mid-west and Far-west, which comprise of markedly different landscapes and ecosystems. These biophysical traits influence land use, management and settlement patterns. These sub-regions cover a range of bioregions.

1.1.1 Uplands and slopes

The Uplands and Slopes sub-region encompasses ecosystems ranging from alpine grasslands, heaths and eucalypt woodlands, through to the extensive foothills and isolated ranges of the lower inland slopes of the Great Dividing Range.

The Uplands comprise part of the only example of alpine climate in NSW, with snow persisting for up to six months of the year. The alpine areas remain predominantly forested, with parts of the Mount Kosciuszko National Park and surrounds managed as conservation area. The Snowy Hydro, forestry, grazing and some horticulture represent major productive land uses (Figure 1).

The Slopes are dominated by a sub-humid climate and hot summers. Soils range from shallow, stony soils on ridge tops and hills and poorly drained valley subsoils often causing dryland salinity, to alluvial clays, sands and loams in the Riverine Plain. The slopes have been intensively cleared and cultivated for grazing and cropping, with the major regional cities of Wagga Wagga and Albury developed from the

[1] DECCW, 2010, Climate Impact Profile.

proceeds of agriculture[2]. Only fragmented patches of remnant vegetation remain, resulting in a decline of native biodiversity that is compounded by threats from invasive species[3].

The Slopes sub-region includes two wetlands of significance, the Barmedman-Yiddah Creek Floodplain near Lake Cowal, which is thought to have capacity to support 32,000 waterbirds, and Wiesner's Swamp north-west of Albury which supports the vulnerable brolga (***Grus rubicundus***)[4].

1.1.2 Mid-west

The Mid-west sub-region extends from near Ivanhoe in the north, and is bordered by the Murray River to the south, Narrandera in the east and Balranald in the west. The Mid-west has a persistently dry, semi-arid climate, with hot summers and cool winters.

The major river systems in the region include the Lachlan, Murrumbidgee and Murray rivers, which flow from the highlands in the east, across the fertile Riverina Plain to the arid mallee country in the west. The rich soils of the Riverina Plain, winter rainfall and river water for irrigation has produced fertile grounds for horticulture, rice and cotton as well as extensive broadacre farming (Figure 1). Cropping in the region predominantly requires summer irrigation, significantly altering water availability to natural systems during this period. While the landscape has been fundamentally changed to allow for irrigated agriculture, which has adversely affected some original ecosystems, opportunities have been also created for some wetlands species, particularly in areas of rice cropping where extended periods of flooding occur[5].

This landscape also supports significant native vegetation, however much of the native vegetation has been either replaced or altered substantially[6]. Native vegetation includes eucalypt communities in sandier soils and salt-tolerant grasses and saltbush shrublands downstream on the Murrumbidgee River where saline-heavy clays occur. The riparian woodland communities along the Murray and Murrumbidgee rivers provide important connectivity for biodiversity, and are reliant on spring flood events to flush and rejuvenate the system to maintain healthy ecosystem function.

A key feature in the Mid-west sub-region are the important wetlands of the Murrumbidgee-Lachlan confluence, Barmah-Millewa River Red Gum Forest, and Edward and Murrumbidgee River floodplains. These areas play a substantial role in the functioning of the Murray River, particularly in terms of hydrology, flood mitigation, water quality, sediment deposition, river health and refugia for biodiversity. Changes to hydrology are a key threat to the area's biodiversity and ecosystems, but there are also impacts from invasive species, altered nutrient levels, salinity, grazing pressure, reduced flows and water storage.

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[2] NSW Parliamentary Library, 2012, 'The Murrumbidgee and Murray Regions: An Economic Profile', e-brief 7/2012

[3] Office of Environment and Heritage, 2011, Bioregions of NSW, http://www.environment.nsw.gov.au/bioregions/Bioregions.htm

[4] Office of Environment and Heritage, 2011, Bioregions of NSW, http://www.environment.nsw.gov.au/bioregions/Bioregions.htm

[5] McGinness et al, 'Literature review – Biodiversity in the Riverina: Potential impacts of irrigation change', CSIRO Sustainable Ecosystems

[6] McGinness et al, 'Literature review – Biodiversity in the Riverina: Potential impacts of irrigation change', CSIRO Sustainable Ecosystems

1.1.3 Far west

The Far west sub-region extends from north of Pooncarie, Ivanhoe in the east, the Murray River from Barham to Wentworth in the south, and the South Australian border to the west. The major regional township of Wentworth lies on the NSW side of the Murray, downstream of the larger city of Mildura in Victoria. Both settlements have historically been built on the river trade, and now support irrigated agricultural communities.

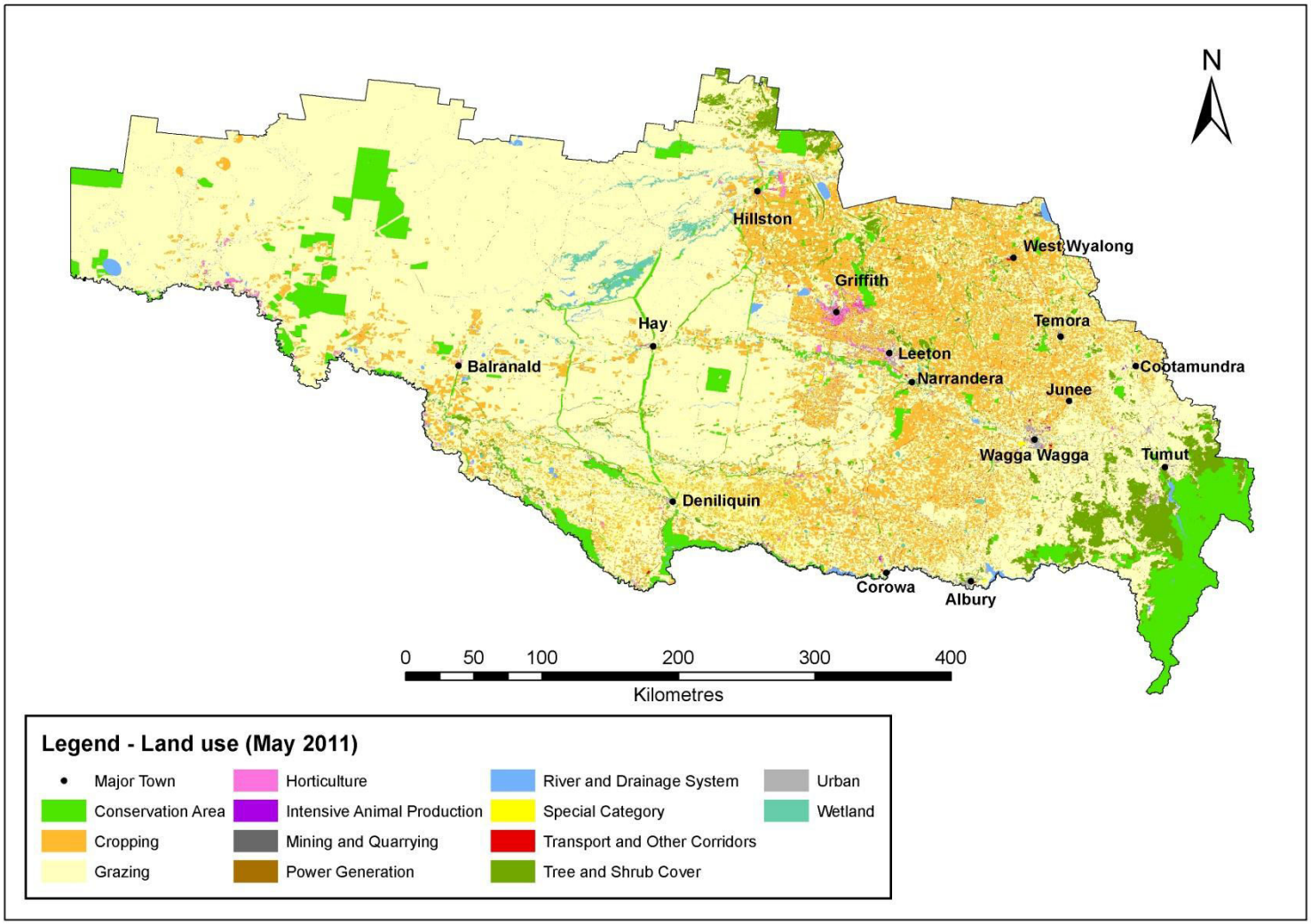
Dominated by a hot semi-arid climate, the landscape is characterised by dunefields of low-lying mulga scrublands and grasses, sandplain woodlands and mallee scrubland, and undulating, dry grassland plains. Significant conservation areas occur in this sub-region (Figure 1), with the Indigenous cultural history and assets of Mungo National Park and Yanga National Park attracting tourism. However, habitat fragments are generally declining associated with agricultural clearing and rare, large-scale fires, affecting the future of biodiversity.

1.2 Workshop participants

This workshop was held in Wagga Wagga on 26 and 27 April 2012, with additional workshops held on 23 May in Wagga Wagga and on 24 May at Albury. In total, 28 attendees participated from the following organisations:

- Albury City Council
- City of Wagga Wagga
- Environment Protection Authority
- Greater Hume Shire Council
- Murray Catchment Management Authority.
- Murrumbidgee Catchment Management Authority
- NSW Office of Water
- Office of Environment and Heritage
- Riverina Environmental Education Centre

Figure 1 Riverina Murray Land Use



1.3 Findings: Indicators of adaptive capacity

The following indicators and descriptions are adapted from the discussions had by participants in the Landscapes and Ecosystems workshops. As much as possible this text maintains the original wording used by participants. Where necessary, changes have been made for readability or to explain concepts and terms.

Capital	Indicators of adaptive capacity	Importance of indicator and adaptation response
Human	Adaptive regional communities	Adaptability is a strength of communities in regional areas. Impacts of climate change may develop slowly, allowing people to gradually adapt. However, there is likely to be a lag in community response, which could limit adaptation options in comparison to early adaptation.
	Regional knowledge base	Management of climate change needs engagement with local research institutions, to tap into expertise and active research. Better links between academics and practitioners are required to ensure that existing regional facilities target relevant research gaps, such as climate risk management and planning for the Murray Darling Basin. The regional presence of some research institutions has diminished. For example the CSIRO research centre at Deniliquin moved to Canberra 10 years ago, and the Griffith research centre has suffered cut backs. In addition, there has been a steady draw down of technical support from the State agencies in the regions generally. Having access to the relevant expert at the right time, in the right location, is not always possible.
	Demographic change	The younger generation is being lost from the regions. In particular, in the South West of the region there is an increasing movement of people from agriculture into mining. In addition, older farmers are retiring. The farm population has declined in part because the amount of labour employed on each farm has declined (e.g. at turn of 20th century each property would have multiple stockmen and farm hands – this is no longer financially viable). The incomes that can be made from farming are no longer sufficient to educate children at boarding school to improve their education. This limits options for younger farming families to remain in regional areas. People with professional qualifications and skills don't want a 'subsistence livelihood' on the land, and are unlikely to be satisfied with a farming income. This trend is strongest in the smaller towns, while larger regional centres seem to continue to grow. People move from remote and regional areas because the provision of basic services is poor (such as education and health). As transport to larger towns becomes easier (including better roads), more and more services are moved out of smaller towns, exacerbating this problem.

		These issues result in a loss of knowledge/ intellectual capital/ mentoring of younger staff and high turn-over of staff in the natural ecosystems sector, and are an issue for both Local Government (LG) and CMAs. For example, the Western region doesn't have adequate human resources because of low rates of services, communications, skills and education opportunities. The absence of these services means that attracting people and maintaining human resources in regional locations is difficult. The human capital of the CMA is at risk because of uncertainty related to funding. With this budget uncertainty, it is difficult to build and retain human capital, and establish both organisational and program innovation. Changes to farm management are also driving demographic change and affecting adaptive capacity. Each property manager is now managing an extensive tract of land, which may limit their ability to engage in natural resource management (NRM). Land managers have fewer resources and are operating in 'survival mode', which impacts their ability and desire to be involved in CMA programs. Under such conditions, landscapes and ecosystems are not a priority. CMAs have also found that there is reluctance among younger people to get involved. Land managers are predominantly of an older age group. Tendencies to climate change scepticism and risk aversion were thought to be over represented among in an aging demographic. These tendencies may limit the scope to change land manager behaviour. However, it was felt that farmers who run their properties as businesses (rather than hobby farmers) would be more likely consider the carrying capacity of the land and sustainability. The Evocities campaign involves Albury, Armidale, Bathurst, Dubbo, Orange, Tamworth and Wagga Wagga. It aims to encourage people to live, work and invest in an Evocity. According to the Evocity website the name was coined because the cities are centres of Energy, Vision and Opportunity. Over past few years this campaign has assisted in driving demographic change and migration to regional centres. It was thought with climate change the rate of migration would increase, and there was uncertainty if these regional centres have adequate services to accommodate this demographic change. Evolving peri-urbanism around centres like Wagga Wagga leads to pressure on the capacity of the local community to provide services to these settlements. The incoming population often has greater expectations of LG, and the changes to land use in the area due to peri urbanism also increases demands on LGs. Rural residential sub-divisions in peri-urban areas are popular with LGs as they bring in extra growth and ratepayers. However, the expansion of the rates base is at the expense of fertile agricultural lands. Often the significant costs associated with developer fees mean development provides little benefit to landholders. Hobby farmers in peri-urban areas have big demands on their time (often they have jobs in town during the week and family commitments on weekends) which constrains their ability to properly manage the land.

	Belief in Climate Change	The scepticism of farmers toward climate change may be an impediment to the management of landscapes and ecosystems. Scepticism impacts program implementation for CMAs – particularly programs relating to climate change, which may be undersubscribed. A Central West CMA survey about climate change showed that people up to the age of 35yrs would do work on climate change adaptation for NRM. However, people aged 35-55yrs have other life priorities that take precedence and therefore have little time to think about climate change. While older age groups are often thought to be resistant to climate change theory, the survey showed that those over 55yrs were open to engage in climate change discussion. The key to overcoming this scepticism is in the presentation of the information. If terminology such as climate variability is used, there is generally greater engagement from farming communities. CMAs tend to tailor messaging, to present projects as encouraging innovative farming practices and systems. This helps to overcome reluctance to engage in climate change programs. The average age of farmers in the region is estimated to be 58yrs, and this group falls into what has been shown to be a climate-sceptic demographic. However, while farmers will give greater credence to information handed down from family and friends with farming experience, farmers are also highly adaptable and pragmatic. If presented with information that identifies co-benefits, they will often hedge their bets and do as much as possible to ensure farm productivity and revenue. The CMAs are currently undertaking the Catchment Action Plan review process, which seeks to identify the barriers to understanding climate change impacts and adaption, and how this may be linked to land and regional history. There is uncertainty whether enough staff in the region who believe in climate change, and are therefore able to do adaptation work. In addition, staff understand that regional areas are often small communities and they need to operate within that framework.
Social	Regional networks	Increasingly, property turnover is occurring in the region. Large companies/multinationals and/or younger hobby farmers are replacing traditional farmers, with a resulting loss of knowledge of the land/region. Changes to ownership are also causing a decline in the social networks from which newcomers might learn from and gain knowledge. Some towns need better communication channels (e.g. Griffith and Leeton), as the communities don't have inbuilt knowledge because of a higher proportion of newer land managers. Networks such as Landcare are important for community support and cohesion. However, during the drought few Landcare groups met because there were too many pressures on individuals, and there was no time to meet. Once the rains came, regular meetings have recommenced. However as a background to this, it is perceived that Landcare is increasingly considered passé.

		With increasingly dry conditions, a community support network is going to be increasingly important. Other community networks, such as the Men's Shed and grey nomad travellers, are seeing increasing numbers and provide the chance for people to share stress/experiences. Younger people are using online networks, and this is important given that it is this group in the community that will come of age under climate change. CMA networks with land managers are quite strong. However, CMA resources are limited (shortage of personnel) constraining the level of involvement in community activities. Time and capacity are thin, so despite opportunity to expand programs, this can't be resourced. Connections among CMAs are getting better, but still need improvement. For example, there are now more collaborative applications for funding, CMAs have jointly participated in the MDB Plan and through the CAP review process, CMAs are starting to look beyond their own boundaries. CMAs as a body have matured, and cultivate each other to improve practices. Local Government (LG) linkages along the Murray River can be disrupted by the Victorian border (Albury is split into 2 towns), and Interstate connections are forming; for example, Murray CMA has an MOU with Goulburn Valley Catchment. Informal communications were relied on in the past and do occur, but are becoming more formalised. It was thought however that the CMA needed stronger engagement with Department of Primary Industries and agricultural industry groups. Within NSW, LGs cooperate and good system of communications has been established between LGs through the Regional Organisations of Councils (ROCs). For example, quarterly planner's meetings are held to discuss commonalities, environmental reports, waste collection and objectives to change legislation. These meetings have enabled programs to get underway that may have otherwise been limited, e.g. Albury City Council facilitated waste contracts for Greater Hume Shire Council, which has realised other waste services for the smaller LG also. The federal system has a major impact on horizontal interaction among LGs. Linkages are also established between NRM non-government organisations (NGOs). NGO links with CMAs are important, as NGOs have access to different funding pools and have different networks and relationships with the Commonwealth. NGOs also have the ability to do things that government bodies can't, such as offering different incentive packages to landholders and operating within their own networks. It was thought that there could be stronger links between regions, for example between inland and coastal groups. It was thought that linkages in the South West of the region may not be as strong, due to the larger distances and smaller populations in the area. Some corporate linkages exist, especially with carbon farming and mining operations, but these are limited in southern NSW.

		These can also be difficulty for public servants working in small communities, as it can be challenging to separate their role in the government from their role as a member of the community.
	State government administrative churn	State agencies have had so much administrative churn in recent years that many of the formal networks, relationships, knowledge and expertise has been lost or diverted, with significant effects for regional organisations. CMAs depend on OEH/DPI to distribute information, and communication channels and processes can always be improved. CMAs feel that there is good engagement with government however the reverse engagement is not as strong, due to the politicisation of relationships at this level. State agencies regulating LGs such as the EPA really define the relationship between LG and State Government – while they do work collaboratively there is the overriding knowledge that State agencies are regulators and may impose fines for non-compliance. Within State agencies, the maintenance of personal communications and informal networks built through people who work directly with each other over many years are important channels for exchange of information and ideas. To achieve meaningful change requires familiarity and trust in relationships which takes time to build, and is eroded through restructures and change. The aging demographic of the public service, particularly in regional areas, was seen as significant issue, not only for staff replacement and consistency, but also because there tends to be a technological understanding and provision gap in regional areas. Regional offices aren't provided with modern communication systems, therefore staff are often required to travel significant distances to access videoconferencing, reducing time availability for community engagement and work. The appeal of the city for workers as it is seen as more 'advanced' and younger, leading to a knowledge and skills drain from regional areas. Churn is not only an issue within agencies but also for the community. Government representatives are often greeted by community members asking 'what are you called today'. Constant change in government was seen as leading to reluctance by the community to contact agencies. As an example, farmers are sending their Native Vegetation reports in to an office, but because of agency changes, these reports are not being received by the right organisation. This is not the fault of the farmer but means that effective regulation is affected.
	Local community decline	Smaller towns are undergoing big changes. Many are becoming 'welfare towns' because housing is more affordable, attracting a lower socio-economic population which can have additional service needs that smaller towns aren't equipped to supply. In addition, absentee landholders are becoming more common as people move away from family farms. Some areas have suffered decline due to the flow-on effects of a series of natural disasters in close succession. For example, Lockhart has had two floods in past 18 months and is now a very vulnerable community. This community's

		existence depends heavily on insurance payouts. The potential closure of the town's businesses could cause a 'snowball' effect. Community thresholds, such as hospital/ police/school closures all influence landscapes and ecosystems, because of loss of land managers. The growth of larger centres, albeit relatively low, such as Wagga Wagga and Albury, is at the expense of the smaller towns. City growth often comes from retirees from the land needing to move closer to services and facilities. City growth also occurs because of younger people moving to attend tertiary education. These both contribute toward a reduction of social fabric, because of the draw of people from smaller communities to 'tack-on' to the larger centres. Social pressures, such as double income families, reduce opportunities and ability of people to socially interact. Greater demands on time mean there is less time for community engagement. With increasing extreme weather, there will be more need for volunteers, yet there is declining community involvement. Increasing need for community involvement in recovery work also means that there is less opportunity for community involvement in land care and conservation work. Maintenance of natural environments in the region is seen as very important for recreational uses and community cohesion.
Natural	Landscape connectivity	Natural connectivity is considered important for landscapes and ecosystems to adapt to climate change. Regional connectivity is limited and constrained because of the modification of the landscape for agriculture over the past 200 years. However, the climatic gradient within the region (particularly provided by mountains in the east) may provide the chance for ecosystems to shift and adapt. The Travelling Stock Route network offers a good opportunity for improved connectivity, but is constantly under review because of upkeep costs. It must be noted that the ability of vegetation to adapt in the period that climate change occurs, may be a limiting factor on the usefulness of landscape connectivity. CMA strategic planning is looking to integrate environmental variability to ensure the survivability of environments such as riparian zones, but reluctance or inability of clients (land managers) to engage in programs makes it difficult to implement.
	Land use options	Land use options depend heavily on a combination of land capability and rainfall. In the western areas there are fewer options beyond extensive grazing because of the natural environmental constraints – low rainfall, poor soils and high temperatures. In the more easterly areas where land productivity is greater, e.g. Holbrook, more options for alternative farm enterprises are possible. Land productivity affects the potential for integrating native vegetation conservation with agricultural practices. In the

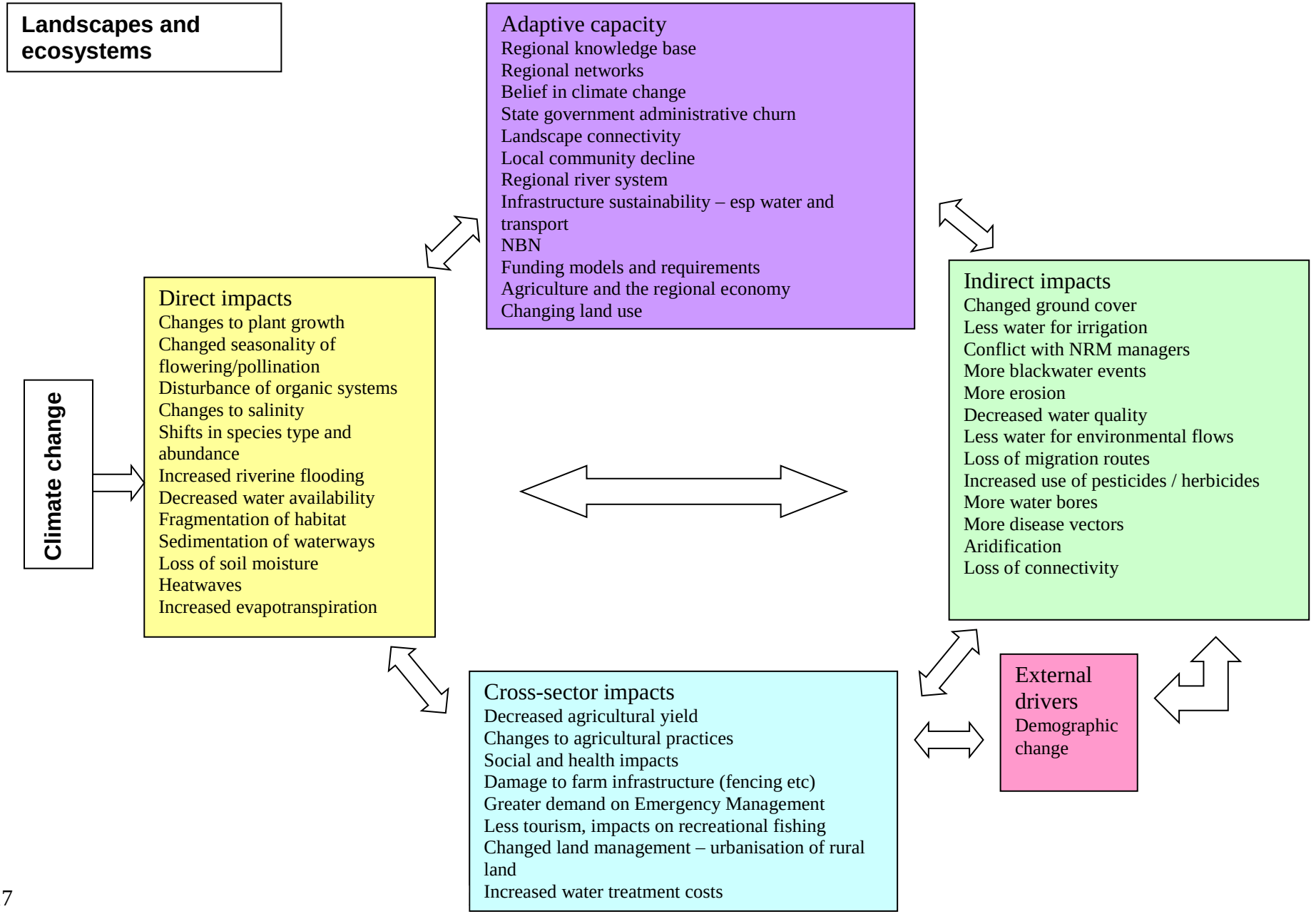
		west, the costs of production are so great and value of output so constrained that it is difficult for the farming community to take up additional responsibilities. For example, saltbush integration with cropping still requires the concession of some arable land, which is not financially viable option in the west of the region. Currently mining does not have a large influence in the region, however competition for land is set to increase. Ensuring that environmental costs and connectivity are considered at the start of any mine development is key.
	Regional river systems	People who have river access, and can maintain this access, will have a big advantage under climate change, particularly if food prices rise in response to reduced food supply to markets. Woodland/riparian communities along the Murray/Murrumbidgee are a key asset for biodiversity. The river systems of the region act as biodiversity corridors. The National Parks on the river provide refuge and enhance the ability for biodiversity adaptation. However, there is a need to ensure connectivity with these riparian areas and the broader landscape. In addition, where water is severely limited even access to the river may not be enough to prevent the death of large numbers of trees in national parks, particularly when water allocations for agriculture are a higher priority. Rivers and wetlands also have significant amenity value. National Parks and Travelling Stock Routes are important as recreation spaces for tourism, social well being and health. However, the river systems are also a source of on going conflict between the environment and other water users because the rivers form the financial base of river communities. The Murray-Darling Basin Plan (MDBP) is dividing communities. Communities involved in the MDBP are sick of government intervention and perceived restriction on their livelihoods. It was thought it would be helpful if government was more conciliatory, in order to encourage more community engagement. Climate extremes, such as flood and drought, are the key to river health and biodiversity management – management systems need to flexible enough to accommodate these extremes. For example, a recent revegetation project at Wagga Beach removed all natives, however the intensity of recent floods pulled out all the revegetation work, including older, well established natives. Extreme weather resulting in flooding also impacts property boundaries and fencing for land owners/managers. Changing river course is a natural occurrence, but is not convenient for human development, and can increase land degradation and water quality issues due to the lack of riparian vegetation on the new river course bank.
Physical	Water infrastructure	Policy around the infrastructure for the delivery of water (dams/ weirs/ farmland dams/irrigation channels/pumps) is the key influence on the management of landscapes and ecosystems under climate change. Significant water losses occur through channel seepage. Piping water can reduce this leakage, but is expensive. LG

		believe that some costs should be borne by the broader community, which benefits through food production. Piping water provides a reliable water supply for farmers for stock water supplies, however while this has a longer infrastructure lifespan than dams, it attracts a large upfront cost. Piping also results in less evaporation and less leakage, which consequently affects the water table less, resulting in less salinity. However less leakage would have a significant impact on native animals that rely on it as a source of drinking water. In some locations, water buybacks are resulting in infrastructure becoming redundant, because it is no longer used for production. However, that infrastructure is relied upon to distribute environmental flows. Wetland management needs to spread the water flow, thus localised water infrastructure is needed to assist this. The destruction of these channels therefore has implications for wetland rehabilitation. The changing nature of the use of water channels is leading to liability issues for channel operators/owners. Although the water channels are no longer being used to deliver irrigation water, management of the channels is still required to mitigate impacts during flood. There is currently a class action by farmers at Yenda against Murrumbidgee Irrigation, due to flooding of their properties and inability of the water to drain away, which they claim was caused by the lack of maintenance of disused irrigation channels. In order to improve environmental outcomes, there is likely to be pressure on landholders to reduce water retention on farm, bringing agriculture into conflict with the environment. Murrumbidgee Irrigation has large irrigation channel infrastructure, and there may be benefits in maintaining the infrastructure to ensure water can be directed to places where it is needed to sustain the environment. With climate change, new pockets of stress/weakness are likely to be created in the landscape and changes to the infrastructure network that are occurring today (for example closing channels) may be maladaptive for future conditions. Water infrastructure is also important for managing salinity issues. There are currently nine bores pumping in Wagga Wagga to keep the water table low enough so salinity doesn't affect city infrastructure and water supply.
	Peri-urbanism	With increasing population growth in urban centres such as Wagga Wagga, the disposal of waste is becoming a problem, due to limited landfill space. There is limited land, or funding, available for waste disposal. Councils on the North Coast of NSW have banded together to address waste issues – this may be necessary for the Riverina-Murray. Increasing peri-urbanism will also increase pollution, run-off issues and electricity use as increased sub-division of land impacts upon landscape productivity and connectedness.
	Transport	Limited transport infrastructure (roads and rail) in the west of the region is a problem. The conditions restrict options

	infrastructure	for transport, both for people and produce (e.g. grain and stock) and access/delivery of goods and services. This in turn impacts the agricultural sector. If silos close, grain will need to be transported further, increasing costs to the primary producer and limiting options for land management. Infrastructure may also be a barrier to species migration – roads and towns are a barrier to migration, while fish ladders are increasingly installed to assist migration over weirs.
	Fossil fuel costs	The likelihood of less fossil fuel availability, increasing cost of petrol and pressure to mitigate emissions will place pressure on the ability of landholders and remote residents to do day-to-day activities. For example, farming practices, accessing remote areas and travel will become more difficult because of increasing costs.
	National broadband network (NBN)	The National Broadband Network (NBN) may improve communications in the west of the region, and is likely to increase business opportunities such as video-conferencing. If the NBN meets expectations, it will improve information and online services access, particularly for remote areas. The NBN may make small towns more attractive for online businesses, as there are smaller overheads. Data monitoring is largely wireless, so improved services with the NBN will improve information gathering and storage. The downside of this is that individuals may not interact as much with their environment, but the NBN will likely allow greater opportunities for remote communities in areas such as education. The current loss of social community networks means that it may fall to online networks to provide this support. The NBN presents a potential positive for older generations, as a social network and support forum if help with improving technical skills is provided. This is important for older generations as they tend to be less mobile and more socially isolated, and particularly so in regional communities, as many older people retire to regional centres away from established friend and family networks.
Financial	Requirements of funding bodies	Federal and State agency financial year spending deadlines do not work for environmental programs, and they don't account for the complexity of natural systems. Grants need to be flexible so that they can be used when there are suitable environmental conditions. For example, DPI has significant funds available for weed control, but these funds are taken back if not spent in the financial year regardless of the suitability of environmental conditions for carrying out weed control actions. Similarly, funding may be available for tree planting during drought years, when trees would die if planted. CMAs need to be able to invest over longer timeframes and in ways that are sensitive to natural systems. More discretion is required in funding models, and for the models to be independent of the political cycle. Funding structures also lead to high levels of staff turn over in CMAs, as many staff are employed on short term contracts tied to project funding.

		Project frameworks try to be efficient with funding dollars, for example making a $1 tree worth $3 investment because of associated co-benefits. The imperative to spend funds by end financial year means that these improved management measures are scrapped to get dollars out the door. Funding programs follow 'fashions' of political interest – e.g. salinity, biodiversity, carbon farming – and need funding for staff positions to maintain works programs. CMAs often seek assistance from NGOs to help get programs done within timeframes. NGOs present an opportunity for government bodies to carry funds over financial years, however the high turn-over in NGOs and accountability issues are a concern. Regional NGOs need best practice guidelines from funding bodies, to know they are investing in the right areas and projects for climate change Some farmers are willing to try and implement climate adaptation measures, but they have difficulty accessing government funding that is available, and their actions fly under the radar and are not supported or recorded.
	State Government restructures and funding reallocation	The administrative restructures of State agencies over recent years has resulted in reallocation of funding and a reduced amount of funding going to monitoring and data collection. This is leading to data gaps and system vulnerability in the future. Loss of data because of lack of funding leads to greater difficulty in understanding natural processes such as flooding and salinity.
	Agriculture and the regional economy	Recent wet seasons mean that there is a perception in the community that anything is now possible in the region. However, memories appear to be short and it is inevitable that drought and its attendant hardships will recur. The local economy has not fully recovered from the last major drought. The agricultural industry is suffering because of the high Australian dollar and high labour costs. There are poor prices for produce despite good seasons and this means farmers still have not tackled their debt problems. This debt burden flows on to landholders' ability to effectively manage their land. As farmers control the bulk of the land in the region, debt consequently effects management of landscapes and ecosystems. Making money from farming is marginal, so younger people aren't prepared to take up farming as a career or take on the family farm. Land prices are a major influence on people getting involved in farming. Current high land prices mean that only corporations can get into property ownership and production. Also, landholders are not getting a good return on capital for their land. Some businesses are simply not viable and are closing, for example, a feedlot in Griffith closed after only 4 years despite a $10 million investment. Agricultural farming systems are determined by the market. Adaptation will be forced upon primary producers to ensure a revenue stream. Changing crops and stock breeds will be inevitable. This change may lead to increased

		corporatisation of agriculture. The impact of globalisation may see production occur outside of Australia. Lockhart LGA has mining exploration licences and there is potential sand mining at Balranald; however, mining isn't considered a significant industry in the region. There is greater financial diversity in the east of the region and along the rivers, where there is more income from tourism. Further west the ability/resources to diversify are limited. Areas that are predominantly dryland cropping country will be significantly affected by climate change. It is likely that greater crop specialisation and opportunistic production systems will be required. The carbon tax presents a potential opportunity for alternate revenue source for landholders, with carbon farming and forestry.
	Fossil fuel costs	Increasing costs of fuel will significantly influence how we live, travel, grow food and what we eat.
	Local government funding model	LGs finances are constrained by rate pegging at 3 per cent per year, in line with inflation and supplemented with grants from the Federal Government. This financial base does not allow for much other than operational priorities, and climate change is not currently seen as core business. LG budget and works programs are generally fixed a year in advance, leaving little flexibility to take advantage when short-term or new funding opportunities arise for example from CMAs with money to spend before end of financial year.
	Corporate funding	There is scope for engaging corporate landholders in management of landscapes and ecosystems. CMAs have a good relationship with property managers of corporately owned properties. Some corporations improve land management because they have the disposable income to not push the land so far for production. However, this is not always the case, as many corporate properties are run by absentee overseers and weed management in particular can be a problem. In the recent past, establishment of pine plantations was encouraged by the Australian Taxation Office as managed investment schemes. Many of these are now in receivership, jeopardising future management of those lands.

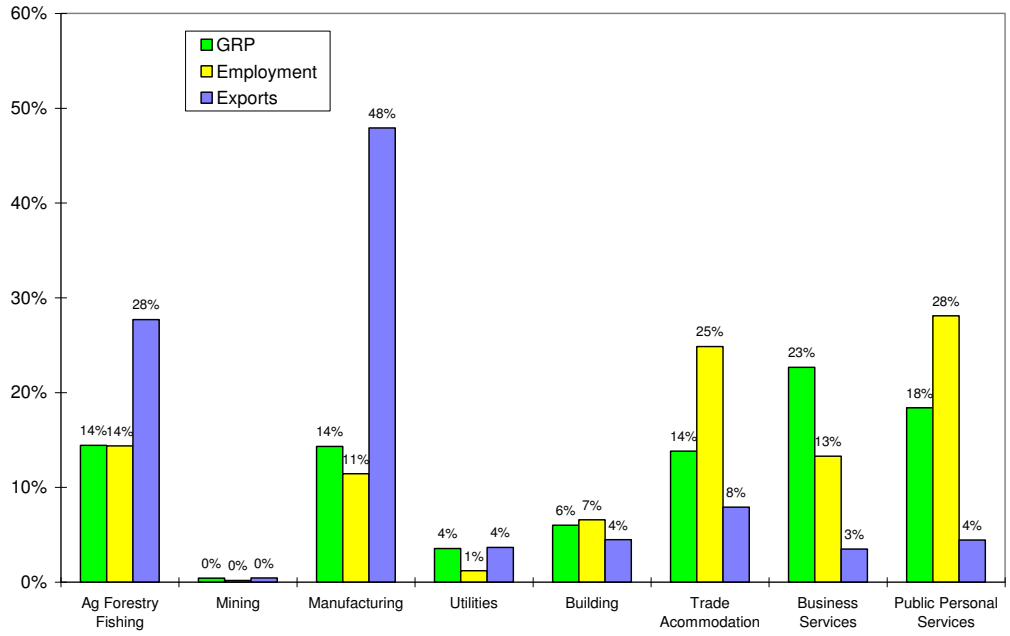

Landscapes and ecosystems
Adaptive capacity
Regional knowledge base
Regional networks
Belief in climate change
State government administrative churn
Landscape connectivity
Local community decline
Regional river system
Infrastructure sustainability – esp water and transport
NBN
Funding models and requirements
Agriculture and the regional economy
Changing land use
Climate change
Direct impacts
Changes to plant growth
Changed seasonality of flowering/pollination
Disturbance of organic systems
Changes to salinity
Shifts in species type and abundance
Increased riverine flooding
Decreased water availability
Fragmentation of habitat
Sedimentation of waterways
Loss of soil moisture
Heatwaves
Increased evapotranspiration
Indirect impacts
Changed ground cover
Less water for irrigation
Conflict with NRM managers
More blackwater events
More erosion
Decreased water quality
Less water for environmental flows
Loss of migration routes
Increased use of pesticides / herbicides
More water bores
More disease vectors
Aridification
Loss of connectivity
Cross-sector impacts
Decreased agricultural yield
Changes to agricultural practices
Social and health impacts
Damage to farm infrastructure (fencing etc)
Greater demand on Emergency Management
Less tourism, impacts on recreational fishing
Changed land management – urbanisation of rural land
Increased water treatment costs
External drivers
Demographic change

2 Industries

2.1 Background

The Riverina Murray region is situated in the Murray Darling Basin, which is one of Australia's chief agricultural regions. Its Gross Regional Product (GRP) is estimated at $10.9b (3.6 per cent of the NSW economy). Agriculture is a major contributor to the regional economy, with a direct share of GRP of 14 per cent and 28 per cent of exports from the region. This represents a substantial dependence on agriculture for the Riverina-Murray region, and this figure may be as underestimate given the influence of drought and the limited access to irrigation water that existed in 2005-06. The drought over the decade to 2008 stressed all the agricultural industries directly, and through limited availability of general security water for irrigation. The overall industry structure of the region is shown in **Error! Reference source not found.**.

Figure 2 Industry Structure of the Riverina Murray Region 2005-06



The Riverina Murray region is characterised by its waterways, and has evolved around the emergence of irrigated agriculture during the twentieth century. Major enterprises reliant on irrigation in the Riverina Murray include rice, wine grapes, citrus and vegetables and other tree crops, winter crops and annual pastures, growing cotton and livestock production and dairying.

Communities such as Coleambally, Darlington Point, Deniliquin, Finley, Griffith, Jerilderie, Leeton, Moulamein and Wakool have a high dependency on irrigated agriculture, with around 90 per cent of businesses in the Central Murray irrigation region being directly reliant on irrigated agriculture.

Agriculture also contributes to the regional economy through the manufacturing industries based on it. Manufactured primary products contribute a further 27 per cent of exports. Throughout the region there is close integration of production with processing in terms of cattle feedlots and processing, pig production and processing, poultry production and processing, wine production, rice production and milling and between tree crops and processing.

In the east of the region, there is an integrated wood processing industry centre based around Tumut, and built on the substantial softwood plantations in the area. This includes sawmilling, fibreboard and cardboard manufacturing operations. There is also a paper processing facility in Albury, and a range of wood processing operations throughout the western parts of the region based on river red gum and cypress pine resources.

Figure 3 Gross value of agricultural commodities produced, Murray and Murrumbidgee Statistical Divisions, ABS 2007-08

Estimated Gross Regional Product 2010-2011		$12.3 billion
Total land under agric production (2006)		13 496 000 ha
Area irrigated as proportion of agricultural land (2006)		4.6 %
Agricultural commodities by gross value (2006)	Cereals for grain	$325,049,532
	Crops - vegetables	$147,386,715
	Crops – fruit (excl. grapes)	$243,220,848
	Wine grapes	$248,761,516
	Wool	$212,569,867
	Meat - beef	$220,980,027
	Meat - pigs	$152,466,031
	Meat – sheep and lamb	$102,726,019
	Dairy - milk	$129,298,697
	Total gross value of agricultural commodities	$1,782,459,252
Gross value of tourism (year to end March 2012, NSW Tourism)		$1.099 B

Apart from agriculture, other export contributors include electricity, road transport, retail trade (sales to visitors), building, agricultural machinery and education.

Electricity production is a high growth industry, and hydro-electricity generation already exists in the region as part of the Snowy Scheme. The electricity generation industry seems likely to expand with a number of projects under construction or planned. These include wind farms in the Broken Hill area, solar energy in the Mildura precinct and wind farms in the east of the region.

One of the major transport corridors in south-east Australia runs through the region. As a result, road transport is also a critical industry, and the region may be well placed to be active in the growth in road and rail freight. There is potential for this region to host a number of operators providing services and distribution facilities to the south-east portion of Australia.

The two major regional centres, Albury (-Wodonga) and Wagga Wagga represent fast growth areas with a diverse industry and technical base. Wagga Wagga has a major iron foundry among a diverse array of industries, while Albury includes several important manufacturing operations, including some related to the motor vehicle industry and

paper production. Wagga Wagga also has an extensive defence presence with an army base and RAAF training facility near the town. Both of these facilities are growing.

The region has a strong education sector, with a number of specialist schools and universities in Wagga Wagga and Albury making the region an exporter of education services. There are a number of specialist research and technology centres in the region, particularly to support primary industries. These assets help the region to maintain its competitive advantage in those industries.

2.2 Workshop participants

This workshop was held at the Murrumbidgee Rural Studies Centre in Yanco on 8 and 9 May 2012, with attendees from the following organisations:

- Albury City Council
- Department of Primary Industries
- Department of Trade and Investment, Regional Infrastructure and Services
- Environment Protection Authority
- Greater Hume Shire Council
- Griffith City Council.
- Murray Catchment Management Authority
- Murrumbidgee Catchment Management Authority
- NSW Office of Water
- NSW Trade & Investment
- Office of Environment and Heritage

2.3 *Findings: key vulnerabilities and adaptive capacity*

The following indicators and descriptions are adapted from the discussions had by participants in the Industries workshops. As much as possible this text maintains the original wording used by participants. Where necessary changes have been made for readability or to explain concepts and terms.

Capital	Indicators of adaptive capacity	Importance of indicator and adaptation response
Human	Knowledge gaps	The regional knowledge base of the effect of climate change on industry is patchy. There is some information about how some industries, or parts of industries function now and might be affected by climate change. However, for other industries very little is known. For information to be useful it needs to be at a regional scale; targeted and simple; present the range of scenarios so that people can make their own decisions and cross-sectoral.
	A case for change	Currently many people do not see the need for change. Even when they can see that change is necessary, making changes can be difficult because it can be hard to see the positives in the short term. There needs to be leadership and information on why change is required. Positive and forward thinking is required, on how to change and why you need to. The current focus is on doom and gloom rather than positive options. For agriculture, it is important to provide information in terms of what will be useful on their farm. Individual farmers can then grab hold of information most relevant for their situation. Agricultural land holders are in a difficult position because it is difficult to reconcile the messages about climate change they receive from trusted researchers, with their personal beliefs. The general population doesn't think climate change is an issue, but change is inherent in our life and the urgency is often cyclical (for example, periodic droughts amplify the need in Murray Darling Basin planning). People lack information about what is happening in the world. Greater effort is needed to help people understand what climate change will mean for them. If we think about how climate will change over the next 20 years, some adaptations that will be sensible in 2030 are not in 2012. This leads to confusion, as the need to prepare now for a longer timescale makes adaptation messages difficult to communicate. The media focus on long term impacts of climate change means people dismiss the need to change, because the impacts described are too distant in time for them to see how they can respond.
	Diminishing skills base	The region has strong research credentials in agriculture, and good engagement with farmers, but the skills base is diminishing rapidly across the state and region. Experienced people have retired and a lot of knowledge has gone with them and isn't being replaced. This decline in skills and experience is a trend that is likely to continue. Government is providing much less research and development (R&D) than 20 years ago, so that industries are relying more on the private sector. However the private sector responds to demand, therefore while there is scepticism in the broader community and among farmers about climate change, demand for private R&D will be

		limited. Moreover, as with public R&D, private research isn't increasing either. Private companies are under pressure to focus on products not research. It is questionable whether government has the drive to change operations throughout NSW, and if the right skill set currently remains among public sector researchers. Current government agencies' skills may not be applicable to new situations posed by climate change. Government will need to mentor this change. There is an appetite within department and among regional staff for change to a more consultative approach to providing services, and change is occurring. The political cycle which results in changes in government policy can often leave people, projects and assets stranded. The case for improved regional R&D has to come from industry saying that they need help. The IRVA provides a process by which industry can be consulted on broad regional impacts and adaptation. If industry seeks help, then the government may be more likely to allocate resources to climate change. However, the changes required to adapt to future climate pose a challenge to conservative values inherent in the regional community, which works against industry seeking this help. Understanding of climate change and skills in devising adaptation strategies are not broadly available within the regional skills base at present. This limits the support regional officers are able to provide to the community particularly in strategic planning.
	Demographic change	Population of regional Australia is aging. Younger people are leaving the region and this trend is likely to continue, leading to further demographic change. Older people are generally less willing to embrace change. With an aging population base, government clearly has a role to assist this group to adapt. Pre-emptive research on the factors involved in encouraging adaptation among older generations is required. An aging population is likely to suffer greater health impacts from climate change, increasing demand on health services (especially mental health services). Mental health services are a fast growing regional industry. Suicide is a big problem among some sections of the regional community. Another group highly vulnerable to climate change and that will need specialised attention to adapt are those sections of the regional community who have suffered most losses through recent government decisions, such as the likely changes to sustainable diversion limits under the Murray Darling Basin Plan.
Social	Regional networks	Networks operate within a number of industries both formally and informally. For agriculture, field days were once a hub that provided social, educational and other benefits. Given the demand for education and information by the agricultural sector, field days provide a chance for people to gain knowledge and to interact. However, with the decline in labour on farms, individual farmers are busier and have less time to network. People need shorter, sharper sessions for information than field days provide. Despite their value, field days have declined in popularity.

		Other social and organisational linkages are breaking down because of the demands on people's time. For example, 25 years ago there was an agricultural bureau network, which now gone. Sporting organisations are struggling too, and this contributes to the isolation of people in smaller centres. People now look online for information that they used to get from other sources such as field days. However, the web is less useful for complex issues. For example, on climate change there has been party political noise, but not targeted discussion, which contributes to confusion. Political noise leads to far less engagement in the information being presented. It is difficult to fabricate a social environment. Use of internet and online information sources means there isn't the social interaction that occurred in the past. For example, farmers used to attend clearing sales, not really to buy but to catch up with their community. The internet in this social context is a negative – breaking down networks and interactions. It is very challenging to support change where there's no effective social network in operation. In areas where formal networks exist they don't meet as frequently. This can make engagement more difficult on issues that network members don't see as a priority interest. For example, the Northern Cattle Industry now meets annually – similarly in the Western Division, the industry meets for only one week annually. Getting climate change on their agenda is difficult as they have so much to consider in a short timeframe. Ninety percent of regional businesses have turn over of less than $1 million. Small business is therefore working hard on the short term with no time to look at long term. Small business owners don't have enough time to understand issues such as climate change as they are so focussed on their business. For tourism, small businesses like the Riverina Tourism Organisation can help. Similar assistance is not available for other types of small businesses. For example, the regional Chambers of Commerce and the NSW Business Chamber (which now links smaller chambers together more strongly than in the past) have an interest in climate change impacts on businesses. However, they need to focus on opportunities (rather than the negatives). There is a need to educate small business operators on opportunities, perhaps through the use of communication technology (e.g. participation by tele-conference or online forums). Government could assist by showing international examples of business opportunities that arise through adaptation such as new technology. There may be a need to find ways to engage outside of business hours. The tourism industry very well networked. Tourism has had a climate change policy document for 10 years, including how to take advantage of climate change opportunities, but many smaller businesses wouldn't know it exists. Small businesses are operating with their life-savings, and are therefore thinking how the investment can be best used. This needs to be considered when communicating about climate change. There is a need to communicate more effectively with a focus on opportunity, assist with ways to minimise business costs and with understanding what their customers want now and in the future. At moment there is an indication that customers may be looking for new products and services.

		Regional Organisations of Councils (ROCs) can help local government with communications, with facilitating social and human aspects of adaptation, and to build local collective visions. Every region will have opportunities and needs to identify and communicate these. Riverina and Murray Regional Organisation of Councils (RAMROC) Strengthening Basin Communities project is an important initiative around climate change. Informal links across agencies are a critical influence on action. Social connections between government agencies are personality driven. It is difficult for people in government to know what other government groups are doing. Influence is made through who you know. It is important to recognise that climate change and the associated issues are not owned by one agency, all sectors are impacted. Therefore, all agencies need to be involved and informed, because the achievement of a regional vision and effective adaptation is at risk. Whole of government action and identification of key stakeholders is critical, and can be the hardest thing to achieve. Also identifying who has ownership of specific programs/projects is important. A whole of government effort is required to be develop bigger picture thinking, as climate change is affecting people's livelihoods.
	Research linkages	Within government there are growing links between state government researchers and national research organisations such as the CSIRO. However, development of these links is driven by a lack of people. NSW Office of Water work with universities because the agency has less capacity (skills and personnel) in house, and can leverage a small investment through such collaboration. The downside is that universities rely on postgraduate students for the bulk of their research effort, so it may take about 4 years to obtain results and there is the risk that projects may fail due to non-completion of theses. Even industry R&D corporations are struggling to find people to conduct some research. All research organisations have dramatically downscaled. Lack of people in the regions is affecting inter-agency collaboration – downscaling means there is often no one with whom to collaborate. With the decline of research and extension services in agencies, official channels of communication have been lost, leaving only informal channels of communication relying on contact among individuals. There used to be a transfer of knowledge downward in government agencies, however integral parts of the system are no longer there because people have left, and are not replaced due to structural change. This loss of connection limits the flow-on of corporate knowledge. This is particularly so in situations of emergency response where gaps exist in the knowledge base of people in operations. We need to construct a system that preserves corporate knowledge, and that can, and will, engage with people at all levels of government and the community.
	Regional identity	There is a regional sense of identity along the Murray River. Although these communities receive broadcast media and access services from Victoria, they strongly identify with NSW. However, people are perhaps withdrawing to more local identities. For example, Henty has strong local identity and in smaller centres outside 'threats' create social cohesion. For example, MDBP community sessions led to a greater sense of community and regional support

		within the irrigation community, because have similar issues they want to address. Women in particular became a powerful voice through Country Women's Association groups. Community cohesion appears to be at least partly driven by farm size, with a longer history of cooperative action and closer social linkages in areas where farm size is smaller. Irrigators are in closer proximity than dryland farmers (because of the relative sizes of a viable productive unit) which creates better social cohesion among the irrigation community. Further west consolidation of farms to achieve a viable size has resulted in empty houses, and decreased social networks. In addition, a lower population mean fewer visitors, as people coming to the region to visit friends and relatives is a big driver of the need for tourism services.
	Government-community relationships	Links between government and the community are suffering. The community finds working with government confusing, as they don't now how to access services, people or which agency is responsible for particular issues. Government, like banks, has a major impact on regional life. Currently there is disconnection between people on the ground, 'policy wonks', and elected representatives. Policy has good intentions but struggles to connect up to government and down to people in the regions. People working with the community can access only shallow information. A lack of confidence in State government in regional areas has implications for regulatory frameworks. The government workforce involved in regulation is declining, therefore they are unable to offer help (by providing information on regulation and the role of the regulator) to the regulated community until issues emerge; by then, the community isn't willing to engage with government. If more staff were available the community can be assisted with regulation when problems begin to emerge. In addition, when experienced people leave often the subtlety needed in implementation of regulation is lost. The constant churn in government agencies means there is no confidence in government in regional areas, and no trust in services government provides or what policy/programs are likely to be ongoing. Regional staff report a common mantra when dealing with local people of "what are your names today", reflecting the cynicism surrounding government restructuring.
Natural	Water	Water is both a source of conflict and a provider of prosperity. Those who can get it have advantages, while others are annoyed at a lack of opportunity. Water is divisive, as there are haves and have nots in the regional community. Rivers are important in attracting tourists. Irrigation communities are suffering because of lack of certainty around water allocations, which is affecting broader investment in the region.
	Nature-based tourism	Regional tourism is predominantly nature and environment based, or derived through people from outside the region visiting with family and friends. Environmental tourism is heavily reliant on water-based recreation activities, and a decline in tourism can trigger a cascade of effects on motels, restaurants, clubs and small businesses.

		Family/friends visitation is being affected by downscaling of employment in regions, population decline in smaller rural centres and the growth of large cities. National parks are considered important for local recreation and social cohesion. In addition, national park development is thought to produce an increase in tourism and revenue for the community, but in reality the distance to national parks in the Riverina Murray means they attract fewer tourist numbers than more accessible areas. If the parks are created on previously productive land, then the creation of national parks can also means a loss of people from the area, which leads to a decline in local businesses because of reduced expenditure on local services. State government buy-backs and development of national parks often results in loss of rates to council. For example, Wakool Shire lost $75,000 in rates with creation of Yenga National Park. In Deniliquin, the conversion of commercial forestry to national park did not deliver the projected increase in visitation. National park visitation can often lead to problems in emergency management situations, such as catastrophic fire risk days. Emergency services instruct tourists move off parks; while an essential risk management procedure, this generally means tourists simply leave the region with further lost business revenue. Perceptions of tourists about the Murray were mostly unaffected during the drought and tourist numbers were largely unaffected. However, with the return of better rainfall conditions and flooding across much of eastern Australia, there is a suggestion that tourist numbers are down as people are able to access water-based recreation locations closer to home. Generally, the creation of festivals and events based on the agricultural calendar (for example harvest festivals) are seen as a way to boost tourism. However, climate change may threaten this source of tourism and community revenue as it affects harvest times.
	Soil-landscape information	While farmers are already managing this variation there is a need for extensive soil landscape mapping at finer resolution to improve local recommendations on adaptation for agriculture, such as the selection of crop better suited to soil types. The region's agriculture is generally highly productive but the soils do have limited capacity. The interaction between rainfall (or water availability generally) and soil type is integral to adaptation. For example, Wakool is a rice-growing area because of poor soils and available irrigation water. However, if water allocations are altered there will likely be flow-on effects to communities and families because of a lack of other viable agricultural options. At specific locations the impact of climate change is not uniform because of differences in soil type. Light soils will be affected, because their lower water holding capacity means they need regular rains to provide a supply of water to plants.
Physical	Water delivery and storage	Water storage and delivery is important in both irrigation and dryland grazing systems. For irrigators, change to infrastructure can drive up water costs. Also, irrigators have made significant investment in the layout of their properties for flood/surface irrigation (such as laser levelling), which limits their willingness to change to other irrigation systems. There are differences between the western and eastern parts of the region in the past investment in stock watering

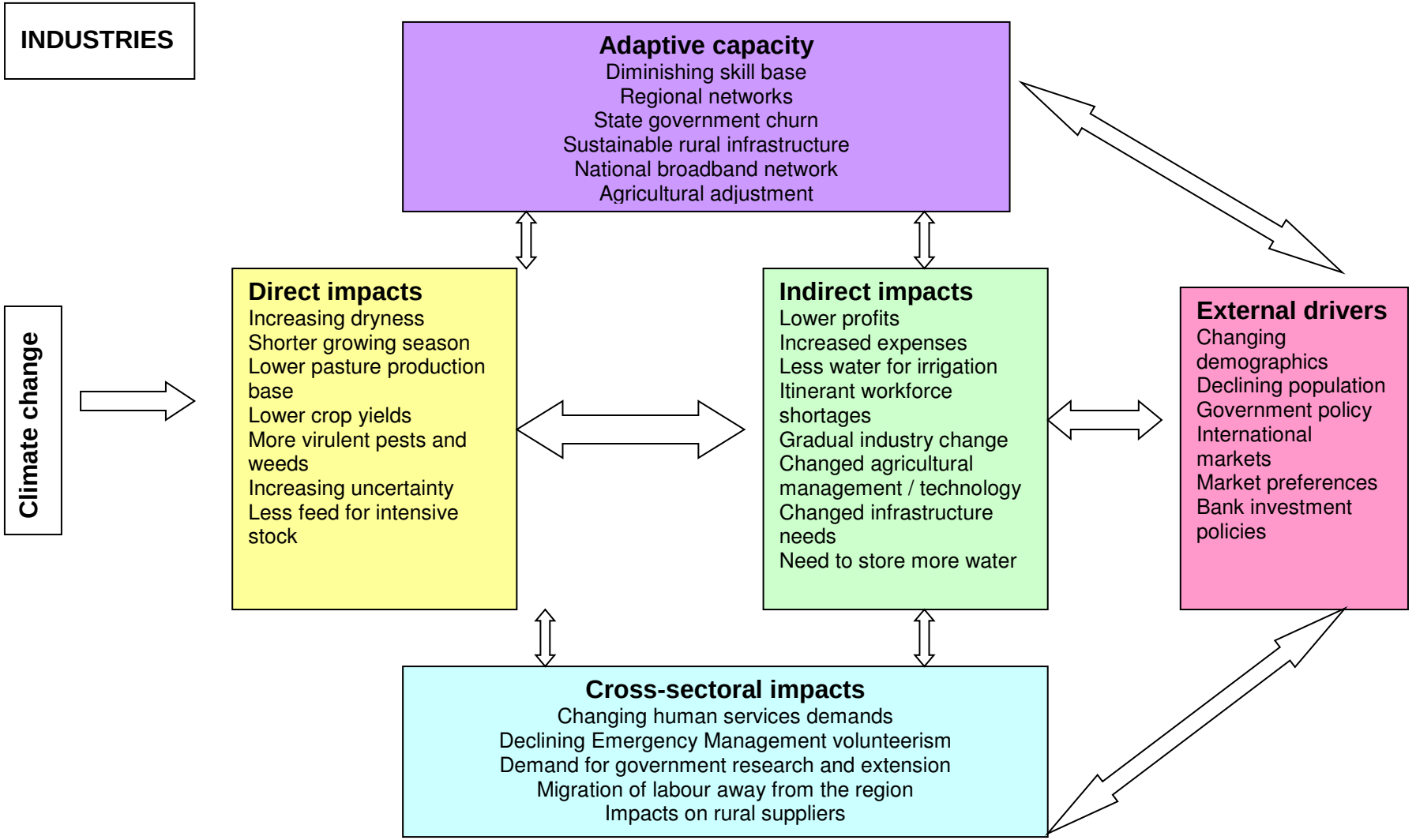
		systems. In the west, there has been greater investment in tanks and troughs to deal with in recurrent droughts so these graziers are better prepared for climate change. Stock watering hasn't been addressed as much in the east, and graziers may have to think more seriously about their watering systems. New infrastructure may be needed to improve robustness of water delivery. Most on-farm dams are 70-80 yrs old and are very shallow as a consequence of silting, making them prone to high evaporative losses. There is a need for fewer, deeper dams to improve their usefulness. Many dams are also gully control structures which are often destroyed in big rainfall events, which means erosion is then uncontrolled and stock water availability is reduced. There is a need to examine whether such dams should be maintained for stock water, or whether pipe and trough system would be more effective.
	Grain handling and storage	The investment in and operation of grain handling and storage infrastructure such as silos may become increasingly problematic. Some assets could be stranded or be un-utilised with shifts in grain production areas and poor seasons under climate change. It can be difficult to find staff for isolated or distant silos. Closure of some silo facilities results in farmers travelling further to access silos, increasing fuel costs and causing delays in harvesting. This may result in greater reliance in on-farm storage, and such changes need to be factored into the natural cycles of grain production. Floods, which may increase under climate change, often cause silos to become isolated which means that they cannot be opened even if operators are willing. Growers then have to access silos further away, at times when transport is already impeded by flooding. Because grain growers are increasingly time limited they need to harvest grain faster. The need for greater harvest capacity has lead to investment in physical capital, such as headers. The recent trend has been for grain growers to use harvesting contractors to reduce the capital costs, but to achieve the timeliness they need this may need to change (contractors are often unavailable at peak times). For example, grain farmers out near Pooncarie are now buying more headers as they have to get the grain off earlier, and can't rely on contractors to get the harvest done, resulting in greater cost of production to the farmer.
	Transport infrastructure	Rural decline in many local government areas is leading to an erosion of the rates base. This in turn impacts the ability of local government to maintain the roads network which in turn impacts on regional tourism and transport. There is considerable tension between state and local government over the purchase of rural properties for national parks, because of a loss to local government revenue (Wakool Shire was suggested as an example). Higher fuel costs cause multiple impacts on the region, because they not only increase the costs of grain production, they also result in tourists preferring destinations closer to home. Regional rail transport infrastructure is inadequate. There is a move towards reopening the rail line south to Melbourne, because Sydney is not considered a feasible destination for movement of grain. However, the NSW government is unlikely to support such investment because it provides a source of revenue to the Port of

		Melbourne. Much of the business in the Riverina-Murray, particularly from Albury, goes to Victoria. Therefore there may be overall hesitancy by NSW government and business to invest in services, infrastructure and assets to support industry, despite the region being part of NSW. The Griffith-Narrandera rail line is still in use, but suffered considerable damage by floods, so is currently out of action. With the increasing investment in the rice and cotton industries by multinational companies, there is uncertainty around their willingness to invest in regional infrastructure. Difficulties in the transportation of grain may lead to increased reliance on on-farm storage, increasing costs to producers already struggling with slim profit margins. On-farm storage coupled with the loss of single desk selling of grain into international markets increases the risk of double handling, and makes selling more complex for producers.
	Genetic resources - agriculture	Ongoing research and development (R&D) is required to improve genetic resources to deal with climate change. There is a disconnection between research and modelling on climate change and breeding programs. Limited funding also means programs have a short lifespan whereas they should be ongoing. Genetic improvement (crop and livestock) needs to be a constant; you can't think that you have 'done it'. There is a risk that government and industry will think that way and move on to the next project. Annuals are better able to adapt than perennials. For annual crops, genetic material can be brought from overseas that has shorter growth periods, to take advantage of changes to seasons and get more than one harvest per season. For example, Australia no longer breeds pasture varieties, cultivars are brought in from New Zealand. For horticulture, it will be increasingly critical to explore breeding as an option to improve adaptation. For livestock, genetic progress is being made but will it be sufficient to keep the industry ahead of climate change? The dairy industry has moved to larger, high-milk-producing cows, which is probably not the best type to cope with heat stress. The industry will either need to modify the environment to keep them cool, or get a smaller cow with less milk but fewer cooling costs. Livestock breeding is dependant on individual producer preferences – either choosing for production, strength or environmental adaptability. The market will most likely drive the particular breeding practices/requirements. Is there a role for government in the event of market failure? If the only genetic material imported to Australia is not suitable for the challenges of future climate, then that is a market failure. Government has a role in ensuring that market failures are identified and alternatives are offered. Unfortunately the loss of regional research facilities (research stations, agricultural colleges, stranded facilities and lost assets) that might have assisted in genetic adaptation are unlikely to be refurbished.

	National broadband network (NBN)	The NBN is as yet an unknown, and products and services will develop once people see what it can do. At present the community believes that it offers great potential to the region. Computer technology is likely to become increasingly more important to the region as time goes on. For example, farmers are increasingly using GPS technology for harvesters/headers/ploughing in precision farming systems. The National Broadband Network (NBN) is coming to Wagga Wagga and Albury in the next three years. It will likely offer significant opportunities for regional communities to be informed and educated in the home. It could also help to gather information from rural communities on local scale changes to and responses in the landscape. For example, during the recent floods the CSIRO didn't have information on catchment flows and where water was going. However, there were farmers who had local experience that would be invaluable in such events, if a system was available to access their knowledge and experience. There are also likely to be greater opportunities for communities to participate in and add value to conversations on the internet. There is, however, a potential downside for local business through increased use of online shopping and other services. It will be up to regional businesses to make the most of opportunities to advertise regional products to an expanded market through the internet. Online buying is not expected to affect local service providers, such as tradesmen.
	Climate data	Climate projections rely on climate models, which in turn need up to date climate data to be of greatest use. The current limitation on climate modelling is getting this data. There must be continual funded programs of data collection and analysis so that current models can be continually improved. At present, government churn and change and the political cycle doesn't allow for a clear direction and path to be forged. There is a need for balance between stability and stagnation in climate research.
	Private housing stock	In some western locations as many of 75 per cent of houses are not occupied. Houses that can't be sold represent a stock of capital that can't be transformed by owners into new more productive uses. However, poor property prices stemming from little demand for housing in these locations is resulting in owners offering properties to relatively less employable (often welfare dependent) people for low rents or for free in exchange for minimal labour. Affordable housing encourages people to move to those areas, changing local demographics. Such people are often unprepared for the problems of isolation and social dislocation. In many cases, new-comers require a higher level of services than local education, health and community providers can deliver.
Financial	Banks and the regional economy	Changes to the banking sector mean that there is little understanding of the regional issues, and growing uncertainty about the regional economy which damages investment in the region. In addition the 'Big Banks' are moving out of communities and rural bank manager positions have disappeared. This means that farmers and regional business owners deal with bank staff from anywhere in Australia through online services. Unfortunately, because they lack a local presence and are not engaging with regional offices on regionally important issues the big banks are guided by a lot of misinformation at head office, (particularly about the Murray Darling Basin Plan (MDBP)).

		Regional communities often perceive the banks' lack of understanding of the regional context as disrespectful. Banks are reluctant to invest in the regional innovation that may be required under climate change without government backing to reduce the risk. When regional confidence is low, banks won't invest and business won't invest in itself. Through the drought, banks have seen what low allocation can do and are wary of changes likely under the MDBP. For example, regional investors recently sought a big investment in cotton production, which was declined by bank. However, banks still generally like agriculture on their loan books, even if they don't want to lend the industry money. For most parts of the agricultural industry, landholders' equity is around 70 per cent or better. However, many properties carry debt burdens so large they don't have the cash to service them. The big banks are increasingly being replaced by smaller more community-connected banks (such as Bendigo Bank). It is positive that these banks are present in the community however they have less money to lend. Finance ebbs and flows with seasonal conditions, and some confidence is returning to the region, but is still limited. The region hasn't yet bounced back from the drought and recent floods. The repercussions are still being felt because last year's income goes into this year's investment, and other latent financial impacts on the community.
	Agricultural adjustment	Significant barriers exist to adjustment in agriculture. With the migration of rural youth away from the region land holders have no one to pass the farm on to, and they have no spare money to invest in new approaches that might help keep farms viable. These factors mean that people external to region buy land in the east of the region (slopes and tablelands), but not generally in the western rangelands. While agricultural property values are holding up (particularly in the east of the region where there is some demand) and landholders' equity is relatively high, most landholders are struggling to service very high levels of debt, because of almost a decade of drought and recent severe flooding (people are 'still regaining their feet'). Graziers are re-stocking, but the cost of purchasing new stock is still very high. Many farmers have invested a lot in cropping and livestock because of the recent good seasons, putting them further in debt. Community and individuals are seeing a window of opportunity with the good seasons encouraging greater confidence and more spending. Another extreme weather event now would be very hurtful. Changes to exceptional circumstances (EC) policy are causing some uncertainty around the ability of agriculture to survive future extreme weather events. Nine years of drought, with the availability of EC assistance, has meant very limited structural adjustment in agriculture. However, it is uncertain whether the scaling back of EC assistance will stimulate adjustment (such as exit of landholders and property amalgamations), and what the flow-on effects could be for rural communities already under significant financial pressure. Government needs to remember that agriculture is not always about profits. The culture and lifestyle of being on the land is also an important part of regional Australia. Policy on this issue needs to tread a fine line between supporting people and propping up an

		industry.
	Viability of local governments	Local governments have huge financial issues. With fewer grants on offer from federal and state governments, local government is raising money from any resource it can. Public-private partnership is one way local government is looking at funding works projects. For example, the new hospital in Griffith was mostly funded through grants not revenue, and the Hume Highway upgrade is a public-private partnership. However, there are issues with trust because these partnerships haven't always worked well in the past. Further amalgamations are the likely end point of this chronic lack of funding. However, local government is a major employer in small towns, so it's a big issue if they amalgamate because local job losses would see further declining population and loss of local businesses in small towns. Regional Organisations of Councils (ROCs) are operating effectively at the moment. They encourage sharing and a cooperative spirit among councils and have achieved efficiencies. Councils may initiate their own amalgamations in the future based on the ROC example, to help ensure the survival of some communities.
	Investment in social capital	Government needs to invest in local land management organisations such as Landcare and other groups, in order to build social resources. Previously, community based NRM groups found it difficult to obtain funding which resulted in many of them collapsing because unable to take any action. Investment is needed to make sure community based NRM groups are supported allowing issues like climate change to be discussed and social networks to be established.


INDUSTRIES
Adaptive capacity
Diminishing skill base
Regional networks
State government churn
Sustainable rural infrastructure
National broadband network
Agricultural adjustment
Climate change
Direct impacts
Increasing dryness
Shorter growing season
Lower pasture production base
Lower crop yields
More virulent pests and weeds
Increasing uncertainty
Less feed for intensive stock
Indirect impacts
Lower profits
Increased expenses
Less water for irrigation
Itinerant workforce shortages
Gradual industry change
Changed agricultural management / technology
Changed infrastructure needs
Need to store more water
External drivers
Changing demographics
Declining population
Government policy
International markets
Market preferences
Bank investment policies
Cross-sectoral impacts
Changing human services demands
Declining Emergency Management volunteerism
Demand for government research and extension
Migration of labour away from the region
Impacts on rural suppliers

3 Settlements and Infrastructure sector

3.1 Background

3.1.1 Settlements

The Riverina Murray region is large and diverse, with a range of settlement patterns from large towns like Wagga Wagga and Albury to small hamlets and villages. Some areas have good access to transport and infrastructure while others, particularly in the west of the region, are remote and residents need to travel large distances to access services. Most of the region's larger towns are located near rivers or within irrigation districts.

While the region is likely to see a slight decrease in population overall, this will not be evenly spread. Large cities and towns are likely to see population growth, whereas smaller towns and villages are more likely to see population decline.

The population of the Riverina Murray is also aging at a faster rate than for NSW generally. This is likely to drive demand for smaller and more accessible housing, as well as for local services and amenities such as secure water supply, public transport, health care and recreational facilities.

Rural residential developments have also increased over recent years and this trend is likely to continue due to the attractive riverside land in the region. Rural residential development can represent an opportunity to develop the economy and social fabric of the region. However, this development pressure also has the potential to degrade riverine environments and riparian land, impact on agricultural and primary industries and strain local government service provision.

Careful management of these settlement pressures is required. There are several ways that state and local government can manage settlement patterns and characteristics. The mechanisms available include:

- Strategic Planning
- Regional and Local Strategies
- Local Environmental Plans
- Development Controls
- Individual Development Assessments.

3.1.2 Infrastructure

Transport

The Riverina Murray region is situated as a key transport hub for distribution of goods across south-eastern Australia, with rail freight, roads and airport links within reach of major markets, and good roads linking regional townships.

Three interstate truck routes run through the region: the Hume Highway from Sydney to Melbourne; the Newell Highway from Melbourne to Brisbane; and the Sturt Highway from Sydney to Adelaide. There is an equivalent rail route following the Sydney to Melbourne highway. There are good roads running east to west through the region, such as the Riverina Highway.

The strategic location of the Riverina Murray region between Sydney, Melbourne, Adelaide and Canberra provides a basis for the continuing expansion of industries such as transport, goods distribution and tourism. Melbourne is the main port for the

region, with most produce being transported south. The traditional transport hub for the Hume Highway is Albury, a centre which has recently provided significant growth in transport, warehousing and logistics, such as the Ettamogah Intermodal Hub and expansion of Border Express.

There is a direct link to the Victorian and NSW rail networks, and air service to national and State capitals from Albury, Wagga Wagga, Griffith and Mildura (in Victoria), as well as a handful of smaller airports throughout the region. There are passenger rail services to Griffith, Albury and Wagga Wagga, with connecting buses reaching smaller communities. There are also services linking Griffith, Deniliquin and the towns along the Murray, with public transport access to Melbourne.

Water

Irrigated agriculture is the major economic driver within the region, dating from the early 1900s with the development of irrigation schemes around Yanco and Mirrool. Major water users include local councils and water utilities, forestry, tourism and agriculture, including rice, dairy, wool, wheat, beef, lamb, grapes, citrus and cotton.

The main irrigation areas are the Central Murray, Murrumbidgee, Coleambally and Lowbidgee Irrigation areas[7]. The delivery of water and maintenance of infrastructure in these areas is managed by private irrigation companies, of which the largest in the Riverina Murary are Murrumbidgee Irrigation Limited and Murray Irrigation Limited.

Rural Water Utilities are responsible for supplying water for non urban water uses, particularly irrigation, stock and domestic supply. They also manage public reservoirs and supply water to urban water authorities. Local Councils and County Councils are responsible for delivery of water to urban areas, and treatment and disposal of wastewater and stormwater.

Water supply is facilitated by a series of dams and catchments managed by State Water (Figure 4), as well as through bore fields usually managed by Water County Councils.

Figure 4 Key Dams supplying the Riverina Murray Region

Dam	Capacity (megalitres)
Murrumbidgee Catchment	
Blowering Dam	1,628,000
Burrinjuck	1,026,000
Talbingo Dam	920,550
Tantangara	254,080
Googong	125,000
Murray Riverina Catchment	
Hume	3,038,000
Dartmouth	3,906,000
Lower Darling Catchment	
Menindee Lakes	1,730,000

[7] Murray Darling Basin Authority, 'Community Profiles'.

Power

The distribution network service provider for the Riverina Murray region is Essential Energy. The Riverina Murray is covered by the Far West and Southern supply districts.

The NSW–Victoria Interconnect natural gas supply pipeline owned by the APA Group runs south from Young, through Junee, Wagga Wagga and Culcairn, and on over the Victorian boarder. A further branch of this pipeline runs west from Junee through Leeton and ends at Griffith.

Information and Communication Technology (ICT)

Telstra own and operate the landline and mobile networks in the Riverina Murray. Telecommunications services may be accessed through other providers, but delivered through the Telstra network.

The Riverina Murray is well covered by 3G networks, with the exception being a lack of reception in the area in and surrounding Mungo National Park to the west of Hay and north of Balranald, and a smaller area to the south west of Hay. Global Systems for Mobile (GSM)[8] (2G) coverage is limited, with reception areas focused on larger towns and major highways. Remaining areas rely on satellite telephone communication.

Efficient ICT infrastructure built around the high capacity fibre optic trunk link (Sydney–Melbourne) runs through Wagga Wagga. The $200 million Royal Australian Navy Defence Communications Station makes the Riverina home to some of the most advanced communication technology in the world. High-speed broadband is expected to reach the region by 2015.

Research

Significant research establishments are also located in the region, such as the CSIRO centre at Hanwood, Wagga Wagga Agricultural Institute, the NSW Department of Industry and Infrastructure Yanco Agricultural Research Centre, Murrumbidgee Rural Training centre (at Leeton) and Inland Fisheries Centre. The Australian Defence Force (Australian Army Base at Kapooka and Royal Australian Air Force at Forest Hill) maintain a strong presence in the Riverina Murray region, and play an integral role in the local economy.

3.2 Workshop participants

This workshop was held in Albury on 24 and 25 May 2012, with attendees from the following organisations:

- Albury City Council
- Environment Protection Authority
- Department of Planning and Infrastructure
- Office of Environment and Heritage
- Riverina and Murray Regional Organisation of Councils (RAMROC)
- Roads and Maritime Services

[8] GSM is a standard set of protocols for second generation (2G) digital cellular networks used by mobile phones.

- Greater Hume Shire Council
- Murray Catchment Management Authority
- Murrumbidgee Shire Council.
- TAFE Riverina Institute
- Wentworth Shire Council

3.3 Findings: key vulnerabilities and adaptive capacity

The following indicators and descriptions are adapted from the discussions had by participants in the Settlements and Infrastructure workshops. As much as possible this text maintains the original wording used by participants. Where necessary changes have been made for readability or to explain concepts and terms.

Capital	Indicators of adaptive capacity	Importance of indicator and adaptation response
Human	Attract and retain skilled professionals	The region has difficulty attracting and retaining skilled professionals. People appear to be fearful of coming to regional areas. There is a perception that government and other services are not of a sufficiently high standard to retain people. It is particularly hard to get professionals (such as doctors and dentists) to small towns. This may be because small towns are less attractive for the spouses of professionals. In addition, maintenance and civil engineering roles in councils are difficult to recruit. There are many opportunities in the mining industry at the moment, so councils struggle to fill these positions, even though they offer very good deals. Some councils provide housing and surgeries to encourage professionals to relocate. Difficulty recruiting is likely to worsen as the baby boomer work force is approaching retirement. Replacing these retirees may only be possible through outsourcing. Replacement is made more challenging as the region's youth tend to leave to get an education in capital cities, and then don't return. This difficulty recruiting professionals is less of a problem in a regional centre such as Albury. This may be in part because they have sporting associations and social networks. Services are more important than salary. People with the skills to leave move to areas with better services. Markets determine flow of skilled labour, however, where there is inequity, government should intervene. Perhaps the region could market itself to professionals better. More products offered by regional universities may be a way to keep people in the region, and develop skill sets for people to run regional communities. Educating professionals will be more costly to here than in Sydney and Melbourne, for example Charles Sturt University has a big impact on the region, but they don't offer engineering degrees or medical training (other than nursing). It may also be possible to exploit relationships with people who spent their childhood in the region, or with those who have lived here and moved away to encourage them to return. The idea of making them 'regional citizens', and maintaining contact in a similar fashion to the relationships between universities and their alumni, could be explored further.
	Demographic change	Projections for the region show an increase in population, but it occurs in the bigger centres with a decline in smaller towns. There's some movement of people from outside the region but there is also significant movement within the region. Generally, the bigger cities are absorbing people from smaller towns. Small towns are losing people in the productive age range. This leaves a greater proportion of people who cannot

		work, which results in increased demand for services (for example health care) from an aging and vulnerable community. Youth are leaving the region for education and not returning. Agricultural industries are changing and the old system of family farming is being lost. With the MDBP and prolonged drought, there is a lack of confidence in the future of agriculture. People are fearful of the impacts of climate change so they sell water, and farms then use the capital to pursue a better lifestyle elsewhere. The remaining demographic often have had little exposure to climate change concepts, so may have less ability to manage the complex issues around climate change. They may also have lower self-reliance and the expectation that someone else will help them. Older farmers are likely to be more sceptical about climate change and not worried as it is too far in the future to affect them personally.
	Community attitudes	Lack of community belief in climate change is an impediment to adaptation. In general the community are not alarmed about climate change or are distrustful of climate change information. These attitudes make it difficult for local government to allocate resources to climate change. So far everything is a 'guesstimate' so it is difficult for the community to believe and all can be manipulated for political ends. Uncertainty leads to' chicken little'. The population has become more cynical of climate change, due to carbon tax and other government policies. Bad publicity and groups trying to exert extreme views has been counterproductive to getting people engaged on adaptation. People are tired of the negativity. Climate change has to be considered over a long time frame, and most people live day to day, 'stick heads in the sand'. People need to look at how they can adapt, when dealing with lots of variables that can't be easily quantified Communication on climate change needs to be more effective about regional impacts and timing so that community leaders and champions can convince others to allocate resources. The conversation needs to be more positive, focussed on building productivity and competitiveness. There are also significant differences in attitude between elected local government representative and people in council administration. Councillors with a farming background believe that creeks are drainage systems. If they were cleared out, then water would get away faster. Local government representatives advised by farmers provide information that is at odds with desired outcomes. These issues occur more often in rural areas. Climate change can be 'sold' to elected representatives by promoting co-benefits of adaptation, in particular in terms of cost savings in the longer term. However, more effort is needed to train elected representatives. In the past, professionals in local government have been ostracized for belief in climate change, so not able to do work on the issues. Now perhaps councillors may be more open. Local government professionals have to bring the decision makers along with them.
Social	Strong regional	The region has strong regional networks, which could be used to deal with climate change. Good horizontal networking exists between councils. Councils generally work well together and try to help each other. Albury City

	networks	Council provides advice and mentoring to smaller councils. There are strong state-wide regional managers' networks, and good relationships between councils and their contractors. The region also supports a number of healthy social, sporting, political organisations, but they are not turning their energy to climate change because largely because the tasks they might need to undertake are not yet clear. Regional Organisations of Councils (ROCs) are an example of a strong network and have been able to attract attention from state and federal governments. The Riverina and Murray Regional Organisation of Councils (RAMROC) has developed an advocacy role especially in relation to the Murray Darling Basin Plan (MDBP). ROCs provide councils with access to higher levels of government than they would have as individuals. They allow smaller rural councils to obtain funds that they couldn't access on their own because they lack sufficient scale to make projects economical for funding bodies. ROCs also support networking among local government professionals. Councils realise they need the community of councils to keep activity going. CMAs are now talking to local council as a partner rather than just giving them funding. The drivers of council business that come from the community are also becoming drivers of CMA business. The approach is part of a general realisation that cooperative work is more effective. It has come about through the maturing of CMAs as regional organisations and recognition that CMA and local government activities can be welded together, and that this will be mutually beneficial. For example, Murray CMA has developed a community committee which is linked to RAMROC. Increasingly, the CMA and local government are trying to ensure that their activities are complimentary. For example, councils are looking to collaborate on flood mitigation, and seeing CMAs as a useful partner in this. While there are regional networks for professional groups, for most of these organisations, climate change has been an issue for only the last 10 years so they do not have a great deal of expertise. Drought and flood have helped highlight possible issues and this is getting raised at engineering forums. In other instances there is information, but the networks in the region are not as strong. For example, there is a wealth of information on climate change available through the Planning Institute of Australia (PIA), but PIA has no presence in this region.
	Top-down, uniform policies	State government regulators try to apply policies uniformly across regional areas. However, they often don't have a good understanding of the regional area. This may mean the regulation creates time and cost pressures in the region that are unforseen in central areas. Engineers and other local government professionals are often over burdened with paper work to comply with regulations. For example, councils are required to undertake flood studies to avoid imposition of a blanket ban on development. Such policies may have discouraged people from wanting to live in these towns.
	Cross-border co-operation	Differences exist in the planning schemes and development approval systems on either side of the Murray River, which has led to different rates of growth in communities between NSW and Victoria. More even standards between Victoria and NSW would remove these inequities. New alliances and partnerships, albeit informal, are forming to consider some of these issues. For example, RAMROC has informal alliances with ROCs in Victoria. NSW has appointed a cross-border commissioner (NSW – Victoria, NSW – Queensland and NSW – ACT), to examine these and other issues. As yet, other states have not appointed their own commissioner.

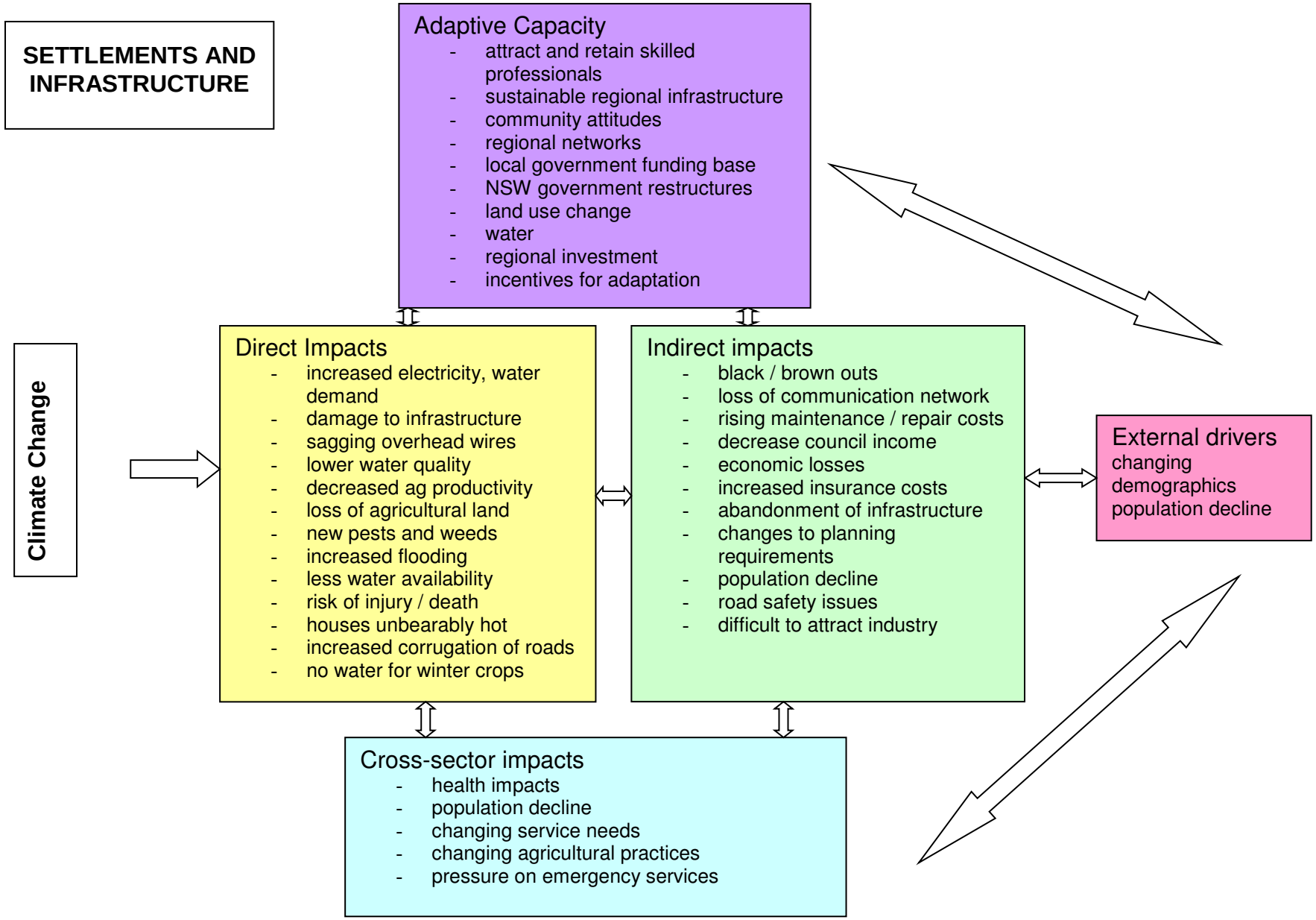
	New regional partnerships	The private sector could be drawn into new partnerships in the region that might allow government to meet some of the challenges of climate change. A combined, top-down and bottom-up management approach is needed to encourage these partnerships. Champions and message bearers are needed, who are willing to go outside of their traditional comfort zones and engage with businesses. A new dialogue between sectors is needed, as landscape function provides natural infrastructure that supports built infrastructure.
	NSW Government restructures	NSW government restructures and the creation of larger regions means that you can't just 'go down the hall' to talk to someone anymore. It is often very difficult to identify who to talk to in other agencies to address issues quickly, particularly when agency structures are in a cycle of change. In this region, the administrative boundaries of two of the major government service providers for climate change information (DP&I and OEH) are different, and contacts between agencies are not as strong as they could be.
Natural	Water	A number of states are involved in water management. In this region, everyone is jostling for water and therefore management is seldom optimised. In times of extreme weather, the community is often divided on the best way to manage water. The MDBP is trying to balance environment needs (including climate change impacts), against maintaining a viable agricultural industry and minimising negative flow on effects to communities. Concerns about food production are increasing. We need more water for the environment and recognition that farmers are good land managers. There is a need to better harness our water resources so that more is generated at the lower end to service South Australia; that would take the pressure off the Riverina region. Towns use a very small percentage of the water in the overall river system, but have significant impositions placed on them in the form of water restrictions that can result in significant damage to infrastructure, and pose a risk to human health for little saving. The sustainability of ground water resources is a significant issue. Riverina Water County Council (3/4 of production from bore water) and Gold Fields Water County Council (over 50 per cent bore water supply) used to try to sell water. Now these authorities are trying to manage demand, and opposing rural-residential development as it is seen as wasteful of the resource. Properties along the river are in significant demand for development, and these 'river communities' are bringing increasing pressure on water authorities to improve river health. For example, towns such as Albury, Echuca and Moama are growing.
	Land use change	In local government planning, rural-residential subdivision is a significant source of conflict. It is difficult to determine how much of this type of development is happening across the region. In some areas such as Wagga Wagga, it is significant. The pressure for subdivision tends to increase as roads are improved, making access to regional centres easier and land prices rise. Farmers rely on growth in capital of their land asset for retirement, and

		an aging farm population increases pressure for sub-division to facilitate this. Placing restrictions on rural-residential development is extremely challenging and political processes don't reflect the extent of the problem. For smaller councils, rural-residential subdivision may not be popular but it may be the only strategy to grow their rates. It often causes conflict over water because if council doesn't supply the water/sewerage services to the development it may not be approved. Councils often do not recoup the costs of development, because it is very costly to provide these services. Rural-residential development tends to cause a hollowing-out effect of human settlement patterns (people living in rural-residential development at the city fringe but nobody in the town). There is a market for rural-residential development but it is not necessarily good for everyone. A lot of prime agricultural land can be wasted through rural-residential subdivision. As a result, there are fears that it will erode long-term food security and inflate the price of land preventing new farmers from buying into the area and existing farmers from increasing their farm size to improve viability. Because the costs and high demand for services to these development, local government could consider differential pricing for water on those blocks. For example, Riverina Water County Council places caps on the volume of reticulated supply available to rural-residential developments, and the Department of Planning and Infrastructure required them to capture more water for development approval. Because of generally large house sizes providing a big harvesting area for water, it may be feasible for rural-residential blocks to capture and store larger quantities of water reducing their reliance on reticulated supplies. However, this may mean more reliance on water deliveries to replenish tanks in extreme drought. On the positive side, in many locations rural-residential development brings professional people into the area supporting the regional economy. Development should be able to take advantage of land that is not suited to agriculture. However, a better understanding of the economics of rural residential development is required (what does it cost infrastructure wise? What are we losing?). Closer management, and some constraints particularly on larger lot sizes, are needed (closer development means the economics of development for local government are more viable).
Physical	Dam management	Hume Dam is a major regional water storage dam not a flood mitigation structure. However, there is a public expectation that the dam could be used for flood mitigation. The weir water level rose by up to 20 per cent in March 2012 (that resulted in extensive regional flooding). If the dam levels had not already been low at that time, the dam may have spilled, potentially exacerbating flooding downstream. Such infrastructure may have to be managed differently in the future. However, use for flood mitigation conflicts with the State and power stations requirements that want to retain as much water as possible in the storage. For example, if 10 per cent of the storage is released in expectation of rain, and the rain doesn't come, then can the community afford that lost water? Management of these dams should be reviewed, especially with the risk of changes to hydrological flows in the future.

	Sustainable regional infrastructure	The community needs to understand that there is no capacity to build 'bullet proof' infrastructure. Even the best designed infrastructure will fail, and communities need to become more self-reliant, particularly in rural areas. Infrastructure will not last indefinitely without routine maintenance, particularly if climate conditions change. For example, under climate change the standards of engineering required to build structures to withstand certain levels of risk (such as a bridge built to be serviceable up to a 1 in 100 year flood standard) will likely be changing. Investment is needed to get the regional rail system to a sustainable level. The public needs to understand that provision of infrastructure to the community is unsustainable in current environment. The inability of the community to fund infrastructure adaptation builds up to be a significant impact on local government financial resources if they need to redesign community centres, pools and other assets. For example, local government is aware that best practice during drought is to water parks and reserves at night. However, councils are unable to afford a person to do it at those times, so automated systems are needed, but council can't afford that either. These issues can be applied to retrofits for other types of infrastructure. A more sensible approach for some infrastructure may be for service to be lost during a flood, with the structure remaining intact so that it is usable after flooding subsides, rather than needing to be rebuilt. Underground drainage can't cope with flooding so overland flow paths need to be identified, but the processes are not in place to ensure that overland paths are not impeded by structures. A more proactive management approach to overland flow is needed, rather than reliance on building underground drainage (which is only built to 1 in 5 / 10 year events). In general, towns were built in 'gentler times' and may not cope with less water. Town water supply and drainage was built for unlimited availability of water. In times of drought, water restrictions mean that flow through the supply system is very low, resulting in longer times of water retention in pipes. Coupled with high summer temperatures water can become dechlorinated, allowing the growth of human pathogens such as E. coli, with potential impacts on human health. Councils cope with this by reducing the number of reservoirs supplying the system, to maintain higher overall flow rates. Drainage systems can also be affected. Greater use of domestic evaporative coolers means that much of the water supplied to households does enter the drainage stream. Most sewage treatment plants are designed for, and run best on, a constant volume of waste water. Large fluctuations in flow, such as in drought or flood, may result in plant failure. Infrastructure is often established for rural-residential subdivisions by developers, but the maintenance and servicing of this infrastructure is too expensive for councils. New housing in the region probably is able to be adapted to future climate. However, existing housing stock will need upgrading to be resilient to climate change, especially given the lower income levels of people who live in these houses.

	Innovation	Innovation in industry can promote regional growth and resilience. There needs to be a focus on, and encouragement for, innovation in the region. There needs to be a better balance between regulation and development to allow innovation for adaptation to climate change. Innovation might come through greater investment in industries that work on climate adaptation for example agricultural genetics, renewable electricity generation. Australia has a good track record of developing and exporting innovative technologies. The National Broadband Network (NBN) could encourage innovation, but it could also hurt retailers in small towns due to greater use of online shopping by local consumers. The region has a 'watch and see' attitude to the NBN. The NBN will be available in Albury by 2014-15, however there is unlikely to be wide coverage in the region for some time. For example, Deniliquin will probably not receive coverage until 2020. The region would benefit from a strategic plan so that community can get indication of when the NBN will be coming and prepare for it. Some consideration should be given to seeing how the NBN can help struggling communities.
Financial	Local government funding base	The pegging of local governments rates to inflation means that local governments' limits local government finances and therefore their capacity to act on climate change. Many councils are barely viable now, and are struggling to maintain current aging infrastructure. Rate pegging means that the funding base has eroded, and there's a huge infrastructure construction and maintenance backlog so it is difficult to prioritise adaptation projects. Local government's rural income base is also being whittled away by a declining population in the small rural centres. However, councils can't 'just jack up the rates', as the financial burden on the local community would be too great for them to pay. This imposes a big limitation on adaptation. With future changes in climate, local government may have to find extra dollars quickly to cope with more frequent emergency infrastructure maintenance. The level of service that has become expected of local government managed infrastructure can't be maintained because currently it is not maintained on a cost recovery basis. Most other infrastructure provision has been privatised and is on a cost recovery basis, which leads to an over-expectation in the community of what local government should be able to provide.
	Incentives for adaptation	Federal government funding to promote adaptation is limited, and a highly competitive process favours larger councils that can demonstrate bigger benefits per dollar invested, over the smaller projects put up by rural councils. The loss of the Country Towns Water and Sewerage Grants program means it is impossible to introduce any new water and sewage schemes in rural towns. Availability of alternative funding for these programs is very limited. Most investment in infrastructure is focussed on urban areas, because in rural areas there are additional costs due to less dense populations. A 'user pays' approach is too expensive for these rural communities. A lack of subsidies means no ability to build new infrastructure that might be needed to cope with future climate extremes. Structural adjustment, particularly of regional natural resource-based industries, will be necessary to cope with climate change and may require government assistance. The recent conversion of Red Gum forests to national

		parks in Deniliquin area is an example of what can happen when an industry is lost without a comprehensive adjustment package in place. In this case, the local timber industry was replaced with a one off payment, which wasn't sufficient to allow proper adjustment in local economies. RAMROC has been successful in securing about $3 million in Federal funding to identify the regional issues in climate adaptation, where and what may happen and what action could be taken. Some councils have formulated new economic development strategies, and there is a further $180 million for follow up works. Only a small amount of the funding has been spent to date, and much hasn't yet been allocated.
	Regional investment	There is little surplus financial capital in the region, so there is a need to attract it from outside the region. This is a concern particularly in rural areas where there is little investment from industry. Under climate change, a decline in agriculture incentives may mean development of new industries, but what could replace agriculture and what incentives would promote that change? The Federal government is currently examining economic diversification opportunities for the region, but it is difficult to know how to develop new investment in regional manufacturing. Development of public-private partnerships may be useful to stimulate investment. Corporations often have social responsibility charters, so they may be interested in engaging with the community on regional sustainable development. These types of investments do have profitability pressures, but ethical investment helps create loyalty and brand recognition for businesses, so they are looking at channels to invest in council partnerships and governments. The Federal Government could encourage investment by giving companies incentives for engaging with local governments.
	Carbon sequestration payments	Payments for carbon sequestration may provide new opportunities for agriculture in the region. However, to grow the plants that capture the carbon requires water. In an area where rainfall is projected to decline, such as the Riverina-Murray, and under the current permanence provisions for sequestration, opportunities may be limited.


SETTLEMENTS AND INFRASTRUCTURE
Adaptive Capacity
- attract and retain skilled professionals
- sustainable regional infrastructure
- community attitudes
- regional networks
- local government funding base
- NSW government restructures
- land use change
- water
- regional investment
- incentives for adaptation
Climate Change
Direct Impacts
- increased electricity, water demand
- damage to infrastructure
- sagging overhead wires
- lower water quality
- decreased ag productivity
- loss of agricultural land
- new pests and weeds
- increased flooding
- less water availability
- risk of injury / death
- houses unbearably hot
- increased corrugation of roads
- no water for winter crops
Indirect impacts
- black / brown outs
- loss of communication network
- rising maintenance / repair costs
- decrease council income
- economic losses
- increased insurance costs
- abandonment of infrastructure
- changes to planning requirements
- population decline
- road safety issues
- difficult to attract industry
External drivers
changing demographics
population decline
Cross-sector impacts
- health impacts
- population decline
- changing service needs
- changing agricultural practices
- pressure on emergency services

4 Human Services sector

4.1 Background

In the Riverina Murray region, human services are delivered by Federal, State and Local Government, often in collaboration with local NGOs.

Department of Education and Community is responsible for providing and maintaining public schools, TAFEs, migrant English programs and early childhood education in NSW.

Education and Research and Development facilities in the region are significant economic drivers, and the region hosts a number of higher education institutions. These include Charles Sturt University (Albury and Wagga Wagga), Latrobe University and a number of TAFE centres. Significant research establishments are also located in the region, such as the CSIRO centre at Hanwood, Wagga Wagga Agricultural Institute, the NSW Department of Industry and Infrastructure Yanco Agricultural Research Centre, Murrumbidgee Rural Training centre (at Leeton) and Inland Fisheries Centre.

The NSW Ministry of Health is responsible for providing health services to the Region. In particular, the Murrumbidgee and Far West Local Health Districts administer health services in the Riverina Murray Region. Local Health Districts operate public hospitals and health institutions, and provide health services to communities within their geographical areas. The Local Health District's primary purpose is to:

- provide relief to sick and injured people through the provision of case and treatment, and
- promote, protect and maintain the health of the community.

Base Hospitals are located at Albury, Wagga Wagga and Griffith while Deniliquin, Hillston, Henty and Narrandera among others are home to regional hospitals.

The Department of Family and Community Services (FACS) delivers services to some of the most disadvantaged individuals, families and communities in NSW through its own services and through NGOs that it funds to provide services. In particular, FACS is responsible for providing:

- government housing and housing assistance
- ageing, disability and home care services and support programs
- community services including child protection services, parenting support and early intervention, foster care and adoption services.

These state operated programs are complemented by Australian Government policies and programs administered by the Department of Human Services (DHS). DHS is responsible for a range of health, social and welfare payments and services through:

- Medicare, which delivers the Pharmaceutical Benefits Scheme, the Australian Childhood Immunisation Register and the Australian Organ Donor Register
- Centrelink, which delivers a range of payments and services for retirees, the unemployed, families, carers, parents, people with disabilities, Indigenous

Australians, and people from culturally and linguistically diverse backgrounds, and provides services at times of major change.
- Child Support, which provides support to separated parents to provide the financial and emotional support necessary for their children's wellbeing.
- CRS Australia which provides disability employment services to help people with a disability, injury or health condition to get or keep a job, and help their employers to keep their workplaces safe.

The service provision by DHS includes face-to-face delivery in the region through Centrelink Customer Service Centres in Wagga Wagga, Tumut, Leeton, Albury, Deniliquin and Griffith, and Medicare and Child Support offices in Griffith, Albury and Mildura in Victoria.

Local Governments contribute to delivery of essential human services through provision and management of local aged care, child care, libraries, public swimming pools and public recreation facilities.

4.2 Workshop participants

This workshop was held in Griffith on 31 May and 1 June 2012, with attendees from the following organisations:

- Albury City Council
- Centrelink
- Charles Sturt University
- Department of Education and Training
- Department of Family and Community Services
- Environment Protection Authority
- Griffith Base Hospital
- Murray Local Health District & Southern NSW Local Health District
- Murrumbidgee Local Health District
- Office of Environment and Heritage
- TAFE Leeton-Narrandera Institute

4.3 Findings: key vulnerabilities and adaptive capacity

The following indicators and descriptions are adapted from the discussions had by participants in the Human Services workshops. As much as possible this text maintains the original wording used by participants. Where necessary changes have been made for readability or to explain concepts and terms.

Capital	Indicator of adaptive capacity	Description of what must change (indicator)
Human	Attract and retain skilled professionals	The health systems in the region struggle to attract and retain staff. There are variable skills gaps in current workforce including nurses and allied health staff, and shortages in allied health and medical staff due to an aging workforce. Migration from the region also means loss of skills. In the regions there are fewer specialist experiences and fewer career opportunities – the "grass ceiling" – so younger generations are less likely to stay in regional jobs. There is also competition with the NGO sector when recruiting personnel. If a suitable applicant is found, there is often no appropriate position for their partner. Housing costs and availability can also be an issue (eg Griffith and Wagga Wagga). The sector needs to attract young staff before they have established their family and put down roots elsewhere. The Department of Education and Training has a program that encourages teachers to move west, although the difficulty is getting people to make the shift permanently and it results in staff with low experience levels. There has been much more success in bringing in overseas migrants for 5-10 year periods, however these migrants are faced with a lack of familiar social networks, possible racism and difficulty travelling in regional areas if they don't have a drivers licence. Financial incentives are one solution, as they don't really cost the government because they are already paying a premium for locums. However, provision of incentives by agencies and marketing by local government is not consistent across the region. For example Griffith has marketed for health by providing incentives but other areas have not. In addition, incentives do not work in some agencies and areas, so there needs to be a switch to market the location to the whole family. The Riverina Murray region does not have the focus of Sydney-based State government agencies in relation marketing to attracting health professionals. New England region has marketing; however, the south-west of NSW has been left to its own devices.
Human	Human resources surge capacity	The region needs a 'surge capacity' of human resources, to draw on during events/incidents. Current emergencies are a practice for the future. The recent floods tested all resources, right up to the state level. The region managed the events, but if the Murray River had flooded as well, all the staff from the outer regions would have been redirected to their own region, and the surge capacity in some agencies (eg FACS) would not have been available to assist in nearby regional areas. It is important that staff, especially those working away from centres, are multi-skilled so they

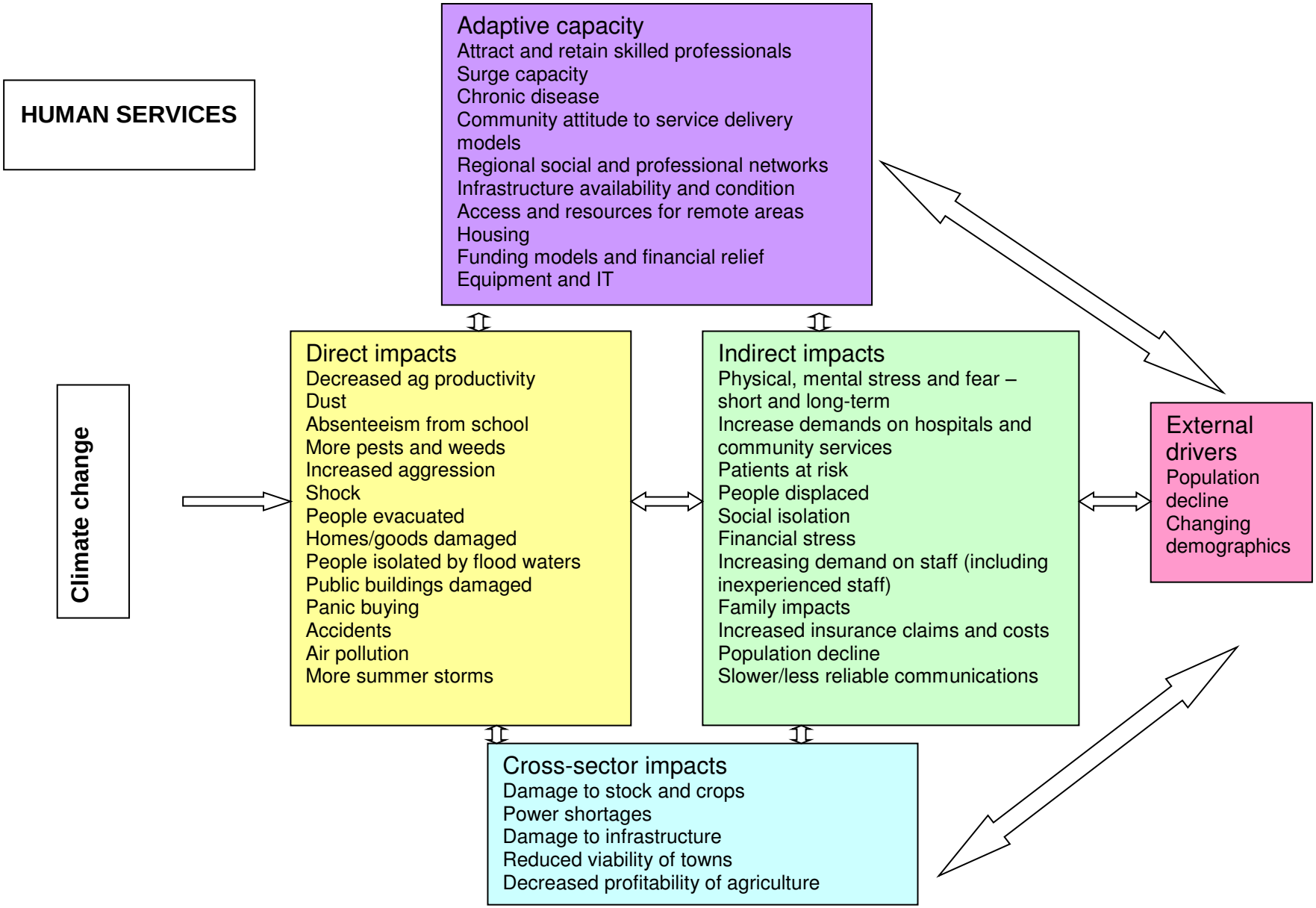
Capital	Indicator of adaptive capacity	Description of what must change (indicator)
		can provide surge capacity. Workforces outside of regional centres are already adaptable in this manner. Flooding can also prevent the movement of staff to where they are needed. **Suggestion:** There is potential to extend multi-skilling to other sectors and agencies (eg Department of Agriculture), by building the capacity of their key community contacts e.g. on mental health issues.
Human	Chronic disease	Diseases that have seen significant improvements in city areas, such as cardio-vascular disease, have not seen similar improvements in regional areas. Health services are therefore dealing with multiple and compounded health issues. The population of the region is also aging, putting further pressure on health services. These recurring health issues are likely to be exacerbated under climate change. There is a lack of treatment available for acute surgeries and getting to treatment centres within the required timeframe for successful surgery, is still not being achieved in regional areas. The regions are trying to address the chronic diseases, but are getting mixed messages from policy and the State. If the regions stay in the acute care focus they won't survive/succeed. The planning focus is looking backwards, not forwards – all the models are historic and there is no future planning. The focus needs to be on every person's right to health.
Human	Regional training	Regional training is often not available and, if it is, it is not valued. In medical studies there is still a hierarchy in universities and training institutions, so potentially even if Charles Sturt University offered medical studies it may not attract students.
Social	Community attitude to service delivery model change	Public perception of a good health system is linked to access to hospitals and specialists, however most people are unaware that the majority of health services are delivered outside the town. Sometimes rural communities feel they are losing services due to impacts on hospitals, but are in fact receiving very good services outside the hospital. There is also a fear of change. The community does not hear about the positive changes to health service delivery, due to bad media and difficulty in getting message out there. There is no political interest in communicating with the community about change in service provision. For example, people don't like visiting services as they see it as a loss of service to the town, rather than as a way to maintain some service when a full version is no longer viable. It is important that a mechanism is found for the community to be an integral part of change.
Social	Regional networks	The formal networks of Centrelink and Health are working well in the region but the informal networks need improving. There is a need for more inter-agency forums (similar to IRVA workshop) to enable communication across the service

Capital	Indicator of adaptive capacity	Description of what must change (indicator)
		sector, and for providers to help build understanding and capacity. It would be useful to review the forums, groups and networks already in place. Within agencies there are good checking mechanisms in place and review processes after emergency events, including debriefs to staff. However communication between State agencies, or across the region, is less effective. In the service delivery field there is a lack of understanding about what everyone is doing, and there is a need to develop a whole-of government-approach. For example, there has been a lot of collaborative planning work for the "***Keep Them Safe***" program, which is a whole-of-government approach for child safety and homelessness. The program has been very successful in sharing information and building inter-agency networks. However, there are considerable issues with confidentiality and privacy, which are particularly difficult in small town situations, and had to be managed carefully.
Social	Social networks and cohesion in the community	Social connections are very important in maintaining personal health, particularly during stressful periods. During the recent drought, remote communities organised gatherings and were strongly protective of each other. In some areas, the community is very supportive, close knit and work together towards a common goal (eg Griffith community annually raises funds for Hospital equipment). However, the cost of socialising can be limiting in tight financial times such as during droughts, and people can lose touch with important support networks. Social cohesion enables communities to work together to build future changes and adapt to changes. Community division regarding water allocations (eg the Murray Darling Basin Plan) is hampering this. Fracturing issues and pressures such as drought and flood need to be managed by agencies, to ensure the continuation of important social relationships to avoid social decline, as well as maintain a current and future employment base. Health agencies need to work to promote socialisation, and could benefit from looking at forums and social networks that are already in place.
Natural	Ability to service remote areas	Community services have a limited presence further out from the regional centres. A decrease in the amount of water available may result in farmers leaving the land to pursue livelihoods elsewhere. A declining population may result in further loss of remote services, and the need to deliver health and community services over bigger distances. This issue may also extend to regional centres such as Griffith, where the irrigation industry is water dependent.
Natural	Health issues related to water availability	A decrease in the amount of water available will reduce farmer's ability to produce food. Decreases in food availability and quality can lead to poorer nutrition, and issues for disease prevention. This could accelerate over time, but is likely to become a long-term issue. Associated with an increase in water from floods is the potential increase of vector-borne disease not commonly seen in this region. It may also increase animal and pest plagues, which have the potential to transfer diseases to humans (eg mice/rats).

Capital	Indicator of adaptive capacity	Description of what must change (indicator)
Natural	Connection to land	Significant changes in the natural landscape may impact on cultural identity and the spirituality of land and place. Changes in historical land use due to a decrease in water availability may mean a loss of connection. It should be noted that Australian landscapes have been decimated in the past and are still surviving and continuing to adapt. It is important to map the Aboriginal cultural assets of the region so they can be preserved during events and considered in management plans for example pushing through fire breaks during or prior to bushfire events.
Physical	Telecommunications	Telecommunications are at risk from extreme events. For example, the Telstra hub at Hay was damaged, resulting in 20,000 homes losing phone services and ability to access 000 services. The Disaster Plan response includes mobile stations manned by ambulance officers, who provide for hospital and patient communication using radios. All GPs are also notified about the system breakdown. This response doesn't help with internal communications at the hospitals, and the government radio network is limited in southern NSW. There would be a major issue if mobile phone services were also lost. Telstra does everything it can to protect the hubs, and if they are affected they work to get them operational as soon as possible.
Physical	Infrastructure	There has been a lack of interest from government in maintaining aging infrastructure. Existing facilities will need to be adapted for different services in the future. For example, more shade refuges will be required to escape hotter temperatures, especially in schools. Actions that can improve adaptation and mitigate emission are difficult for regional facilities to access. In some cases, facilities don't have energy efficiency or renewable energy options or staff don't know when or how to access funding (if it is available). There is also a skills issue for renewable energy and energy efficiency in regional centres, as builders don't know how to quote for energy efficiency retrofits or access materials.
Physical	Transport links	Governments are making decisions that do not support the community. Abandonment of rail services due to damaged infrastructure forces community to use buses, which some elderly and immobile persons are not able to physically access. Also some roads can be cut off for weeks, preventing access by staff. Some businesses will choose not to locate to regional towns, because there are insufficient transport services to allow delivery of goods.
Physical	Housing	The existing public building and private housing stock was not designed with climate change in mind, and will be unsuitable for higher temperatures and extreme events. During heatwaves, dust storms and smoke pollution caused by fires, people will seek out public refuge centres such as shopping centres, which may not have capacity or characteristics to manage this requirement. In Wagga Wagga and Griffith there are housing affordability issues, which make it difficult to attract new staff to the

Capital	Indicator of adaptive capacity	Description of what must change (indicator)
		region and house temporary staff, with agency staff and students is usually billeted. There is also an issue of locating housing of a suitable quality and standard for newly recruited healthcare professionals.
Physical	Equipment and Information Technology (IT)	There is already a 10-15 year lag for health equipment when compared to metropolitan areas. This is an issue for provision of care but also had implications for the regions ability to attract specialist doctors who want to work with cutting edge technology. Private companies are filling the gaps but this increases costs. Tele-health will be a vital asset for the regions. However, there are issues relating to the lack of compatibility with other states and GP services, plus issues around data encryption. Schools are beginning to use technology to offer expanded curriculums to students but this mode of delivery needs to be validated by parents. Often the equipment, software and training of teachers is out-of-date. Technology maintenance, upgrades and training needs to be accommodated in the budget. The National Broadband Network (NBN) needs to be investigated for what it can offer regional areas, and how it can be used to our advantage.
Financial	Funding models	Longevity of funding is an issue constraining the ability to create long-term plans. The current funding model does not account for the realities of delivering services in a rural setting. It needs to factor in the true cost of rural service delivery, and look at costs and loadings such as larger travelling costs, higher salary costs and fly-in fly-out expenses. Flexible funding models are needed, to be able to respond at a local level. More discretion at the local level particularly would facilitate work across different streams (eg health and education). Competitive outsourcing to NGOs creates inefficient outcomes. Community mistrust of service change can be overcome by giving greater responsibility to communities for managing money, giving them greater ownership of outcomes, value and probity. The use of local providers also needs to be encouraged, but there needs to be investment in capacity building of local providers alongside this investment.
Financial	Events not triggering financial relief	An increase in flooding may increase pest plagues, which can have significant financial impacts on hospital services but for which no extra funding is received as they are outside the Disaster Plan. For example, a 2011 cricket infestation resulted in the closure of hospital theatres and went on for a week. If it had gone for longer, it is unclear how the hospital would have coped.
Financial	Funds for equipment and IT development	Care facilities do not know how much there is to spend from state budgets at the local level therefore it is difficult to strategically plan for replacement of equipment. There are plans to upgrade the IT systems but not the funds. In some

Capital	Indicator of adaptive capacity	Description of what must change (indicator)
		cases there is reliance on significant public donations for service provision, which requires the need to maintain relationships with those people and organisations. Issues can arise when there is a misalignment between community needs and wants, and the good will of the community. This needs to be managed to avoid donation of equipment that cannot be maintained. Funds are needed for maintenance, replacement and obsolescence, as well as just purchase of equipment.


HUMAN SERVICES
Adaptive capacity
Attract and retain skilled professionals
Surge capacity
Chronic disease
Community attitude to service delivery models
Regional social and professional networks
Infrastructure availability and condition
Access and resources for remote areas
Housing
Funding models and financial relief
Equipment and IT
Climate change
Direct impacts
Decreased ag productivity
Dust
Absenteeism from school
More pests and weeds
Increased aggression
Shock
People evacuated
Homes/goods damaged
People isolated by flood waters
Public buildings damaged
Panic buying
Accidents
Air pollution
More summer storms
Indirect impacts
Physical, mental stress and fear – short and long-term
Increase demands on hospitals and community services
Patients at risk
People displaced
Social isolation
Financial stress
Increasing demand on staff (including inexperienced staff)
Family impacts
Increased insurance claims and costs
Population decline
Slower/less reliable communications
External drivers
Population decline
Changing demographics
Cross-sector impacts
Damage to stock and crops
Power shortages
Damage to infrastructure
Reduced viability of towns
Decreased profitability of agriculture

5 Emergency Management sector

5.1 Background

Emergency management agencies include the Rural Fire Service, State Emergency Services, NSW Ambulance Service and NSW Police Services. These organisations work in collaboration with functional area coordinators, covering:

- Agriculture and Animal Services (NSW Agriculture)
- Communication Services (Department of Information Management and Technology)
- Engineering Services (Department of Public Works and Services)
- Environmental Services (Environment Protection Authority)
- Health Services (Department of Health)
- Public Information Services (Public Affairs, NSW Police Service)
- Transport Services (Department of Transport)
- Welfare Services – Disaster Recovery, Human
- Services (Department of Community Services).

The Riverina Murray is covered by two emergency management districts:

Murray Emergency Management District comprises the areas of Albury City Council, Balranald Council, Berrigan Council, Conargo Shire Council, Corowa Council, Culcairn Council, Deniliquin Council, Holbrook Council, Hume Council, Jerilderie Council, Murray Council, Tumbarumba Council, Urana Council, Wakool Council and Wentworth Council.

Riverina Emergency Management District comprises the areas of Bland Council, Carrathool Council, Coolamon Council, Griffith City Council, Hay Council, Junee Council, Leeton Council, Lockhart Council, Murrumbidgee Council, Narrandera Council, Temora Council and Wagga Wagga Council.

In each of these emergency management districts, a District Emergency Management Committee (DEMC) has been formed which is representative of the emergency management resources available in the district. The DEMCs consist of:

- The District Emergency Operations Controller (Chairperson)
- A senior representative of the council of each local government area within the relevant district
- A senior representative of each emergency services organisation operating within the relevant district
- Representatives of such organisations providing support services in each functional area in the relevant district – Functional Area Coordinators.

The DEMC is responsible for preparing plans in relation to the prevention of, preparation for, response to and recovery from emergencies within the district. These responsibilities normally include such activities as emergency risk management, multi-agency training and exercises, and supporting combat agency public education programs.

The Police Service is required to provide executive support facilities for each DEMC and the District Emergency Operations Controller in the district concerned. The principal executive officer is known as the District Emergency Management Officer.

The emergency management structure and arrangements at local level are based on the local government authority areas (or combined local government authority areas). At this level, a LEMC is formed, again reflecting (where they are represented) the membership of the District Emergency Management Committee. A LEMC consists of:

- A senior representative of Council of the relevant local government area or combined area (Chairperson)
- The senior local representative of each of the emergency services organisations operating in the local area
- Functional Area Representatives
- The Local Emergency Operations Controller.

Council is required to provide executive support facilities for the LEMC and the Local Emergency Operations Controller in its area. The principal executive officer is known as the Local Emergency Management Officer (LEMO). In many areas the chairperson of the LEMC performs the functions of the LEMO. Many LEMOs also have other roles in council, additional to their role as LEMO.

5.2 Workshop participants

This workshop was held in Narrandera on 27 and 28 June 2012, with attendees from the following organisations:

- Albury City Council
- Albury Police
- Berrigan Shire Council
- Carrathool Shire Council
- City of Wagga Wagga
- Department of Trade and Investment, Regional Infrastructure and Services
- Environment Protection Authority
- Greater Hume Shire Council
- Griffith City Council
- Murray Local Health District & Southern NSW Local Health District
- Ministry of Police and Emergency Services
- NSW Ambulance
- NSW Family & Community Services
- NSW Fire and Rescue
- NSW Volunteer Rescue Association
- Office of Environment and Heritage
- Rural Fire Service
- State Emergency Services
- State Water Corporation
- Tumbarumba Shire Council
- Urana Shire Council
- Wentworth Shire Council.

5.3 *Findings: key vulnerabilities and adaptive capacity*

The following indicators and descriptions are adapted from the discussions had by participants in the Emergency Management workshops. As much as possible this text maintains the original wording used by participants. Where necessary changes have been made for readability or to explain concepts and terms.

Capital	Indicators of adaptive capacity	Findings
Human	Skill levels of staff, volunteers and community	Emergency Management (EM) staff in the Riverina Murray region are generally highly trained, however skill-sets will need to be expanded and new skills learned. Staff will need to be more proficient because events are likely to be bigger and more severe. A challenge will be how to increase skills when staff are spread across a large region. Previously strong regional EM-training programs are declining, with numerous activities cancelled due to operational needs and financial and resource constraints. Training participant numbers are also low, because staff cannot be spared to do EM training. At the same time, there has been an increase in the level of training within organisations and these two training formats may be competing for limited staff time. E-learning is an option, but staff need the skills to use it and it cannot provide the practical component to skills training. There is increasing pressure on volunteer organisations to be first responders in remote areas, and so there is an expectation of higher skill levels. Training overload can result in some people ceasing to volunteer. Some agencies that provide emergency response assistance on voluntary basis are handing back their extra responsibilities to EM-focussed agencies, because they are finding it too difficult to maintain skill levels. Lack of training may be offset by the increased experience gained recently due to several major natural hazard events. After several floods and fires in the past few years, the community is now better prepared to respond, and EM staff have greater confidence in dealing with emergencies. More frequent events due to climate change may mean people having more real life experience and individual capacity, however this may not be sustainable and lead to fatigue. In the areas that have not recently been directly impacted by events, the community may not have the same capacity or awareness to embrace preventative measures to increase resilience. It is difficult to engage the community in long term preparation when they have not experienced a threat for a long time.
	Declining human	Human resource levels are decreasing across the public service, primarily due to budget cuts which will

Capital	Indicators of adaptive capacity	Findings
	resources	likely continue. As the public service is getting smaller, there are fewer people to do an increasing number of tasks. An increase in workload due to more frequent and severe emergency events will require more EM staff. While state government agencies are able to fill resource and skills gaps from resources outside the region, local government and regional organisations are not able to do this. Major centres such as Sydney, Wollongong and Newcastle are well staffed, but beyond the "Sandstone Curtain" (the Blue Mountains) there are fewer resources and there is little understanding in central agencies of the "tyranny of distance", regional conditions and fatigue that this causes. Staff fatigue or "burnout" can arise from responses to multiple events, and can lead to an increase in absenteeism. Currently EM staff are moved around the state to address emergencies, however this becomes a problem if there is a state-wide emergency. When emergency services are under greatest pressure addressing floods or fires, it is likely that EM staff will already be posted, and it can be difficult accessing surge capacity. Smaller councils only have part-time Local Emergency Management Officers and administrative assistance, so in emergency events there is greater pressure of these limited resources. Ambulance services have seen a general increase in demand recently, with services sometimes running at a bare minimum. There have also been similar increases in demand for volunteer ambulatory transfers to Sydney and Melbourne, however not all volunteers have the time available to provide this service. Local governments have difficulty attracting and retaining skilled staff, particularly specialists. They struggle to compete with the higher salaries offered by the private sector and smaller councils cannot offer as many career advancement opportunities. It is also difficult to attract people to move to small towns and rural areas due to rural decline, which has been occurring for the region for the past 20 years. The aggregation of properties and family farms by conglomerates means there is less work in the region, resulting in declining regional populations. As populations decrease, resources and services are withdrawn and there is less to attract people to these places. Climate change impacts (eg less rainfall and higher temperatures) will further reduce the attractiveness of these areas and lead to greater economic stress. Currently the economic impact is felt mainly in smaller communities, however this issue is beginning to escalate to larger towns.
	Demographic change – aging population, volunteers and staff	The Riverina Murray region has an ageing population, and many older people want to remain living in their homes in smaller towns. As many specialist health services have been centralised to larger towns, there is a growing need for ambulances to transport the elderly to health services. Heat is a particular problem for older persons, and there are already noticeable increases in demand on ambulances during heatwaves. The estimate is that the average age of Rural Fire Service volunteers is approaching 60, with some volunteers in their 80s. Older people are being asked to continue volunteering because of difficulties in

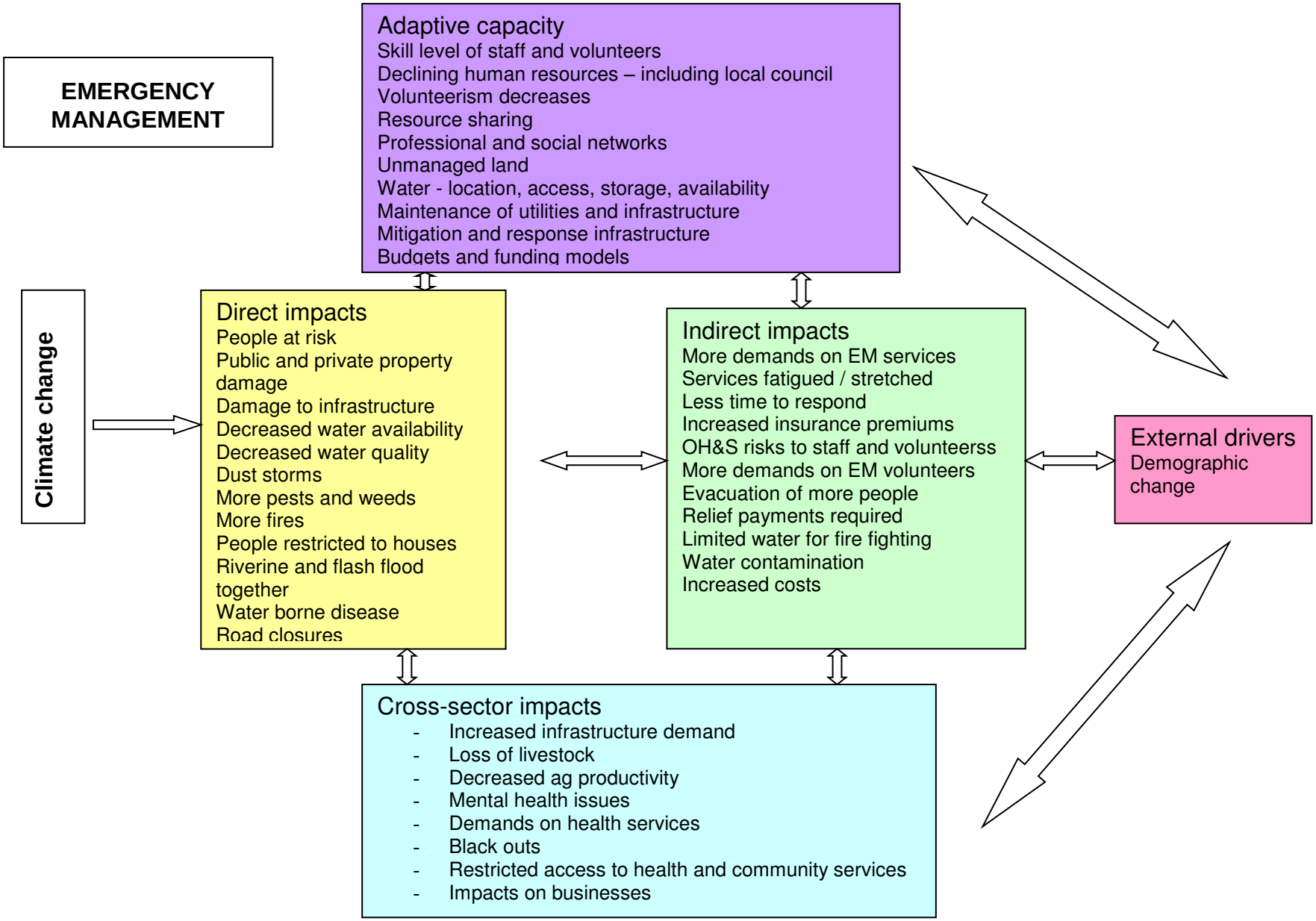
Capital	Indicators of adaptive capacity	Findings
		recruiting younger people. Younger generations are either moving out of the region to find work, or have time and financial pressures and other priorities. An aging workforce is also an issue. The average age of a nurse in the Riverina-Murray region is 55 years, 7 years older than the NSW average. The Ambulance Service is able to attract a younger workforce, but there is still the issue of recruiting these young workers to regional and rural areas.
Social	Volunteerism	Rural decline is eroding the EM volunteer base. For example, the feedlot closure in Carrathool Shire saw individuals and families moving away to find new jobs. Many of these people were also local volunteers so the closure resulted in losses to both community and volunteer services. The impact of these volunteers leaving the region is felt across numerous EM groups, as many people volunteer for multiple organisations. There are increasing cases where volunteers are not being released to attend emergency events, due to the cost to their employer's business, resulting in a lower volunteer base. It can also be difficult to re-recruit volunteers when economic situations improve. For example, EM services in Deniliquin are struggling to fill volunteer positions as people are busy working at the re-opened rice mill, and there are insufficient volunteers to service the Rural Fire Service station during the day.
	Councils and Local Environment Plans (LEPs)	EM is generally only a focus of local councils when natural hazard events have occurred. Communication about EM within some councils is poor, specifically between staff and elected councillors. Understanding of EM issues by councillors is generally low. Local Environment Plans have a wealth of professional EM input. Although some councils along the Murray do send development applications to the Local Emergency Management Committee for consideration from a risk perspective before council makes a decision other council-level development decisions may be politically influenced and can contradict the LEPs. Decisions like these can potentially undermine agreements and relationships made at the officer level. There is need for education of councillors to ensure understanding of issues and consistency in planning.
	Sharing of resources across boundaries and borders	Larger towns and communities have a philanthropic attitude toward neighbouring smaller towns and councils, and help is offered and resources shared during emergency events. Cross-border cooperation is fundamental in emergency events and these networks benefit from being formalised. The Rural Fire Service, State Emergency Service, police and councils have cross-boarder committees. The Riverina Murray District Emergency Management Officers have linkages with Victorian organisations, and share memberships of Local Emergency Management Committees and District Emergency Management Committees. Environmental Protection Authority has developed Memorandums

Capital	Indicators of adaptive capacity	Findings
		of Understanding (MOUs) with Victorian counterparts and other NSW agencies to supplement local-level services and share costs. These MOUs were developed at a local level, but supported centrally and at upper levels and they work well. EM is not core business for some organisations (eg EPA), and their role in emergency situations is on a voluntary basis, which limits their ability to be involved in EM response.
	Networks	Recent emergency events have strengthened local and regional bonds across the region. District Emergency Management Officers play an important role in connecting people and making networks. Informal links between council, EM services and agency staff (eg EPA) are working well at a local and district level. Formal interactions between the Local Emergency Management Committees and District Emergency Management Committees are working well at a regional level, and provide good information exchange. Department of Premier and Cabinet Regional Managers Networks meetings provide a forum for information sharing across agencies. There are issues between regional and state levels of EM services, with fewer opportunities for vertical discussions. Knowledge and information sharing at this higher level is generally minimal until agencies are in a response situation. When an emergency event is elevated to state level, its management can become politically influenced and often local knowledge is not acknowledged or is less valued. These issues are compounded by different approaches to managing EM-related risks, with state-level agencies generally more risk-averse, and local-level prepared to take greater risks to protect local communities.
Natural	Unmanaged national parks and forests	Large tracts of land are being turned into national parks, however there are fewer resources to adequately manage natural hazard risks on these public lands. Increasing fuel loads are resulting in higher fire risks, and the potential for big fire events. Forestry in the Riverina region has scaled back recently and there are now fewer people to manage forestry areas. Potential abandonment of agricultural lands due to climate change may also lead to wider tracts of unmanaged lands.
	Changing water courses	The development of farming landscapes (eg laser levelling) is changing where water courses historically flowed, leading to unexpected impacts on infrastructure and other assets from flooding. Similarly, increasing development of urban areas results in more hard surfaces and greater run-off. There have been no changes or improvements to infrastructure and buildings to deal with this, and community drainage infrastructure is not coping. There is a need to understand where water courses are now flowing, changes to drainage systems and to have old creeks and drains declared.

Capital	Indicators of adaptive capacity	Findings
	Water access and storage	The Murray Darling Basin Plan is reducing access to water, and this will be compounded by climate change impacts, resulting in communities having limited access to water to respond to emergencies such as fire. Conversely utilities may be capturing and storing water in dams in preparation for drier periods, which may lead to more spillage and flooding when heavy rains arrive.
	Changed seasonality of rainfall and storms	A change in the seasonality of rainfall such as heavy rains in summer, may lead to multiple natural hazard events. Increased summer storm events may lead to increased flood events, as well as increased fire risk due to lightning strikes. This may also lead to multiple events at the same time, such as fire and flooding in summer. When this happened in 2009, with a fire at Gerogery at same time as storm and flooding in Albury, volunteers were already out fighting the fire and could not respond to Albury issues. In addition, vehicles got bogged when trying to put out a fire.
Physical	Utilities and critical infrastructure	Higher temperatures may cause issues for electricity supply and demand, both regionally and interstate. Smaller towns and remote areas often experience power outage and have resilience in this area, however larger towns and centres would be severely impacted by power outages. Most Local Emergency Management Councils have arranged backup power for their EM facilities. All hospitals have backup power, however only about five per cent of aged care centres do. Air-conditioning is generally not connected to backup system, which will cause issues in increasing heatwave events, particularly on the elderly, leading to increased demand on ambulance and hospital services. The fibre optic network which runs through the region to Melbourne, Canberra and Sydney has been cut accidentally in the past, shutting down communications. The potential for this to occur in an emergency event would be disastrous. Utility managers should already be aware of their vulnerable infrastructure and have plans to mitigate against the affects of flood and fire. There is an assumption that large corporations and other agencies are organised as well however, they may not be. The NSW Disaster Plan (DISPLAN) identifies critical infrastructure and has been communicated quite well. NSW Police have run exercises looking at how power loss would affect emergency services responses. Better identification of critical infrastructure, and communication of mitigation strategies by infrastructure owners and providers, is needed.
	Tele-communications	There are mobile phone and radio signal black spots in many rural areas in the region, restricting EM response. Local telecommunications network can overload due to intensive community use, preventing emergency services from using these services. For example telecommunications overload resulted in

Capital	Indicators of adaptive capacity	Findings
		delayed EM response to sewerage spill in Corowa. Telstra works to quickly restore any failure in telecommunications, but are no longer involved in District Emergency Management Committee planning meetings, and Telstra is not always the provider. There is limited redundancy if telecommunication systems fail due to overload or damage. There are few satellite phones in regional areas, and there is not the facility to charge them or the knowledge of how to work them. The government radio network is now only used by two or three agencies, and it also relies on power. Planning for emergency events needs to improve, especially in smaller agencies. For example, there is a need to identify and supply charging ports for satellite/mobile phones, especially if power is lost.
	Mitigation infrastructure	Drainage capacity in some towns is currently inadequate and increased storm and flood magnitude means drainage and levee banks will become bigger issues for local governments. There are concerns about the legal implications if levees break. Increased frequency of flash flooding causes damage to fire trails, which need to be repaired to maintain access. It is difficult to get funding to repair this damage, as it is not caused by fire.
	Fire fighting equipment	The emphasis has moved from fighting fires to prevention, however if there is insufficient fire fighting equipment there may be shortages during surge events. Fire fighting techniques have moved towards containment rather than extinguishing, for example use of aircraft to buy time for ground response. Outside major areas there may not be enough people to operate equipment, for example in situations where the volunteer Rural Fire Service has three trucks, and only two people to man them. This situation may creep towards the east with a declining population.
Financial	Budgets restricted or declining	Councils have small and restricted budgets that need to cover large geographical areas so they need to prioritise their assets for maintenance and replacement, and some assets miss funding. The Rural Fire Services and State Emergency Services are reviewing their funding models, which are currently insurance premium based but may become rate-based due to declining home insurance uptake in the community. In the Department of Trade and Investment, funds for EM training are reasonable but overall budgets are low, so there is an overall decline in resources and resiliency. There can be a reliance on community donations in emergency events, however with more events

Capital	Indicators of adaptive capacity	Findings
		occurring due to climate change, the community will experience donation fatigue.
	High trigger points for emergency declaration and relief funding	During an emergency event, the Ambulance Service do all they can to provide an adequate response, however the announcement of natural disaster area allows them to throw resources and funding at an event without hesitation, as the State or Federal government will pay for resources. However, some areas (eg Deniliquin) are too small to trigger disaster categorisation, despite the results of such events being significant. If the number and severity of events increase, local government will have reduced capacity to respond, and will need this assistance sooner. The trigger points for disaster categorisation and relief funding need to be reviewed and potentially lowered.
	Disaster relief funding model	The community has expectations about receiving disaster relief funding, which works against building resilience and improving decision-making and is not a sustainable long term model - *"It is essentially spending money to make us less resilient"*. Often the relief is in a small, set amount (eg $1,000 per household), and does not allow for different circumstances and levels of impact. There is political mileage from these handouts, but they provide only short-term solutions. Funding is rarely sufficient to rebuild infrastructure and buildings in a better manner to avoid or reduce future impacts. Relief funding can also be applied inconsistently across local government boundaries. There is a need to improve assistance models and recovery funding, ensuring funding is consistently and fairly available and is producing a more resilient community in the long term.
	Insurance	Insurance is a major liability for local governments. If assets are not managed well then insurance premiums may rise, or assets become uninsurable.


EMERGENCY MANAGEMENT
Adaptive capacity
Skill level of staff and volunteers
Declining human resources – including local council
Volunteerism decreases
Resource sharing
Professional and social networks
Unmanaged land
Water - location, access, storage, availability
Maintenance of utilities and infrastructure
Mitigation and response infrastructure
Budgets and funding models
Climate change
Direct impacts
People at risk
Public and private property damage
Damage to infrastructure
Decreased water availability
Decreased water quality
Dust storms
More pests and weeds
More fires
People restricted to houses
Riverine and flash flood together
Water borne disease
Road closures
Indirect impacts
More demands on EM services
Services fatigued / stretched
Less time to respond
Increased insurance premiums
OH&S risks to staff and volunteerss
More demands on EM volunteers
Evacuation of more people
Relief payments required
Limited water for fire fighting
Water contamination
Increased costs
External drivers
Demographic change
Cross-sector impacts
- Increased infrastructure demand
- Loss of livestock
- Decreased ag productivity
- Mental health issues
- Demands on health services
- Black outs
- Restricted access to health and community services
- Impacts on businesses