

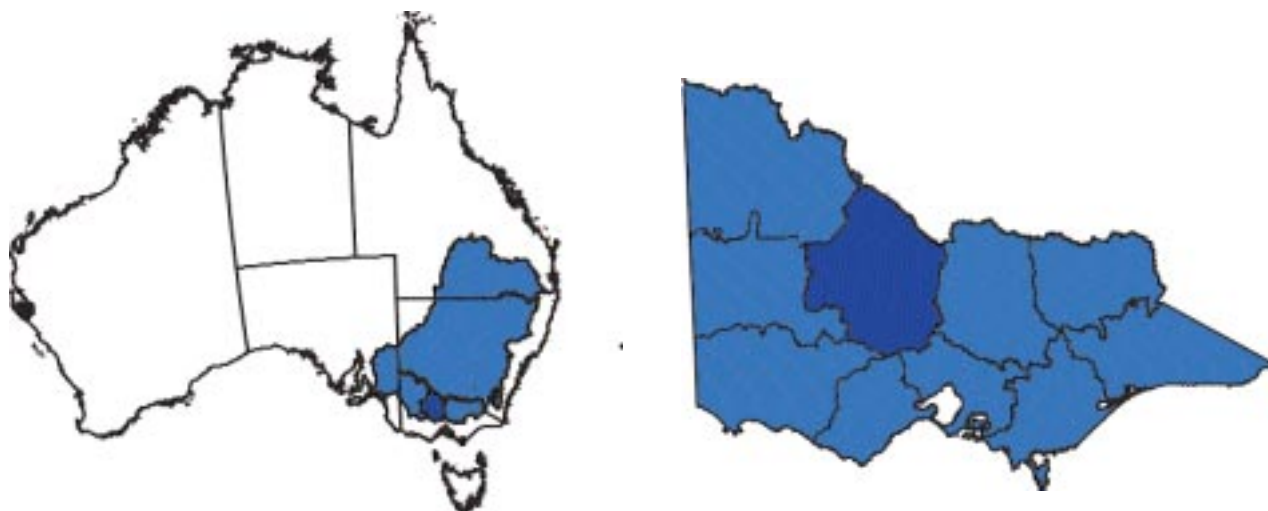
Committed to catchment health

**NORTH CENTRAL
REGIONAL CATCHMENT STRATEGY**

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North Central Region



Located to the north of the Great Dividing Range, the North Central region forms part of the Murray-Darling Basin. Within Victoria, the North Central region is one of ten catchment management regions.



Chairman's message



The care with which we manage our natural resources – land, water, biodiversity and climate – ultimately sustains our social and economic wellbeing. It is also the trust we hold on behalf of all other life and future generations.

The North Central region is a complex mix of environmental values and challenges, productive agriculture and population issues. It encompasses approximately 13% of Victoria and is a significant component of the Murray-Darling Basin. Within this context, the North Central Regional Catchment Strategy sets out a vision and an integrated planning framework for land, water and biodiversity management.

This Regional Catchment Strategy builds on the 1997 Strategy and a range of specific strategies and plans that have been developed over many years. It has been developed by the North Central Catchment Management Authority in consultation with its partner agencies, local government, particular interest groups and the regional community.

The Regional Catchment Strategy takes an assets-based rather than issues-based approach, examining how these assets can be enhanced and how the threats they face can be addressed. In addition to the primary natural resource assets of the region – land, water, biodiversity and climate – the Regional Catchment Strategy identifies our human or social assets. At the core of recognising the community as a primary asset for integrated catchment management is the reality that achieving our objectives is as much a whole-of-community endeavour as it is whole-of-catchment: it is a responsibility we all share. Our partnerships are therefore fundamental to implementing the Regional Catchment Strategy and, on behalf of the Board, I invite the active involvement of all our partners in this great endeavour.

The 1997 Regional Catchment Strategy was contemporary with the establishment of the North Central Catchment Management Authority and the Natural Heritage Trust. This Strategy has been finalised just prior to the CoAG Agreement on the National Water Initiative, the Living Murray debate and the Securing Our Water Future policy document. There are strong reasons for optimism for the period covered by this Regional Catchment Strategy: these are exciting and challenging times.

A handwritten signature in black ink, appearing to read 'Ian MacBean'.

Ian MacBean
Chair
North Central Catchment Management Authority

North Central Catchment Management Authority Board Members 2003-2006

Ian MacBean, John Brooke, Malcolm Fyffe, Noel Harvey, Jill McFarlane, Stuart McLean, Tony Norton, Yvonne Postlethwaite, Jean Sutherland, Alison Teese, Gregory Toll, Chris Norman, Rob Price.

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North Central Regional Catchment Strategy 2003 – 2007

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Cover photos

Front (L to R): Avoca River, photo: Linton Argall, NCCMA.

Tree planting on the Campaspe River at Echuca, photo: provided courtesy of Environment Australia.

Mallee Wattle, photo: Ian Higgins, NCCMA

Back: Headwaters at Myrtle Creek, photo: Geoff Park, NCCMA.



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PART A – Purpose and Scope



A 1 Introduction

Waterways are special places – the Avoca River near Avoca.



Photo: Linton Argall

The North Central Regional Catchment Strategy (RCS) provides a vision for the future landscape of the North Central region and the management of its natural resources. The communities of the North Central region have a successful track record in natural resource management and the RCS has evolved from the lessons of those achievements.

The RCS recognises that the future health of the environment is highly dependent on the people of the region – people who farm and manage the land or live in the towns, work in agribusiness or government agencies; school children from Swan Hill to Kyneton, as well as volunteers who contribute their time and energy for a better environment.

Therefore, the RCS seeks to strengthen people's skills, motivation, partnerships and resourcing so they can continue their work in natural resource management.

The RCS will be the foundation for decisions on priorities and actions for the North Central Catchment Management Authority (NCCMA) and its partners to achieve a healthy and sustainable environment for current and future generations.

The North Central region is rich in natural assets of local, regional, national and international significance. The RCS recognises that it will not be possible to protect every natural resource asset in the region from the threats and challenges, which they face. For this reason, it identifies key natural resource assets with the greatest environmental, economic or cultural significance from which the community derives the greatest benefit and values the most. Where it is technically possible, cost efficient and socially desirable, investment under the RCS will be directed to protect and enhance those key assets.

In a practical sense, the RCS is the investment guide for natural resource management funds from State and Commonwealth governments and other sources.

At the end of the day, it is actions on the ground that protect and enhance natural assets. New and existing management plans are the mechanism to prioritise, coordinate and help fund these actions.

The RCS overarches the management plans. Its role is to prioritise, coordinate and guide funding in accordance with management plans.

Once identified and prioritised in the RCS, the management plans will be easier to fund and approve.

The RCS is presented in three parts. Part A describes why and how the RCS has been developed. Part B describes the assets, goals, issues, targets and actions. In other words, this section identifies the priorities for the next five years. Part C provides details on the triple bottom line assessment of the priorities and the monitoring and evaluation framework.

A Regional Catchment Investment Plan will be developed annually to complement the RCS. The purpose of the Investment Plan is to facilitate coordinated investment targeted at achieving the agreed priorities of the RCS through a suite of integrated natural resource management programs.

2 Vision for the North Central region

Tree planting on the Campaspe River – a joint community effort.



Photo: Environment Australia

North Central Regional Catchment Strategy Vision

‘A well informed, resourced and actively committed community protecting and improving the natural resources for the environmental, social and economic benefit of our region’.

The North Central region is home to more than 200,000 people who enjoy a range of benefits from its natural resources. The rivers and streams, forests and bushland, native fauna, soils, water, landforms and climate all contribute to its uniqueness. The natural resources provide immense value to the whole community in a range of ways, for example, agriculture, recreation, tourism and lifestyle.

To continue to provide these and other benefits, the natural resources must be managed sustainably to maintain or enhance their condition. Everyone in the region has a role to play.

This region must work together to have sustainable water use in rural and urban areas, to have healthy waterways and wetlands, to have land that is productive and healthy, to have the region's biodiversity protected and improved on private and public land, to have cultural heritage valued and protected and to have communities learning and managing in partnerships.

The region is an important part of the Murray-Darling Basin and therefore has a responsibility in contributing to the health of the River Murray so that it continues to sustain communities and preserve its environmental and cultural values.

The challenge for the community of the North Central region is to seek ways of improving how the natural resources are managed in light of continuing changes in:

- ◆ population (either growing or declining in different parts of the region)
- ◆ land use in irrigation areas, around urban centres and in the upper catchment
- ◆ knowledge, values and aspirations of the community.

The RCS builds on past achievements to guide natural resource management in the North Central region for the next five years. It adopts a long-term outlook but has also identified programs for implementation in the short term. The RCS recognises that people are the key to the future health of the region. Consequently, the strategy is based upon the vision above.

The RCS is underpinned by the following principles:

- a) Protect and improve the region's natural assets for multiple local and downstream benefits.
- b) Strengthen region-wide community ownership and participation in decisions related to on-ground activity.
- c) Recognise and promote the value of biodiversity in sustaining productive landscapes.

Implementation of the RCS and the management actions will be through supporting plans and strategies and is intended to achieve multiple benefits through integrated programs, while ensuring optimum use of available resources for sustainable outcomes.

It is vital that the community both supports the RCS and is supported in its efforts to manage the environment. Hence, communication and transparent monitoring and evaluation of programs will be required throughout the life of the RCS. Similarly, the region requires effective partnerships at all levels to ensure ownership of natural resource management programs. Finally, there must be a commitment to build the community's capacity to take advantage of environmental, social and economic opportunities.

Location

The North Central region is one of ten Catchment Management Authority (CMA) regions in Victoria. It comprises an area of almost three million hectares (ha), approximately 13% of the State of Victoria. The region extends from the Great Dividing Range in the south to the River Murray in the north, a distance of up to 280 km. It is around 150 km wide and extends from the Mt Camel Range in the east to the western boundary of the Avon-Richardson catchment.

River basins

The North Central region includes four major river catchments – those of the Campaspe, Loddon, Avoca and Avon-Richardson rivers.

The Campaspe and Loddon rivers flow directly into the River Murray. The Avoca River flows into a series of lakes and wetlands (the Avoca Marshes). During flood events, it may drain to the River Murray and via effluent stream channels to a further series of terminal lakes, some of which are outside the North Central region.



Photo: NCCMA

The Avoca Marshes within the Kerang Wetlands Ramsar site.

The Avon-Richardson catchment in the west is internally drained, with most surface water outfalling into Lake Buloke in the north of the catchment. The Avoca River is one of the few remaining unregulated river systems in the entire Murray Darling Basin.

The interaction between the region and the River Murray is very significant. The River Murray is the single biggest source of water for irrigation to the region. It also drives the focus of much natural resource management over the whole North Central region because of the impacts on downstream users.

The Loddon, Campaspe and Avoca rivers all contribute salt and nutrients to the Murray.

Historically, the salt exported from the North Central region and especially from Barr Creek, was responsible for almost half of Victoria's impact on the salinity of the River Murray at Morgan in South Australia¹.

Salinity management in the region has significantly reduced the salt loads exported from the Barr Creek and provides a great economic benefit and a success story for the Murray.

Climate

Generally, the region's climate is Mediterranean, with cool and relatively moist winters and warm dry summers. The north and west of the region is substantially warmer and drier than the south and east. Rainfall ranges between about 350 mm per year at Swan Hill and over 1,200 mm per year in the far south-east. Average daily temperatures at Kerang in the north-west range between 15° and 31°C in January and 4° and 14°C in July. At Creswick in the far south of the region, they range between 11° and 27°C in January and 2° and 10°C in July.

Water resources

The region has substantial groundwater and surface water resources. Groundwater is used extensively in irrigation of horticultural crops and pastures in the south of the region. Mineral springs in this area are also utilised and support both processing and tourist industries. Increasing use is also being made of deep lead aquifers in parts of the Loddon and Campaspe plains.

There are several major water storages in the region, on both the Campaspe and Loddon River systems. The two major storages are Lake Eppalock on the Campaspe River and Cairn Curran Reservoir on the Loddon River. Storages and groundwater supplies are important sources of water. Irrigated agriculture uses 1,425,000 ML/year and urban activity uses approximately 40,000 ML/year.



Photo: Matt Jackson, NCCMA

Cairn Curran Reservoir at low capacity, August 2003.

The region's surface water resources do not fully meet regional demand. The region draws heavily on supplies from the Murray and Goulburn systems, via the River Murray and Waranga Western Channels respectively. Most of this water is used to support irrigated agriculture and horticulture in the north of the region. It

is supplied to users through an extensive network that incorporates constructed channels, natural wetlands and waterways. Urban, domestic and stock supplies in the north of the Avon-Richardson and Avoca catchments are supplied from the Wimmera basin. Again, the supply system includes constructed channels, natural wetlands and waterways.

The use of 'imported' water is substantial. More than 75% of the water used in the region is from the Goulburn and Murray catchments.

Land use

The North Central region is agriculturally diverse. Irrigation areas cover much of the northern Loddon and Campaspe riverine plains. Dairying, horticulture and mixed farming are the main enterprises. Improved irrigation technology and tradeable water entitlements have encouraged the rapid expansion of horticulture outside traditional irrigation areas.



Dairying, one of the main types of agriculture in the region's north.

Dryland agricultural areas are characterised by broadacre land uses, such as cropping and grazing. Land close to the major centres is increasingly developed for horticulture, new and emerging agricultural commodities and as 'rural living' zones. Intensive animal production industries are also represented.

The gross value of agricultural output within the region (excluding intensive animal production industries) was almost \$0.8 billion in 2001 (Table 1). Although irrigated land accounts for only about 10% of the region's area, it accounts for almost 50% of the gross value of agricultural production. The grains and mixed cropping sector remains the largest agricultural sector, with gross production exceeding \$300 million in 2001.



Sheep grazing dryland at Natte Yallock.

The horticultural sector has been expanding rapidly, with an average annual growth rate of 6.3% between 1997 and 2001. The value of output from dairy and pastoral sectors grew by around 4% p.a. over the same period, while the output from the grains and mixed cropping sector grew by only 1.2%, which represents a substantial contraction of output in real terms.

Approximately 13% of the region is public land. Large areas are reserved and managed for recreation and nature conservation. Commercial forestry operations are carried out on public land throughout the region. The most intensive operations are concentrated in foothill forests and softwood plantations in the south. A range of products, including firewood, posts and poles, furniture timbers, honey and Eucalyptus oil, are obtained from forests and woodlands in the north.

Table 1: Gross value of agricultural production by industry sector, North Central region.

Period	Industry sector				Total
	Dairy	Grains and mixed cropping	Horticulture	Pastoral	
1997	\$224,853,881	\$296,893,520	\$68,922,907	\$94,536,773	\$685,207,081
2001	\$269,101,609	\$311,229,307	\$92,101,351	\$113,135,067	\$785,567,334
Change (% pa)	4.1	1.2	6.3	4.1	3.2

Source: Australian Bureau of Statistics 1997 and 2001, *Australian Bureau of Statistics Census* (adapted by Neil Clark & Associates), Canberra.

The region was once Australia's premier gold-mining region. Several gold-mining ventures are still operational, mostly in the Bendigo area. Fossicking is widespread throughout the box-ironbark forests of the goldfields.

The natural environment

Past and present land use practices, particularly those associated with agricultural development, and in some areas, gold mining, have seriously affected the natural environment of the North Central region. Nonetheless, it retains many unique and important features.

The Gunbower Forest and Kerang Lakes are of international significance, and listed under the Ramsar convention.



Gunbower Forest in flood – an internationally significant Ramsar wetland.

These and many of the region's other wetlands provide habitat for migratory birds protected under international agreements. Thirty-six natural features, including wetlands, remnant grasslands, geological sites, wildlife reserves and the mineral springs recharge area, are listed on the Register of the National Estate.

Eight bioregionsⁱ are represented within the North Central region. Native vegetation in particular is poorly represented in all but the Central Victorian Uplands, Goldfields and Murray Fans bioregions. Although 12.7% of the region retains native vegetation coverage, many ecological communities retain less than 1% of their original distribution. Woodlands and grassy woodlands, which occupied the areas most readily developed for agriculture, are especially poorly represented. Nonetheless, the region retains some of the most extensive box-ironbark and river red gum forests in the State.

The result of habitat loss in extent and quality due to agricultural and urban development, weed invasion and impacts from pest animals, mining and changing water regimes, has been that the region now has 100 species of native animal and around 300 species of native plant threatened by extinction.

A substantial area of public land in the region has been set aside for nature conservation. The major reserves include the Terrick Terrick, Greater Bendigo, Castlemaine Diggings Heritage, St Arnaud Range and Heathcote-Graytown National Parks. Together with State and Regional Parks and other types of reserves around 100,000 ha of public land has been set aside for nature conservation and compatible land uses.



Unique remnant grass trees of the Baynton district.

Population

The regional population exceeds 200,000 people, with most living in the larger urban centres. Bendigo is the largest centre, with several provincial centres having a population exceeding 5,000 people (including Swan Hill, Echuca, Maryborough and Castlemaine). The population is concentrated in the southern areas of the region, including the Calder corridor, and along the River Murray in the north of the region.



Enthusiastic school children participating in a tree planting day.

Regional population growth is exceeding the average for Victoria. While population growth is strong in non-urban areas, this tends to be concentrated in rural living zones. There is a migration away from agricultural areas to provincial centres and to Bendigo. The population is ageing and the proportion of young people remaining in the community is declining.

ⁱ Biogeographical regions that capture patterns of ecological characteristics in the landscape.

Indigenous interests and cultural heritage

Aboriginal people have lived in southern Australia, including the North Central region, for tens of thousands of years. During this time, they left physical evidence of their activities, which now survive as cultural heritage sites or places. Examples include: shell middens, scatters of stone artefacts, oven mounds, scarred trees, burial places, axe grinding grooves and stone quarries.

Indigenous peoples of 11 language groups occupied the region prior to European settlement. Indigenous communities continue to hold strong affiliation with the region. Indigenous interests may be from traditional and more contemporary perspectives. There are numerous individual sites and places with which Indigenous peoples have strong affinity. Areas of significance include: Kow Swamp, Lake Boort, Lake Boga, Mt Kooyoora and Mt Franklin. Many are located along rivers and water edges, as the rivers and lakes were and still are important for Indigenous people of the region. In the Loddon-Murray region alone around 1,700 Indigenous heritage sites have been registered on the Aboriginal Affairs Victoria database. Fifteen sites of Indigenous significance have been included on the Register of the National Estate.

Protection of significant recorded sites is fundamental to Indigenous heritage. Past land use, management practice and the actions of pest animals, such as rabbits, has damaged or destroyed important sites.



A rock pool in the culturally significant landscape of the Baringhup

The region is also rich in non-Indigenous cultural heritage. A total of 515 features, buildings and places have been listed on the register of the National Estate. A National Heritage Park for the Castlemaine diggings area was declared in October 2002.

Unique features

The region has a number of unique features, that distinguish it from other regions in Victoria. Examples, some of which have been mentioned above, include:

- ◆ Murray-Darling Basin – the region forms part of the Murray-Darling Basin, the largest and most significant drainage basin in the country.
- ◆ Avoca River – which is one of the last unregulated rivers that at times feeds surface water directly to the Murray.
- ◆ Avon-Richardson Basin – a large internally drained catchment with a terminal lake (Lake Buloke).
- ◆ Internationally significant wetlands – including the Kerang Lakes and Gunbower Forest Ramsar wetlands as well as numerous other wetlands that provide habitat to internationally protected migratory birds.
- ◆ Lowland rivers – the Loddon, Avoca, Avon and Richardson rivers are important examples of lowland floodplain river systems.
- ◆ Flora and fauna ecological communities – the region supports a large number of species and ecological communities. Regrettably, some of these species are threatened with extinction.
- ◆ Mineral springs in the upper catchments of the Loddon and Campaspe rivers, e.g. Daylesford, Hepburn.
- ◆ Unique geological features, including Barfold Gorge and the glacial pavements of the Knowsley-Mia Mia area.
- ◆ Indigenous heritage – including numerous sites and places of cultural and archaeological significance.
- ◆ Loddon-Murray, Rochester and Campaspe West irrigation areas – which produce over \$500 million in gross value of agricultural production annually.
- ◆ Goldrush era heritage – including diggings, racelines, buildings and streetscapes from that era.

Catchment condition report

The NCCMA has prepared the North Central Catchment Condition Report, which provides a detailed analysis of the condition of the key assets of the North Central region. This report is available at www.nccma.vic.gov.au.

Photo: Matt Jackson, NCCMA (reproduced with permission from Brian Neilson, Chairman, Jaara Jaara Corporation).

3 Overview of the North Central region

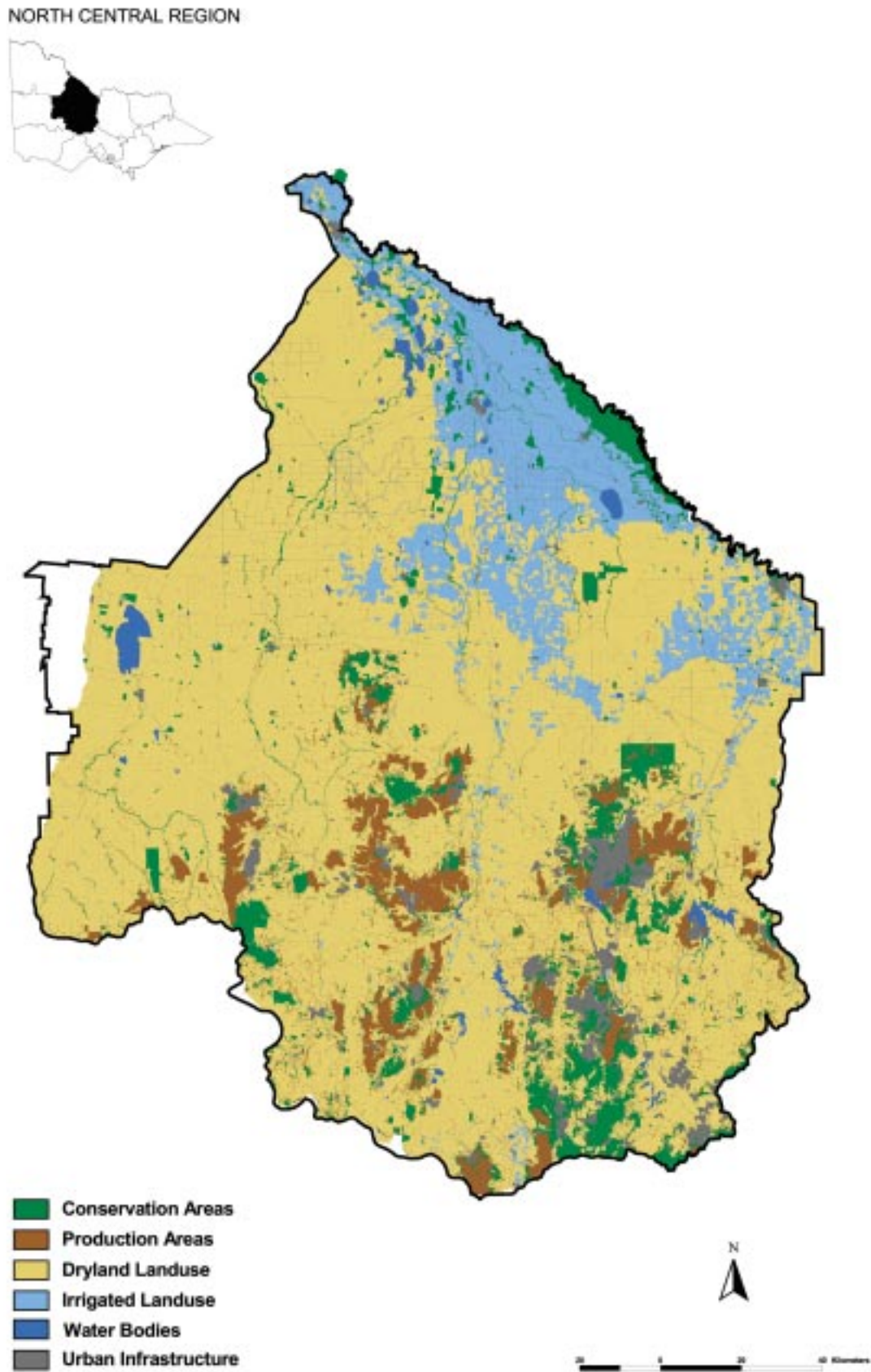
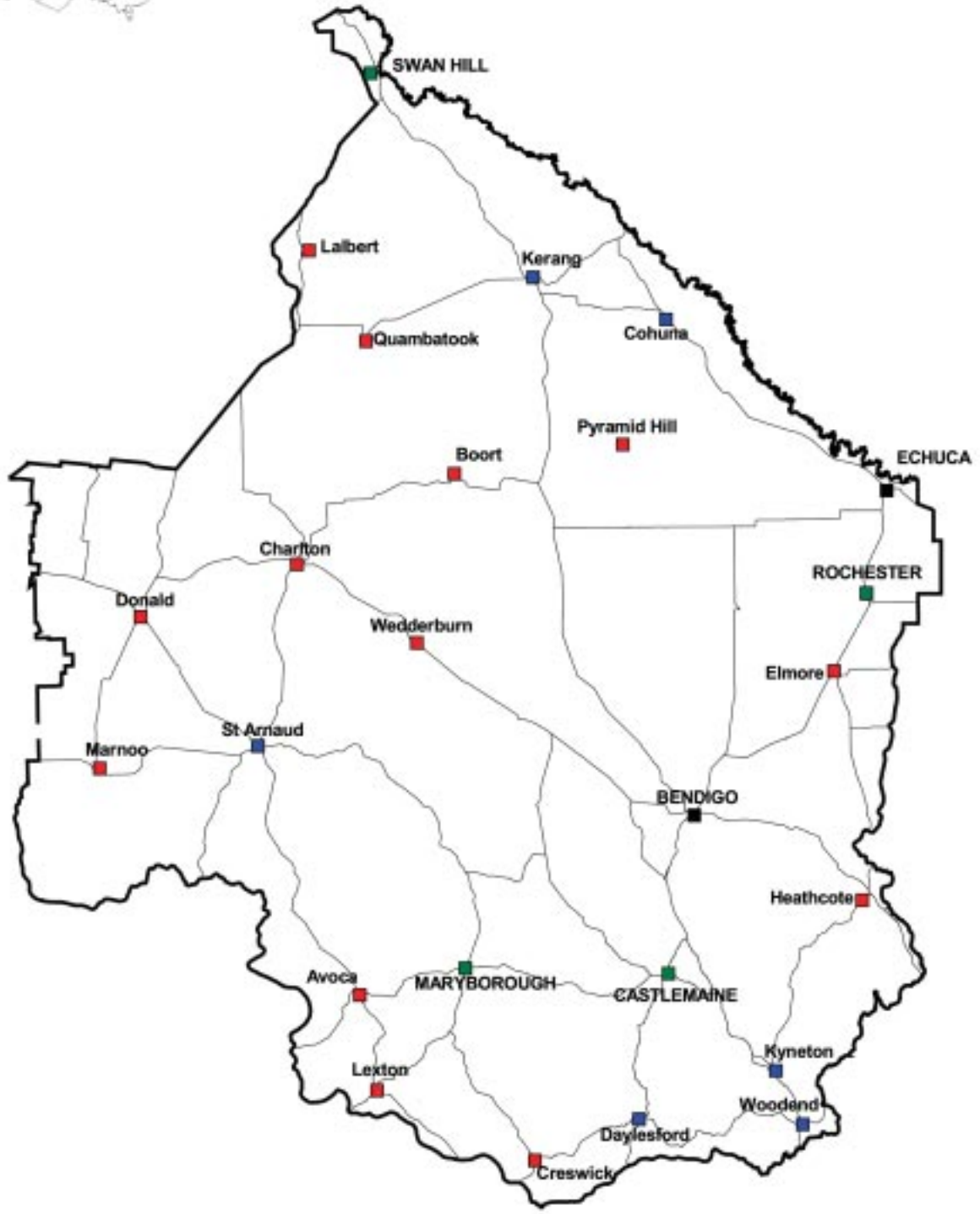


Figure 1: Land use of the North Central region in 2002.





- Main Roads
- 10,000 - 80,000 People
- 5,000 - 10,000 People
- 2,000 - 5,000 People
- < 2,000 People



4 Scope of the Regional Catchment Strategy

4.1 Purpose of the Regional Catchment Strategy

The RCS is the primary integrated planning framework for natural resource management in the North Central region. The RCS establishes the long-term direction for natural resource management in the region based on its assets. Within that framework, it specifies actions for the next five years.

The priority natural resource management issues will be addressed in detail through action plans and projects which may be existing, in need of modification or have yet to be developed.

The RCS integrates the regional priorities with the relevant National and State policies and plans dealing with natural resource management. It sets agreed regional outcomes and targets which will contribute to State and National natural resource outcomes.

In addition, the guidelines established by the Victorian Catchment Management Council require that the revised RCSs include:

- ◆ a broadened scope beyond the essentially biophysical scope of the CaLP Act 1994
- ◆ an attempt to achieve integrated outcomes across the range of issues to be addressed including working more closely with local government to ensure integrated planning for land use and development
- ◆ evidence-based decision making for the protection of priority assets.

4.2 Policy and legislative context of the RCS

Regional Catchment Strategies are the overarching catchment management blueprints for Victoria's catchments. State and Commonwealth governments have agreed that that they will be the accredited plans for investment under the National Action Plan for Salinity and Water Quality (NAP) and the Natural Heritage Trust (NHT).

The RCS needs to be aligned with a suite of natural resource management legislation and policies at both the State and National levels.

At the National level, relevant policies and legislation include:

- ◆ Commonwealth legislation, e.g. *Environment Protection and Biodiversity Act 1999*, *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

- ◆ Commonwealth policy such as the National Strategy for Ecologically Sustainable Development
- ◆ Murray Darling Basin Commission (MDBC) Integrated Catchment Management Policy Statement 2001 – 2010
- ◆ MDBC Basin Salinity Management Strategy 2001 – 2015
- ◆ MDBC Cap on Surface Water Diversions
- ◆ MDBC Floodplains Wetlands Strategy
- ◆ MDBC Native Fish Strategy for the Murray Darling Basin
- ◆ National Action Plan for Salinity and Water Quality
- ◆ Managing Natural Resources in Rural Australia for a Sustainable Future: A discussion paper for developing a national policy.

The targets and outcomes of the RCS will be developed to align with the national outcomes, matters for targets and core indicators as provided by the Commonwealth (refer table 2).

At the state level, there is a range of policies and legislation which support or relate to the RCS, including:

- ◆ *Victorian Archaeological and Aboriginal Relics Preservation Act 1972*
- ◆ *Catchment and Land Protection Act 1994*
- ◆ *Conservation, Forests and Lands Act 1987*
- ◆ *Environment Protection Act 1970*
- ◆ *Flora and Fauna Guarantee Act 1988*
- ◆ *Planning and Environment Act 1987* (Victorian Planning Policy Framework; Municipal Strategic Statement – Local Planning Policy Framework)
- ◆ *Victorian Fisheries Act 1995*
- ◆ *Water Act 1989*
- ◆ Management of Victoria's Ramsar Wetlands Strategic Directions Statement
- ◆ Victorian Salinity Management Framework
- ◆ Victorian River Health Strategy
- ◆ Victorian Biodiversity Strategy
- ◆ Victorian Native Vegetation Management Framework 2002
- ◆ Victorian Pest Management Framework
- ◆ Waters of Victoria State Environment Protection Policy (SEPP)

4 Scope of the Regional Catchment Strategy

Table 2: National natural resource management outcomes, matters for targets and core indicators

National Outcomes Aspirational Statements about desired Natural Resource Outcomes	Resource Conditions Matters for Targets	Core Indicators
<p>The impact of salinity on land and water resources is avoided or reduced.</p> <p>Biodiversity and the extent, diversity and condition of native ecosystems are maintained or rehabilitated.</p> <p>Populations of significant species and ecological communities are maintained or rehabilitated.</p> <p>Ecosystem services and functions are maintained or rehabilitated.</p> <p>Surface and groundwater quality is maintained or enhanced.</p>	<p>Land salinity.</p> <p>Soil Condition.</p> <p>Native vegetation communities integrity.</p> <p>Inland aquatic systems integrity (rivers and other wetlands).</p> <p>Estuarine, coastal and marine habitats integrity.</p> <p>Nutrients in aquatic environments.</p> <p>Turbidity/suspended particulate matter in aquatic environments.</p> <p>Surface water salinity in freshwater environments.</p> <p>Significant native species and ecological communities.</p> <p>Ecologically significant invasive species.</p>	<p>Area of land threatened by shallow or rising water tables.</p> <p>Soil condition.</p> <p>Native vegetation extent and distribution.</p> <p>Native vegetation condition.</p> <p>River condition.</p> <p>Wetland ecosystem extent and distribution.</p> <p>Wetland ecosystem condition.</p> <p>Estuarine, coastal and marine habitat extent and distribution.</p> <p>Estuarine, coastal and marine habitats condition.</p> <p>Nitrogen in aquatic environments.</p> <p>Phosphorous in aquatic environments.</p> <p>Turbidity / suspended solids.</p> <p>Instream salinity.</p> <p>Selected significant native species and ecological communities extent and conservation status.</p> <p>Selected ecologically significant invasive species extent and impact.</p>

Source: Natural resource management Ministerial Council 2002, *National Natural Resource Management Monitoring and Evaluation Framework*, Canberra.

- ◆ Other groundwater and regional surface water SEPPs.

Environmental flow programs for the Murray and Snowy rivers both have potential to impact on the availability and management of water within the region.

The RCS needs to demonstrate consideration of and processes to achieve integrated catchment management in the context of statewide frameworks described in various strategies and policy documents. The major outcomes sought by the statewide frameworks are:

- ◆ creating better, stronger communities aimed at improving social and economic wellbeing across Victoria

- ◆ preventing, stabilising and reversing trends in salinity, particularly dryland salinity, affecting the sustainability of production, conserving biological diversity and infrastructure viability
- ◆ protecting water environments (waterways, wetlands, lakes and estuaries) from further degradation by protecting and rehabilitating existing water quality, flow and aquatic habitats
- ◆ reversing the long-term decline in the extent and quality of native vegetation across the entire landscape, leading to a net gain
- ◆ maintaining and restoring the ecological processes and the biodiversity dependent upon terrestrial, freshwater and marine environments
- ◆ maintaining and improving the present diversity of species and ecological communities and their viability
- ◆ increasing the viability of threatened species and the extent and quality of threatened ecological communities.

A 4 Scope of the Regional Catchment Strategy

The consolidated outcomes sought from these are:

- ◆ better engagement of communities in improving social, environmental and economic well-being across catchments in Victoria
- ◆ prevention, stabilisation and reversal of trends affecting the 'triple bottom line', in particular salinity, water quality, terrestrial and aquatic native biodiversity, including natural ecosystems, native vegetation and threatened flora and fauna.

A 5 RCS development process

The process for reviewing and renewing the RCS is shown in the following diagram.

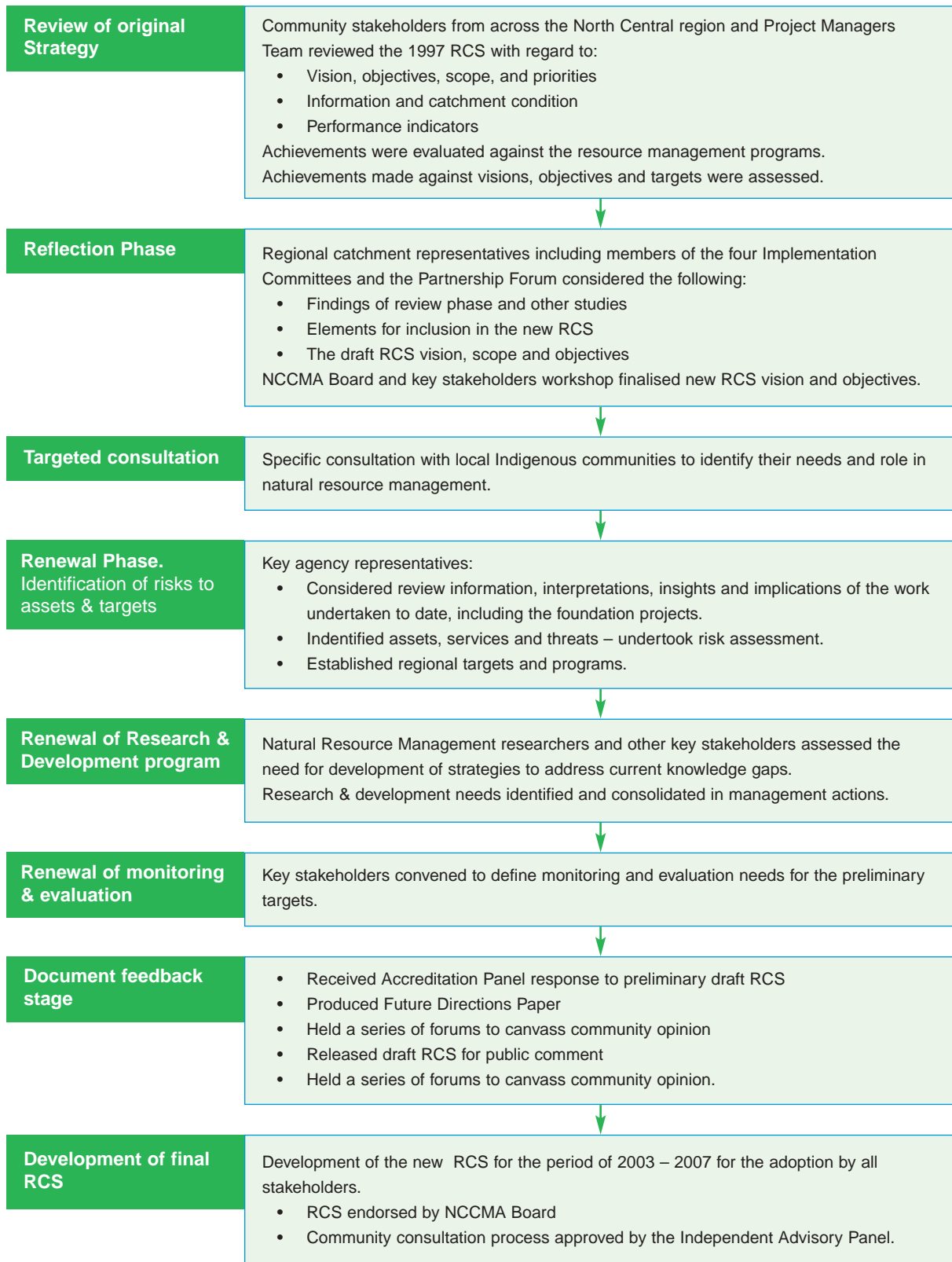


Figure 2: Process of reviewing and renewing the RCS

A 5 RCS development process

5.1 Stakeholder consultation

An essential outcome of the process of preparing the RCS is inspiring community ownership.

The NCCMA has consulted widely with the community and key stakeholders during preparation of the RCS. A range of forums, workshops and meetings have been held to canvass the views and opinions of people throughout the region. This consultation process has utilised existing regional networks such as Landcare and the VFF, and has sought contributions from people and organisations outside those networks. (For a full description of the consultation activities, see Appendix 1).

The major consultation activities revolved around four key stages of RCS development:

1. Review of 1997 RCS
2. Preliminary draft RCS
3. Future Directions Paper
4. Draft RCS



Photo: Clare Claydon, NCCMA

Extensive community consultation was undertaken to review and renew the Regional Catchment Strategy.

Review of RCS

The review of the 1997 RCS was the first major exercise which involved various sectors of the community. The purpose of the review was to:

- ◆ identify the progress that had been made against the 1997 RCS
- ◆ identify the extent of implementation
- ◆ assess the adequacy of the 1997 RCS in light of new information and arrangements
- ◆ identify gaps.

The consultation approach involved a number of activities:

- ◆ initial community engagement, including advertising and website
- ◆ nine community forums and local government forums
- ◆ stakeholder interviews
- ◆ reflection workshop.

Preliminary draft RCS

This stage of RCS development involved a series of workshops with key stakeholders and community representatives. The workshops were structured to build on the findings of the RCS review phase and to commence development of the new RCS.

The workshops addressed the following themes:

- ◆ a new vision and objectives
- ◆ risks and target setting
- ◆ research and development
- ◆ monitoring and evaluation.

In addition, Indigenous communities in the region were consulted at this stage.

This stage culminated in a preliminary draft RCS, which was submitted to the Accreditation Coordinating Group. Detailed feedback was received, which led to the development of the Future Directions Paper.

Future Directions Paper

A Future Directions Paper was prepared and distributed in early March 2003. The Paper formed the foundation of the draft RCS. Distributed widely, it allowed interested parties to comment on the framework, the assets, the services and threats identified and to reflect on how natural resource management programs could be delivered within the region over the next five years.

A communications strategy was developed and implemented to ensure widespread community accessibility.

The NCCMA held a series of presentations to explain the Paper to community forums and Implementation Committees.

A 5 RCS development process

Feedback was received over a five week period. The NCCMA received over 80 written submissions from people from a range of backgrounds, e.g. urban residents, landholders, Landcare groups, government agencies. The submissions were made on behalf of approximately 1,450 people.

Draft RCS

The draft RCS responded to that feedback. It was made available to the community and stakeholders for a four-week period in May–June 2003. A companion document to the draft RCS, the draft North Central Catchment Condition Report, was also prepared and made available at this time. Over 70 written submissions were received on the draft RCS, in addition to the formal feedback received from the Accreditation Coordinating Group and the Key Contacts and Expert Panels.



Photo: Sandra Volk, NCCMA

Community engagement with the draft RCS.

What the community and stakeholders said

The consultation process identified a range of new and existing issues that have helped shape the renewed RCS. The major issues raised were:

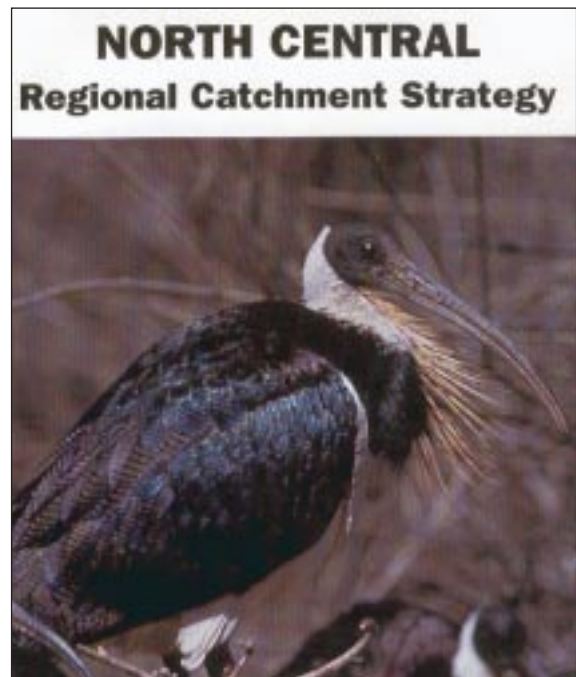
- ◆ improving the river health and water quality within the region
- ◆ improving land and water management practices, including soil health, pest plant and animal management
- ◆ protecting and enhancing biodiversity
- ◆ landscape change incorporating land stewardship, climate change and sustainable farming systems
- ◆ considering the effects of increasing residential and hobby farm development, particularly in the upper catchment, on natural resource management

- ◆ improving community communication and knowledge transfer to enhance the community's capacity to apply integrated management to the land
- ◆ needing to understand that private landholders will contribute to the restoration of the land, water and biodiversity assets of the region but cannot be expected to do it all
- ◆ including the Indigenous communities in management of the region's natural resources
- ◆ enhancing coordination among the NCCMA and other agencies
- ◆ enhancing integration of sub-strategies and action plans
- ◆ ensuring, where possible, that solutions to natural resource management issues are integrated and achieve multiple outcomes
- ◆ adopting a 20 – 50 year horizon that embraces the community's aspirations for natural resource management and landscape change
- ◆ the community must be considered as an asset, along with land, water, biodiversity and climate.

5.2 Review of the 1997 RCS

Introduction

A review of the 1997 RCS is a requirement of developing a renewed RCS to consolidate lessons of the past five years.



Reviewing the 1997 RCS was an important step undertaken prior to its renewal.

A 5 RCS development process

The 1997 RCS was the first natural resource management strategy that considered all four river catchments of the North Central region. The strategy was prepared by the North Central Catchment and Land Protection Board.

Responsibility for implementing the RCS was then passed to the NCCMA.

The strategy identified six regional priorities and a range of programs for implementation. Some programs (e.g. for dryland and irrigation salinity) predated the RCS. The regional priority issues included:

- ◆ salinity – dryland and irrigation
- ◆ biodiversity
- ◆ waterways and water resources
- ◆ soil health
- ◆ pest plants and animals
- ◆ regional development

The performance of each program for the regional priority issues has been assessed to learn from its strengths and shortcomings.

Dryland salinity program

A comprehensive review of the dryland salinity management program was undertaken prior to the preparation of a Second Generation Dryland Salinity Management Plan for the North Central region. It found that the original salinity management plans were based on several assumptions. The first related to the effectiveness of the management practices. The second related to the capacity of the community education, extension and onground works programs to encourage landscape scale adoption of those practices. Proposed implementation programs were also based on bold assumptions about the level of financial support that would be received.

The review found that there has been a substantial gap between expectation and achievement in relation to program implementation. However, while implementation of the plans has not generally proceeded as anticipated there have been successes:

- ◆ the regional community in general, and rural landholders in particular, are now much more aware of salinity than they were when the plans were first conceived
- ◆ stream salt loads have dropped and water table levels have generally receded across the region in

recent years (although this would appear to be largely due to the influence of climate)

- ◆ there is strong evidence from field based trials and modelling that there is a range of farming systems or land management options that can successfully manage salinity processes in some hydrogeological settings
- ◆ there is a greatly improved understanding of the nature of the future salinity threat, of the processes by which salinity operates in different landscape settings and of the ways in which salinity can be managed.

The approach to dryland salinity management adopted within the North Central region has changed substantially in recent years. The focus is now on smaller, high priority areas where the aim is to achieve the landscape scale change in farming systems required to protect the natural resource assets and values threatened by salinity.

This approach is underpinned by a more rigorous and community-oriented implementation approach which emphasises community capacity building.

Experience has shown that:

- ◆ A 'one size fits all' approach to salinity management is not appropriate. Approaches to salinity management must be tailored, with implementation programs developed at local, priority area levels to reflect the real biophysical processes and community capacity issues.
- ◆ Lifestyle landholding and part-time professional farming is increasingly replacing 'full-time' professional farming in much of the southern part of the region. This change needs to be considered in the way extension services are provided. For example, the provision of labour rather than financial support may be more effective in encouraging voluntary adoption to achieve land use or management change.
- ◆ Integration of priorities, targets and actions of the salinity management plans with other catchment health outcomes is essential.
- ◆ Monitoring and implementation programs need to be integrated to test the effectiveness of current recommended practices in various regional landscapes.
- ◆ Successful implementation of the salinity plans relies on more than delivery of a grants program for onground works. Lasting and landscape scale change in farming systems and salinity processes

A 5 RCS development process

requires the capacity of landholders to be developed so they are ultimately dependent on neither financial nor technical support from government agencies or the NCCMA.

Irrigation salinity program

The irrigation salinity program has been based on salinity management plans developed in the early 1990s. It has a strong community-driven approach and has achieved the following:

- ◆ The farm program has been very successful, especially those activities which the farmers understood and could see the benefit of, e.g. soil salinity surveys, re-use systems, whole farm planning.
- ◆ Significantly dropping the water table below a large area of irrigated land with associated triple bottom line benefits. For example, in 1990, 83% of the Tragowel Plains had a watertable within one metre of the surface. That figure has decreased to less than 31%. This trend has been greatly assisted by dry conditions since 1996, but bore hydrographs show that the watertable also dropped from 1990 to 1996.
- ◆ Successful off-farm program components where the benefits were clear and strongly supported by the community, e.g. Lake Charm outfall and the planned Pyramid Creek salt interception scheme.



Photo: Tim Shanahan, G-MW

Salt harvesting at near Lake Charm.

- ◆ The increase in gross value of agricultural production in the Loddon-Murray region in the last 10 years was about twice the rate of increase for the rest of Victoria. Much of the increased production came from irrigated high-value enterprises.
- ◆ A large reduction in salt flow to the River Murray from the Loddon-Murray region (associated with re-use schemes and dropping the watertable).
- ◆ Using provisional figures and conservative assumptions, it is estimated that the plans have produced \$1.40 for every \$1.00 invested (of which Government paid \$0.40).

Much of the success of the program was due to the strong interest and involvement of landholders in planning and decision-making, and a technically robust and practical implementation plan.

Less successful components of the irrigated salinity program related to less tangible on-farm benefits, e.g. revegetation and management of saline soils, or unclear and uncoordinated management responsibilities between land and water organisations, e.g. management of streams and wetlands and development and implementation of wetland management plans.

The default option of 'no change' in management tends to be adopted when there is a risk of an environmental downside, even when risk could be low and chance of environmental gain could be high.

A major recent development has been the merger of the four Loddon-centred plans into a combined strategy (Loddon Murray Land and Water Management Strategy, 2002). This strategy has encouraged a feeling of strong ownership and support in the irrigated agriculture community. It includes two additional themes: Planning and Development (to increase the role of local government in natural resource management) and Social Capacity Building (to encourage the development of people who can invigorate the community).

Biodiversity program

The biodiversity program over the last five years has seen a substantial increase in awareness and understanding of the value of biodiversity in the North Central region. Much of this has been due to a strong collaborative approach with stakeholders in the region.

The program commenced from a small base in 1997–98 (\$200,000 p.a.) to funding of \$1.5m for biodiversity conservation works in 2001–2002. Achievements include:

- ◆ significant implementation of onground works and actions, with a shift from ad hoc activity to strategic landscape scale projects that integrate biodiversity with other natural resource issues
- ◆ adoption of a bioregional planning and implementation approach through biodiversity action planning
- ◆ development of strong skill/knowledge base relating to biodiversity assets across the region

A 5 RCS development process

- ◆ development of strong partnership approach with DSE/DPI, Implementation Committees and non-government organisations (e.g. Trust for Nature, Greening Australia)
- ◆ timely and successful completion of NAP Foundation activities, e.g. EVC Mapping, Biodiversity Risk Mitigation Protocols
- ◆ conception and implementation of collaborative projects with other CMAs, research organisations and local government
- ◆ implementation of regional seed collection program currently collecting 800 kg seed/annum: up from approx 100 kg/annum in 1997–98
- ◆ completion of North Central Regional Vegetation Plan and Climate Change Action Plan
- ◆ initiation of new projects including Environmental Management Systems, Greenhouse and Climate Change, and Bush Tender.

Recently, the approach has shifted to endorse a stronger commitment to integrate the biodiversity program with salinity and river health programs in order to achieve catchment health outcomes.

There is now a much stronger focus on asset protection and enhancement. This has been possible because the information/knowledge base is much improved. The adoption of a bioregional approach to priority setting and implementation is a significant advance that supports statewide policy direction.

A whole of landscape approach to biodiversity conservation is now applied as the relationship between various landscape elements/assets and threatening processes is better understood.



Community tree planting day near Axe Creek.

Photo: Peter Weaving

Waterways and water resources program

The waterways and water resources program of the 1997 RCS was divided into four sub-programs: water quality, waterway management, floodplain management and groundwater. Substantial progress has been made with the main actions proposed under each sub-program.

Water quality

Nutrient management strategies have been completed for all four catchments. These strategies have been supplemented by nutrient action plans. Government endorsement has been achieved for the Avoca and Avon-Richardson Nutrient Management Strategies.

Across the region, stormwater management plans have been developed, erosion control works implemented and waste water treatment plants upgraded. In addition, buffer strip programs to protect streamsides and community education programs have been implemented.



Canoeists on the Campaspe River at Barnadown.

Photo: Angela Gladman, NCCMA

Waterway management

The regional waterways program has been working towards the development of a North Central River Health Strategy. The objectives of the strategy are to establish priority waterway reaches, develop river health objectives and set targets for strategy implementation and the future condition of waterway assets.

Development of the strategy has been supported by extensive field investigations. These have provided an excellent indication of the value and condition of stream reaches across the region and of the threats they face. An extensive consultation process has been undertaken to determine the community's perception of waterway values, threats and priority activities.

A 5 RCS development process

This information has been used to identify priority stream reaches. Implementation programs based on these priorities have been set for the next five years. A draft River Health Strategy has been prepared which outlines the development process, discusses the priority reaches and implementation program and sets 10-year targets for waterway condition. These programs will build on works already undertaken in the region to protect and/or rehabilitate stream reaches.



Photo: Angela Gladman, NCCMA

Round Creek running through Greater Bendigo National Park.

Key successes have been:

- ◆ integration of water quality and river health priorities
- ◆ partnerships with local government on erosion control and urban stormwater
- ◆ extensive works programs across all catchments. These have involved erosion control, willow management, riparian revegetation and fencing.

The MDBC's cap on further diversions of surface water from the Basin is being implemented in the region through a process of defining bulk water entitlements for rural, urban and environmental use. As part of this process, environmental flow regimes are being investigated and developed for the four main regional river systems.

Floodplain management

Floodplain and rural drainage strategies have been prepared for the region. Implementation is well short of targets due to shortfalls in funding.

Flood studies have progressed in many areas including Tyntynder Flats, Pental Island, Lower Loddon, Lower Avoca, Lake Marmal and Avon-Richardson.

In recent years, the demand on the NCCMA for advice on planning referrals for development has been growing substantially.

Groundwater

The issue of groundwater usage and allocation versus availability is being closely examined across all groundwater management areas.

Usage and allocation of groundwater resources have been investigated for the Spring Hill Water Supply Protection Area in the Upper Loddon and also in the Mid-Loddon Groundwater Management Area. The Mid-Loddon investigation resulted in a further 7,000 ML of available groundwater being auctioned by Goulburn-Murray Water in December 2002. A groundwater management plan has also been developed for the Campaspe Deep Lead Water Supply Protection Area.

The mineral springs around Daylesford represent a particularly valuable resource. The management of mineral water is overseen by the Victorian Mineral Water Committee.

Soil health program

The 1997 RCS aimed to increase landholder adoption of management practices that addressed soil structure decline, soil acidification and soil erosion. The proposed soil health program was never developed, funded or implemented in its own right. A soil health strategy for the dryland part of the region was prepared to a draft stage. However, as the level of public benefit was considered to be low, the strategy was neither completed nor implemented.

Soil health issues remain a problem at a paddock or farm scale in many areas. Some are addressed through the implementation of dryland salinity and waterway management programs. Some land managers are of the view that soil health needs to be addressed in the renewed RCS.

Pest plants and animals program

The pest plants and animals program has been driven by action plans for weeds and rabbits which were developed in 1998–99. The action plans introduced a clear focus for the programs, based on reducing impact of the pests over the long-term and working with the community where there is strong support and a high level of participation. This approach changed the way the program was delivered and as a result, is considered to be far more effective.

A 5 RCS development process

The success of community-based programs has been enhanced by the commitment shown to enforcement. Inaction by a few individuals prevents a local community group from achieving its desired standard for pest control.

The introduction of the rabbit-free concept has been a significant step forward. It has changed the way people think about rabbits on their land and has raised the standard for rabbit control within the region and beyond.

There is also an expectation that all land managers, public and private, must participate in pest management programs if they are to be successful.

Challenges facing the program include:

- ◆ insufficient resources to support and enforce all control programs
- ◆ lack of regional coverage by community groups undertaking projects
- ◆ increased community expectation of support for dealing with an increasing number of 'new and emerging' weeds
- ◆ variability in the success of registered control techniques – some priority species are extremely difficult or expensive to manage
- ◆ pest management continues to have a low profile in some communities
- ◆ declining enthusiasm of community groups
- ◆ other more pressing rural concerns push pest management to the background.

Regional development program

The regional development program has comprised farm forestry and Loddon Murray 2000 Plus. More recently, a pilot future land use project has been initiated in the area between Kerang and Swan Hill.

Farm forestry

The farm forestry program was developed to facilitate the establishment of farm forestry for economic, environmental and social benefits. An action plan developed in 1999 established the strategic direction for the program.

The program started with few resources and a low regional profile. Nevertheless, it has been successful in harnessing community interest and support for farm forestry as an emerging and credible agricultural enterprise. The program steadily raised the credibility of farm forestry systems in addressing natural

resource management issues. The program has been instrumental in increasing awareness and knowledge capital relating to the integration and economics of commercial tree growing opportunities.

Loddon Murray 2000 Plus

The Loddon Murray 2000 Plus program was an initiative of the community in the irrigated agricultural area in the north of the region. The community identified an opportunity to improve the region's economic performance by lifting the profitability of agricultural enterprises, changing the enterprise mix of others and shifting irrigation water from low value to high value usage.

A community-driven management committee developed and implemented an integrated solution to meet the regional circumstances. This involved a high degree of community consultation and input into the development of a strategic plan. The strategic plan identified projects addressing regional economic viability, water management, higher value adding activities and achieving a greater regional identity.

The main achievements of the program were:

- ◆ Farm business plans – the cornerstone of the program. The gross income per ML of water shows a projected increase of almost 50% across all enterprises undertaking business planning (from \$540/ML to \$989/ML)
- ◆ Development grants aimed at stimulating on-farm investment has seen the average development grant of \$15,400 leveraging a further \$48,000 investment per business. Over \$4.75 million in development works were planned by the 75 participating farm businesses.
- ◆ The prime development zones project addressed the opportunity for moving irrigation water from low value enterprises to high value horticultural enterprises by identifying potential new irrigation land for high value production. The project assessed land capability and irrigation infrastructure within the region and identified new areas for development. The project considered the potential on-site and off-site salinity impacts resulting from changed hydrogeological and drainage regimes and potential environmental risks from irrigation development. This analysis aimed to ensure that irrigation development in the zones would be environmentally responsible and sustainable.

A 5 RCS development process

- ◆ Loddon Murray Community Leadership Program has been very successful in developing local leadership in the region, with more than 100 participants in its five years of operation. The program plays an important role in community capacity building to manage natural resources. Its stated purpose is to 'equip people in our communities to lead, face challenges, work with communities for positive change and increase awareness and understanding of regional issues, resources, contacts and networks.'

Kerang-Swan Hill Future Land Use

In 2002, this program investigated the key economic, environmental and social issues arising from the impact of water trade and water reform. A community working group is currently working on options for achieving more viable future land use, infrastructure, environment and community.



Members of the Future Land Use Community Working Group learn about Barr Creek weir, near Kerang.

Photo: Jo Haw, NCCMA

Landcare support

The national Landcare movement commenced in the North Central region over 15 years ago. Since then, the region has benefited greatly from the contribution of the many Landcare groups to natural resource management.

A Landcare support program has been delivered in the region since 1997. The intensity of the program has increased in recent years in response to the challenges facing Landcare volunteers and with the increasing recognition that strategic support to community groups results in sustained growth in community awareness, execution of onground works and the development of community capacity.

Components of the program include:

- ◆ developing training in natural resource management issues for landcarers and others in the regional community
- ◆ networking Landcare groups with each other, with agencies involved in natural resource management and with regional community decision-makers
- ◆ publicising the achievements of Landcare groups and raising awareness of natural resource issues in the community
- ◆ developing action plans with Landcare groups to enable them to be more effective and to sustain community energy
- ◆ developing industry investment in Landcare, developing Junior Landcare (Landcare in schools) and working with the Indigenous community.



Photo: Jennifer Johnson

Hands-on activity at one of the region's Landcare courses.

Much of the program is now delivered through local government-based Landcare coordinators. This recent development has greatly improved the scope and effectiveness of support given to regional Landcare groups. Funding available for Landcare support and for Landcare initiated projects remains modest, a factor that limits the scope and outcomes of activity under this program.



PART B – Asset and Actions



1 Strategic framework and integrated catchment management

1.1 Asset-based framework

The first generation of natural resource management plans and strategies in Victoria, including Regional Catchment Strategies, were largely problem- or threat-based. Their focus was mainly on how to deal with problems such as:

- ◆ irrigation and dryland salinity
- ◆ biodiversity decline
- ◆ river health and water quality decline
- ◆ pest plants and animals
- ◆ flooding.

Problem-based programs encouraged a culture that saw problems and threats addressed almost wherever they occurred.

Natural resource management has moved on from that approach. Assets, rather than problems, are the drivers of the current generation of plans and strategies. Even where they remain threat-based, the rationale for action under these plans and strategies is based on maintaining or enhancing assets and their values.

This section outlines the region's natural resource, social and economic assets and provides an overview of the asset-based framework on which the draft RCS has been developed.

The environment is made up of natural resources (assets) which society uses or appreciates/values in a variety of ways (services). The primary assets are water, land, biodiversity and climate. These can be divided into secondary assets which reflect the way the environment is managed in the North Central region.

Assets throughout the region are strongly inter-related and their separation within the RCS is only done so that each asset can be adequately described.

Natural resource management within the region must be fully integrated. For example, in the lower catchment, this is achieved through the integrated implementation framework provided by the Loddon Murray Land and Water Management Strategy.

Table 3: Natural resource assets

Primary Assets	Secondary Assets	Definition
Land	Private Land – Dryland	Land in areas where the predominant use is dryland agriculture.
	Private Land – Irrigated Land	Land in areas where the predominant use (by gross value of agricultural production) is irrigated agriculture and/or horticulture.
	Public Land	Publicly owned land outside urban areas, including National, State or regional parks, nature conservation reserves, state forest and crown land reserves (e.g. roads and streams).
Water	Waterways and Wetlands	All rivers, streams and floodways that convey water and the natural and constructed features, such as lakes, wetlands and reservoirs, in which water is temporarily or permanently stored.
	Water Resources	Surface and groundwater resources, including those generated within the catchment and interbasin transfers.
Biodiversity	Native Vegetation, Terrestrial and Aquatic Fauna	Terrestrial and aquatic flora and fauna, their ecological communities and the ecosystem functions they perform.
Climate	Air, Rainfall, Temperature	The climate of the North Central region.

Table 4: Social assets

Social Asset	Secondary Assets	Definition
Human	Community Capacity	The abilities and resources of individuals, networks, organisations and communities to manage natural resources sustainably ⁱⁱ .
	Cultural Heritage	Indigenous and non-Indigenous cultural heritage sites and landscapes.
	Infrastructure	Built infrastructure in rural, urban and peri-urban areas, including transport, communications, energy, water supply, waste management, residential, commercial, mining and industrial infrastructure.

ⁱⁱSource: Cooperative Venture for Capacity Building and Innovation in Rural Industries

1 Strategic framework and integrated catchment management

People and communities of a region have a fundamental role in protecting and enhancing the natural assets. Hence, the RCS addresses issues relating to the role of the community in natural resource management, as well as the cultural heritage and infrastructure assets which help sustain communities.

Asset-based program logic

The assets define the framework for programs and actions in the RCS. The logic for defining programs and actions to protect these assets is illustrated in the diagram below. The key to developing the RCS programs is the definition of an asset objective, which must be made in light of the trends and risks to the asset and its services.

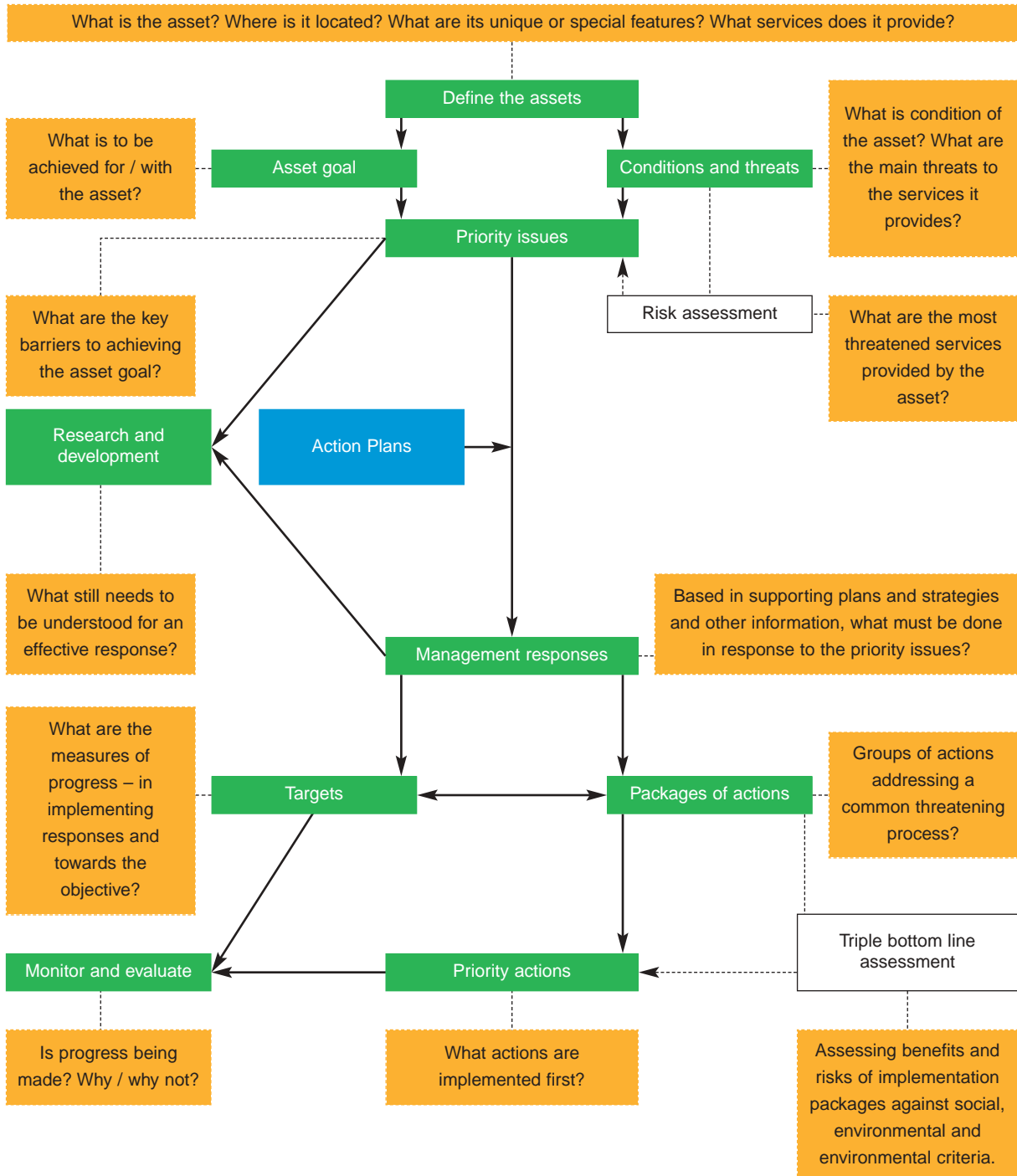


Figure 3: Asset-based program logic

1 Strategic framework and integrated catchment management

Integration of catchment issues

The development of the RCS using the asset-based framework, as required for State and Commonwealth accreditation, has imposed a new discipline on the region to identify the priority assets and values it seeks to protect and enhance. There is a stronger emphasis on working towards agreed targets and outcomes for biodiversity, water, land and community assets.

Whilst the management actions of the RCS are generally specific to assets or services, delivery of the actions will be through integrated programs. The North Central region has a strong record of community involvement in integrated natural resource management planning and implementation, which has enabled the region to tailor technical solutions to meet the needs of land managers. The region pioneered community engagement through the irrigation and dryland salinity plans which established a successful model used widely ever since. The region has also been particularly progressive in the Landcare movement, with the first official group formed in the region in 1986, and very strong growth in groups.

The region has also embraced the concept of catchment management, where the linkage between managing different aspects of the catchment is recognised and understood. This has had a major influence on the way in which projects are implemented to deliver multiple benefits.

Integrated catchment management can only occur when all parties are involved in the planning and implementation process. The NCCMA recognises that community ownership and engagement is fundamental for the successful implementation of the RCS and integrated catchment management. It has initiated a process to determine how best to engage the community and to establish the necessary roles, responsibilities, structures and processes.

The natural resource management capability of the region is considerable and is made up of individuals, community groups, water authorities, local government, state agencies, etc. A challenge is to establish and/or maintain effective relationships between the various stakeholders so that the management of the region's natural resources is improved. The North Central region must maintain a culture that encourages partnerships, information exchange and support in natural resource management.

The suite of management actions within the RCS can be categorised into a set of key regional challenges that apply to communities throughout the North Central region include:

Sustainable production systems

Development of sustainable production systems in the irrigation and dryland farming areas (encompassing the assets: dryland, irrigated land, biodiversity, community and climate).

Regional plans include, but are not limited to:

- ◆ Loddon Murray Land and Water Management Strategy
- ◆ Dryland Salinity Management Plan
- ◆ Farm Forestry Action Plan
- ◆ Rabbit and Weed Action Plans
- ◆ Draft Soil Health Action Plan
- ◆ Land Use Change and Revegetation in North Central Victoria (Climate Change Response).

Healthy rivers and floodplains

Improving the health of waterways, floodplains, wetlands and groundwater resources (assets include waterways and wetlands, water resources, biodiversity, community and infrastructure).

Regional plans include:

- ◆ Regional River Health Strategy
- ◆ River Health Plans
- ◆ Floodplain Management Strategy
- ◆ Nutrient Management Strategies
- ◆ Streamflow Management Plans
- ◆ Bulk Water Entitlement Processes
- ◆ Rural Drainage Strategies
- ◆ Groundwater Management Plans
- ◆ Wetland Management Plans
- ◆ Kerang Wetlands Ramsar Site Draft Strategic Management Plan
- ◆ Gunbower Forest Ramsar Site Draft Strategic Management Plan.

Ecosystem protection and restoration

The protection and enhancement of biodiversity (assets include biodiversity, public land, dryland, irrigated land, waterways and wetlands, water resources and community).

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Regional plans include:

- ◆ Native Vegetation Plan
- ◆ Bioregional Action Plans
- ◆ Bendigo Fishery Management Plan
- ◆ North Central Weed and Rabbit Action Plans

Future landscapes

Managing future landscapes by recognising opportunities for achieving a greater level and diversity of beneficial services from existing natural resource and human assets (assets include biodiversity, dryland, irrigated land, waterways and wetlands, water resources and community).

Regional plans include:

- ◆ Future Landuse in the Kerang Swan Hill Area
- ◆ Land Use Change and Revegetation in North Central Victoria (Climate Change Response).

Capable communities

Promoting and supporting community leadership and participation in natural resource management, e.g. Loddon Murray Community Leadership Program (assets include community and cultural heritage).

Regional plans include:

- ◆ Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management
- ◆ Draft Landcare Support Strategy
- ◆ Loddon Murray Community Leadership Program
- ◆ NCCMA Communications Strategy.

Research

A number of research needs have been identified within the management actions of the RCS, particularly where the relationship between threats and services is not well understood. Similarly, there is a need for improved knowledge of the condition of assets and trends in asset condition which will feed into the adaptive management approach described in Section C of the RCS.

The research needs of the North Central region will be identified via a strategic planning process by 2004. This is a management action target of the RCS. A key regional stakeholder in this process is DPI Research and Development, Bendigo (formerly the Centre for Land Protection Research).

Examples of how the management actions within assets can be delivered in an integrated way is presented in the case studies in this chapter.

1.2 Existing plans and strategies

In the following chapters, many of the management actions make reference to existing regional plans and strategies. One of the strengths of the North Central region is the extent to which plans have been developed in recent years to address many of the natural resource issues. These plans are acknowledged and reflected in the RCS, as they have been developed with considerable community and agency input. Twelve major plans are described below. Note that many plans exist within the region in addition to those listed below, e.g. local government plans.

River Health Strategy

The NCCMA has responsibilities under the *Water Act 1989* to manage natural waterways. This includes catchment planning and works to protect and repair waterways from the impacts of degradation.

The NCCMA is preparing a North Central River Health Strategy and has produced river health plans for the Loddon, Campaspe, Avoca and Avon-Richardson Catchments. The plans outline:

- ◆ actions to improve river health
- ◆ cross agency programs
- ◆ priority works programs
- ◆ future funding application priorities
- ◆ program benefits and costs
- ◆ cost sharing arrangements

Nutrient Management Strategies

Nutrient management strategies have been developed for the four main rivers and their catchments. Some of these strategies were originally developed as water quality strategies.

The nutrient management strategies identify sources of nutrients entering waterways and priority sites for nutrient works.

Floodplain Management Strategy

The Regional Floodplain Management Strategy identifies priority flooding related issues and flood management projects for the North Central region.

1 Strategic framework and integrated catchment management

The NCCMA is responsible for managing the activities on the floodplain to:

- ◆ maintain and enhance the inherent functions of the floodplains to convey and store flood waters
- ◆ minimise the flood risk to property, production, safety and social well-being
- ◆ maximise the environmental values of floodplains.

Rural Drainage Management Strategy

The NCCMA has responsibilities under the *Water Act 1989* with respect to floodplain and rural drainage issues. The management of rural drainage is required to ensure the protection of the North Central region's catchment and waterway health from the adverse impacts of rural drainage.

The purpose of the regional Rural Drainage Management Strategy is to:

- ◆ set out objectives for rural drainage management
- ◆ provide a decision-making framework for a formal planning approval process to apply to proposed rural drainage activities, including clarifying roles and responsibilities of the key stakeholders
- ◆ provide regional design principles and standards to apply to rural drainage activities
- ◆ identify specific measures / studies to be able to implement the strategy.

Native Vegetation Plan

The North Central Native Vegetation Plan is the key document for providing the regional approach to biodiversity conservation and native vegetation management. The plan identifies the current status of vegetation communities and provides a baseline to monitor the status of native vegetation in the region. The plan establishes a framework for determining priorities for vegetation protection and enhancement. It also identifies a framework for involving and supporting communities in biodiversity activities.

Bioregional Plans

Bioregional plans have been developed for the bioregions across the North Central region, including:

- ◆ Goldfields
- ◆ Victorian Riverina
- ◆ Wimmera
- ◆ Northern Inland Slopes
- ◆ Murray Fans

- ◆ Murray Mallee
- ◆ Victorian Volcanic Plain
- ◆ Central Victorian Uplands.

These plans provide an overview of biodiversity assets (e.g. threatened species, ecological communities, wetlands), associated threats and priority management actions across a range of land tenures.

Loddon Murray Land and Water Management Strategy

The Loddon Murray Land and Water Management Strategy provides a framework for the region to achieve its greatest potential while addressing the ongoing problem of salinity, enhancing the environment, improving regional productivity and ensuring social wellbeing. The Strategy provides the focus needed to ensure the sustainability of the Loddon Murray region's social, environmental and economic values and assets. The Strategy also serves as the region's Second Generation Salinity Management Plan. It was developed with extensive community and agency contributions.



Former NCCMA Chairman, Drew English, at the launch of the Loddon Murray Land and Water Management Strategy.

Photo: Tim Shanahan, G-MWV

The Strategy is based on five themes that relate to ensuring the future sustainability of the region:

- ◆ land management
- ◆ water management
- ◆ biodiversity enhancement
- ◆ social capacity
- ◆ planning and development.

The Strategy clearly links to other regional and State strategies such as the Nutrient Management Strategy and Nutrient Action Plan, and the North Central Native Vegetation Plan and River Health Strategies.

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Dryland Salinity Management Plan (draft)

The Second Generation Dryland Salinity Management Plan builds on the successes and learnings from the previous four dryland salinity plans of the region (Campaspe, Loddon, Avoca and Avon-Richardson). The new plan targets the salinity program to ten high priority subcatchments within the region. The program has a strong focus on a farming systems approach to land use change. This is because many of the priority areas have climate and groundwater flow systems that allow farming systems to change to address salinity processes.

Alternative approaches are recommended where the community does not have the capacity to change farming practices on the scale required or where the biophysical processes restrict application of the farming systems change approach.

Rabbit and Weed Action Plans

The North Central Rabbit Action Plan and Weed Action Plan provide clear priorities for action to manage the impacts of rabbits and weeds across the region.

The plans identify targets for onground works and community support. They emphasise that effective rabbit and weed control needs to be part of an integrated approach to land management and requires long-term commitment from land managers and agencies.

Farm Forestry Action Plan

The North Central Farm Forestry Action Plan addresses the challenge of incorporating commercial tree production into low rainfall farming systems. The plan promotes the strategic integration of commercial trees onto cleared agricultural land to provide both economic and environmental benefits.

The multiple benefit approach to farm forestry is expected to provide new land use options to help address many of the region's land and water degradation problems, diversify farm income and create new employment opportunities.

Landcare Support Strategy (draft)

The draft Regional Landcare Support Strategy aims to ensure the sustainability of the Landcare movement in the North Central region. Support measures advocated in the plan fall into six categories:

- ◆ networking and communication
- ◆ action planning
- ◆ assisting groups to greater effectiveness
- ◆ broadening the support base
- ◆ publicity
- ◆ training.

These support measures are based on the belief that Landcare groups will be more sustainable and more effective in their environmental work and contribution to community capacity if they:

- ◆ are well networked
- ◆ have and use an Action Plan
- ◆ have a broad resource base
- ◆ regularly communicate their achievements to their community
- ◆ have skilled and knowledgeable office bearers
- ◆ have the information they need or know where they can readily obtain it.

Shepparton Irrigation Region Catchment Strategy

The strategy is integrated into the Goulburn Broken Irrigation Program administered by the neighbouring Goulburn Broken Catchment Management Authority. This program addresses surface water management, sub-surface water management, farm and land management, waterways and program support services.

It delivers these programs to the Rochester irrigation area and the Campaspe irrigation district, much of which lie within the North Central region.

Originally started as the focus for salinity management in the Shepparton irrigation region, the Strategy now encompasses an integrated approach to a range of natural resource management issues including water quality, pest plants and animals, biodiversity and riverine health.

1.3 Structure of asset chapters

The following ten chapters present the strategic framework used to identify the outcomes and targets for each of the assets. The structure of each chapter is as follows:

- ◆ **Goal** – the desired long term condition, management and/or use of the asset and its services
- ◆ **Resource Condition Targets** – expected outcomes from implementation of management actions over the next 10 – 20 years. Unless otherwise stated, the change in resource condition will be measured against 2003 baseline levels.
- ◆ **Overview of Asset** – definition of the asset, overview of the asset and the services it provides
- ◆ **Asset Condition and Threatening Processes** – brief description of the condition of the asset and the threatening processes impacting on the asset
- ◆ **Priority Issues and Management Response** – Summary of the outcomes of the risk assessment process to identify priority issues and description of the management actions and targets. The management actions and targets are grouped into implementation packages, with linkages to the relevant Resource Condition Targets. (Note: the implementation packages or programs are the basis for determining priorities for program implementation using a triple bottom line assessment process – refer section C)

The resource condition targets, management action targets and implementation packages included within each asset chapter are not presented in priority order.

As outlined previously, the RCS is based on five primary assets of land, water, biodiversity, climate and social (people). However, for management purposes, these are separated into ten secondary assets.

The ten secondary assets are presented in the following chapters in alphabetical order:

- ◆ biodiversity
- ◆ climate
- ◆ community
- ◆ cultural heritage
- ◆ dryland
- ◆ infrastructure
- ◆ irrigated land
- ◆ public land
- ◆ water resources
- ◆ waterways and wetlands.

1 Strategic framework and integrated catchment management

Contrasting views of Lake Batyo Catyo foreshore and jetty.



Photos: John Dod

CASE STUDY

A partnership approach to improving Lake Batyo Catyo

Lake Batyo Catyo is a significant wetland in the Avon-Richardson catchment, particularly in terms of water quality, biodiversity, habitat and tourism. From a recreational and environmental perspective, the lake has tremendous significance for the local community and contributes immensely to the region's social and environmental sustainability. The lake supports native fish species, including Murray Cod and Golden Perch and is thought to be frequented by migratory birds.

Recreational activities that the lake supports include boating, fishing, swimming, bird watching, bush-walking and camping.

In 2000 after becoming dry for the first time in sixty years, attempts were made to desilt part of the lake to enhance its recreational potential and so increase its value as an attraction and community asset. Unfortunately, despite widespread support, very little onground action eventuated.

The appointment of a shire-based Landcare Coordinator in November 2002 allowed the vision of the local Landcare community to become the catalyst for action. The Coordinator was able to bring stakeholders together to take action, including:

- ◆ Avon Plains Landcare Group
- ◆ Banyena Landcare Group
- ◆ Marnoo Land and Water Management Group
- ◆ Donald and District Landcare Group
- ◆ Northern Grampians Shire
- ◆ Lake Batyo Catyo Committee of Management
- ◆ Buloke Shire
- ◆ Wimmera Mallee Water

- ◆ NCCMA
- ◆ Department of Sustainability and Environment and Department of Primary Industries
- ◆ Donald Primary School
- ◆ Victorian Farmers Federation
- ◆ St Arnaud Angling Club
- ◆ Donald Angling Club
- ◆ Donald Boating Club
- ◆ Traynors Lagoon, Rich-Avon and Donald Rural Fire Brigades.

Beginning with Clean Up Australia Day, desilting of the Lake had been completed by the time the break arrived, and the island that was created in the middle, planted out to appropriate indigenous and aquatic vegetation.

Works will soon commence to control the rampant cumbungi in the mooring basin and re-establish black box and lignum vegetation. This will be followed by the erection of boardwalks through that area to link with the proposed walkways.

The stakeholders are due to meet to develop a management plan for the Lake that will include the current plans of the community for the entire wetland system. They are excited at the progress being made at Lake Batyo Catyo.

"We all wanted it done, but nothing was happening. It's wonderful to have a Landcare Coordinator who can talk to everyone and bring things together. Finally, things are getting done and we have a way forward – the Coordinator is so important in this process." Caroline Jesse, Avon Plains Landcare Group.

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Severe erosion in a gully on Bright's farm draining into the Bet Bet Creek

The same gully after tree planting, battering of the right hand bank and mixed perennial pasture species sown on the former bare salt scald.



Photos: DPI North Central Dryland Salinity Team

CASE STUDY

Farmers demonstrate salinity and erosion control options

Upper Bet Bet farmers Rob and Lyn Bright are working with the Department of Primary Industries (DPI) Dryland Salinity Program to develop a demonstration showing the potential benefits of combining a range of options to address salinity coupled with severe gully erosion.

Trialing various gypsum/lime applications, re-establishing ground cover and tree planting together with erosion control earthworks, this demonstration is attracting interest from around the district, including the Waubra Primary School.

The activities being undertaken at the site are funded through the Bet Bet targeted area of DPI's North Central Dryland Salinity Program, supported by the NCCMA and funded by the National Action Plan for Salinity and Water Quality, which is a joint State-Commonwealth program.

Bare salt scalds bordering extensive gully erosion were already present when Rob and Lyn purchased the property located a few kilometres from Lexton in 2000. The property, although generally productive, is intersected by an extensive, badly eroded gully system that drains into the Bet Bet Creek.

This area of the catchment exports more than 1,000 kg per ha of salt annually into the Bet Bet Creek.

Last year, Rob fenced off 18 ha around the gully for the trial that began with the battering of one side of the gully. Battering involves using earthmoving equipment to remove topsoil, reducing the angle of the bank and smoothing the grade and then replacing the topsoil. This allows grass and vegetation to grow on the banks and help stabilise them. Rock structures were also built on the banks of gully corners to stop further erosion.

In 2003, Rob sowed a mix of pasture species on the site including phalaris, cocksfoot, strawberry clover, tall wheat grass, oats, triticale and wheat.

The demonstration site is also trialing different gypsum/lime/superphosphate applications in 20 m by five metre plots. A control plot of normal superphosphate application (12 kg/ha) was established along with one plot with 150 kg/ha of gypsum, one plot with 150 kg/ha of lime, one with 150 kg/ha of lime and gypsum, and one with 150 kg/ha of lime and gypsum, plus super.

Local tree species suited to the site were planted around the entire area through both direct seeding and tubestock. Children from the local Waubra Primary School spent a day at the site, planting 750 trees, listening to a talk on the value of trees, and examining the direct seeding machine. Rob has erected a sign to recognise the efforts of the children and hopes that they will be back to check on progress in the future.

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A Black-winged stilt.



Photo: Garry Cheers, NCCMA

2.1 Goal

The ecological function of indigenous vegetation communities will be maintained and, where possible, improved. Populations of threatened native plant and animal species will be restored to viable levels. Threatened vegetation communities will increase in extent and improve in quality to achieve a net gain.

The goal for biodiversity can also be expressed in terms of long-term aspirational targets for resource condition change. Since the scale of land use change required to achieve them is beyond the scope of the current RCS, they have not been included as resource condition targets. These aspirational targets are to:

- ◆ increase native vegetation cover to 30% of the region
- ◆ increase the coverage of all EVCs to at least 15% of their pre-1750 distribution.

2.2 Resource condition targets

This chapter outlines management actions that are needed to make progress towards the goal for biodiversity. Resource condition targets (Table 5) have been developed to indicate the expected outcomes from implementing those and related actions (described in relation to other assets) over the next 10 – 20 years. They therefore reflect how the ‘condition’ of biodiversity assets (e.g. indigenous ecosystems, species and habitats) might change over that period.

The targets listed in Table 5 relate directly to biodiversity. The management actions described in this chapter will also influence the condition of other assets, particularly waterways and wetlands, water resources and land. The biodiversity resource condition targets they influence are indicated in Table 6.

Table 5. Resource condition targets for biodiversity

#	Resource condition target	Year to be achieved
RCT BD1	Improve the quality and coverage of all vulnerable or endangered EVCs and any others with less than 15% of pre-1750 distribution by 10% (as measured by habitat ha).	2013
RCT BD2	Maintain or improve existing viable populations of significant threatened species (including threatened flora and fauna and migratory birds).	From 2003
RCT BD3	No further bioregional extinctions.	From 2003
RCT BD4	Increase native vegetation coverage to 20% of the region.	2030

2.3 Biodiversity: an overview of the asset and the services it provides

Definition

Biodiversity is defined as:

"The variety of life forms: the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity."

Commonwealth of Australia (1996)

In the context of the RCS, biodiversity as a natural resource asset includes all of the native plants and animals which occupy or, in the case of migratory birds, pass through the region. It includes aquatic and terrestrial species, as well as vertebrate and invertebrate fauna. Biodiversity also includes the ecosystems that these species form and the ecological processes that support them. As a natural resource asset, biodiversity includes: native vegetation communities, ecological vegetation classes, species, river reaches and wetlands. River reaches (or waterways) and wetlands are dealt with separately.

Bioregions and ecological vegetation communities

The ecological patterns of landscapes are represented by bioregions, which are characterised by particular vegetation complexes and associated fauna. The North Central region comprises parts of eight bioregions. The largest are the Goldfields and Riverina bioregions, which occupy almost two million ha between them. The smallest is the Northern Inland Slopes bioregion, which occupies just 15,000 ha within the North Central region. Within each bioregion, distinct vegetation communities can be identified based on floristic, structural and ecological features – these vegetation communities are commonly referred to as ecological vegetation classes (EVCs). Forty-six different EVCs have been identified within the North Central region. Further information on the bioregions and EVCs of the North Central region are given in the North Central Catchment Condition Report².

Biodiversity and ecosystem services

Biodiversity, in the sense of vegetation communities, species, river reaches and wetlands, are a regional

natural resource asset. In the sense of the variety of life forms and the diversity and interconnectedness of ecological processes, biodiversity is also a service. Services that accrue because of these properties have been termed ecosystem services. A range of such services have been attributed to the diversity of species and processes, including prevention of erosion and salinity, filtration of water, assimilation of wastes, control of pests and diseases, maintenance of soil health (in natural and agricultural systems) and the provision of cultural, social and recreational amenity³. While these services may not all be strictly dependent on diversity per se, diversity can often add substantially to their value.

Valuation of ecosystem services has received considerable attention in recent years³. Estimates suggest that the average annual value of ecosystem services for a single hectare of native vegetation is around \$300. Based on this estimate, the annual value of ecosystem services generated by native vegetation in the North Central region could be as much as \$54 million.

Direct economic activity

Currently, a relatively small proportion of the region's indigenous biodiversity has a direct economic use. Native vegetation, particularly grasses, contribute to agricultural productivity in some dryland areas. Several native tree and shrub species are widely used in timber production and for 'minor' forest products, such as Eucalyptus oil, firewood, fencing materials, garden mulches and honey production.

Water production

Native vegetation communities, particularly in the upper catchments of the Campaspe and Loddon catchments and along the riparian zone of the region's stream network, help to provide water of suitable quality for domestic, irrigation, industrial and recreational uses.

Cultural heritage

The region's biodiversity forms an important part of its cultural heritage, from both Indigenous and non-Indigenous perspectives. The most common sites of Indigenous cultural significance remaining in the region are scarred native trees. Native flora and aquatic and terrestrial fauna have been harvested for food by humans for millennia.

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Visual and recreational amenity

Native vegetation coverage adds much to the value of the region's landscapes as well as tourism and recreational opportunities. Native fauna populations, particularly birds and fish, support sustainable hunting and fishing activities, as well as more passive pursuits such as bird watching.

Carbon sequestration and emissions offsets

Young and growing patches of native vegetation sequester carbon from the atmosphere and help to offset carbon emissions from agricultural and urban sources. Recent plantings (post-1990) can be used in a formal sense to offset these emissions and may provide direct or indirect economic value to landholders.

2.4 Biodiversity status and threatening processes

The region had rich and diverse populations of native flora and fauna prior to European settlement. While much of the original diversity has been retained, many populations and ecological communities have been severely depleted. Retained vegetation cover varies from less than 0.5% of pre-1750 distribution for the Murray Mallee and Wimmera bioregions to 31% for the Central Victorian Uplands². Less than 13% of the pre-1750 native vegetation cover has been retained across the region. Native vegetation communities on land that was most easily occupied for agriculture – the natural grasslands, grassy woodlands and wetlands – are most poorly represented.

Within the Goldfields and Riverina bioregions alone, over 200 native plant and animal species have been listed as having rare or higher conservation status. A total of almost 260 indigenous flora and fauna species found in the region have Victorian rare or threatened species status. Only seven of the region's 174 EVC bioregion combinations (for which conservation status has been confirmed) do not have a threatened conservation status.

Losses in regional biodiversity are yet to be fully expressed. Species extinctions may still occur over the next 20 years, even with substantial vegetation protection and enhancement activities. Loss of biodiversity may also jeopardise ecosystem services (e.g. soil health, waste assimilation, amenity value, cultural heritage) that are strongly dependent on variety in life forms and processes.

Habitat fragmentation

Habitat fragmentation remains one of the key agents of biodiversity decline within the North Central region. Historically, clearing for agriculture, mining and urban development have been the major causes of habitat fragmentation. Urban and peri-urban development remain significant contributors. Firewood collection, particularly on private land, can result in the loss of standing and fallen dead timber, which are important habitats for some birds, marsupials, reptiles and invertebrates.

Fragmentation of native vegetation habitat detracts from biodiversity, in that it results in:

- ◆ a smaller area of native vegetation and associated habitat for dependent species – the quantity of native vegetation habitat is considered to be an important and direct indicator of the number of species a landscape can support
- ◆ reduced size of remnant vegetation patches – research suggests that 40 ha is a critical threshold for species diversity, with smaller patches supporting greatly simplified communities
- ◆ creation of patches whose shape increases their exposure to adverse climate, weed invasion and other threatening processes
- ◆ a reduction in the connectivity of remnant vegetation patches, which in turn reduces dispersal and movement of small or less mobile fauna.

Salinity

Prior to European settlement, hydrological and salt balances were maintained entirely by native vegetation. Loss of native vegetation, its replacement with agricultural species (or by urban development) and irrigation is largely responsible for the region's salinity problems.



Photo: Tim Shanahan, G-MW

A dry Second Marsh – one of the Kerang Wetlands.

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Almost 40,000 ha of high conservation value native vegetation and at least part of the habitat of almost 200 species of threatened native flora and fauna are under threat from shallow water tables and salinity. The most threatened ecosystems are those which are more highly fragmented and located in lower landscape positions in mid and lower catchment areas. Wetlands, riparian zones, floodplains and aquatic communities are most at risk.

Altered hydrology

Changed hydrology impacts on both aquatic fauna and vegetation and on riparian and floodplain ecological communities. Regulation and diversion of water for irrigation and urban use in the Campaspe and Loddon catchments have markedly changed the volume and timing of flows along the river systems and have impacted on aquatic, riparian and floodplain communities. The magnitude and frequency of flooding is believed to have increased in the Avoca and Avon-Richardson catchments. This is associated with increased recharge in floodplain areas and enhanced salinity impacts (e.g. lower Richardson River, Lake Buloke).

Construction of drains and levee banks has also influenced the hydrologic regime experienced by aquatic, riparian and wetland ecosystems, particularly in the floodplains of the Avon-Richardson, lower Avoca and Loddon catchments.

Water quality decline

Salinity and increased nutrient levels contribute towards water quality decline and the subsequent reduction in aquatic and riparian biodiversity. Aquatic biodiversity has been severely affected in areas where changes in water quality have been substantial, such as immediately downstream of wastewater or stormwater discharge or when natural waterways receive highly saline water. Water quality decline typically results in a simplification of diversity in aquatic ecosystems.

Population growth/rural residential

Rural residential development can result in the loss and increased fragmentation of native vegetation. Increased proliferation of pest plants and animals resulting from vegetation disturbance and inappropriate land management practices also has adverse effects. Predation by domestic cats and foxes can drastically reduce populations of reptiles, birds and small marsupials in peri-urban areas.

Inappropriate recreation

A wide range of recreational activities, both knowingly and unknowingly, can cause different levels of disturbance to wildlife. Recreational activities such as off road vehicle use, illegal shooting and camping can cause disruption to breeding and nesting, remove habitat and injure or cause death to wildlife.

Even passive recreational activities such as bushwalking, camping, horse riding and recreational nature study can have localised environmental effects by inadvertently trampling vegetation or disturbing nesting birds.

Pest plants and animals

Weeds displace native species from their habitat and provide harbour for rabbits and foxes. The threat appears to be greater in periods of higher rainfall, upper catchment areas, land subject to disturbance and in lower parts of the landscape where water availability is greater (in riparian and wetland communities and the open forests in the south of the region).

Foxes prey on native fauna and can pose a significant threat to some populations. If rabbit populations are excessive, overgrazing can prevent the regeneration of native species and contribute to long term population decline.

European carp and other introduced fish may prey upon and/or modify habitat, such that native fish populations are displaced.



Photo: Matt Jackson, NCCMA

Rabbit warrens in the Baringhup district.

Changed fire regime

Native vegetation communities have developed under fire regimes that are quite different from those existing today. Changes have been made in the frequency, intensity and time of year of burns, with the

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nature of change varying between patches. Fire dependent ecological processes in native vegetation communities, such as succession and recruitment, have been affected to varying extents.



Photo: Greg Chant

Coppice regrowth following a fire along the Coliban River.

Climate change

Ecosystems that are likely to be particularly vulnerable to climate change are freshwater wetlands and riparian ecosystems. Species with restricted climatic tolerances (and range) and which are unable to migrate due to landscape fragmentation, soil differences or topography, could become endangered or extinct.

2.5 Priority issues and management response

Priority issues for biodiversity have been defined by a comprehensive risk assessment process, which considered the range of services provided by biodiversity assets, the likelihood of those services being affected by various threatening processes and the potential impact on service values should that threat be realised. The priority issues for biodiversity are based on combinations of likely threats and the expectation of a significant decline in service values. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

Priority issues for biodiversity are based around threats to:

- ◆ habitat values and ecological function in remnant vegetation communities
- ◆ Indigenous cultural heritage, associated with remaining scarred trees and other sites of significance
- ◆ recreation and tourism
- ◆ visual amenity.

These services are threatened by agents such as urban and peri-urban development, salinity and water quality decline, fragmentation and loss of native vegetation habitat, pest plant and animal infestation, changed water and fire regime and inappropriate recreation. If combined with a failure to protect and restore native vegetation habitat, these are the main impediments to achieving the sustainability goal for biodiversity. While most threatening processes operate across the region, the impacts of land use change are most acute in the upper reaches of the Loddon and Campaspe catchments and the impacts of changed flow regime on lowland aquatic ecosystems in mid and lower catchment areas.

Although climate change is recognised as a threat to biodiversity, the risk assessment did not flag it as a priority issue, due to uncertainty as to its impacts and because of the long timeframe over which they are likely to be expressed. However, responses to the threat have been developed and are outlined in the chapter on climate (Part B, Chapter 3).

A series of responses to the priority issues for biodiversity have been developed (Table 6). They are mostly based on the relevant regional or sub-regional action plans, but include some actions that address key gaps in the current response. Responses are not completely comprehensive: some actions are only the preliminary actions that form part of a longer term response to the issue. Several of the issues and proposed responses overlap with those relevant to assets other than biodiversity. To avoid repetition, Table 6 only includes responses that primarily address biodiversity issues. Other responses are given in the chapter for appropriate asset (as indicated in Table 6).



Photo: Matt Jackson, NCCMA

Gorse Spider Mites biologically controlling Gorse on the Loddon River.

The actions in Table 6 are grouped by implementation 'packages'. These packages are simply complementary actions that address the priority issues, particularly the main threatening processes. Further details on implementation packages are given in Part C. Resource condition targets that link with each package are also indicated.

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Table 6: Management actions and targets for biodiversity

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Biodiversity Package 1: Reducing the impacts of pest and domestic plants and animals on biodiversity.</p> <p>This package is concerned with reducing the impact of pest and domestic plants and animals on indigenous biodiversity. Actions need to be implemented across public and private land. Urban fringe and rural living areas adjacent to bushland and conservation reserves are also emphasised because of the potential impacts of environmental weeds escaping from gardens and the potential impact of domestic pets on small birds and marsupials. Activities supported include on-ground works and activities to educate and inform communities about pest and domestic animal management/control practices. The package relates to the North Central Native Vegetation Plan, as well as regional Weed and Rabbit Action Plans.</p> <p>This package directly addresses RCTs BD2 and 3.</p>			
BD1	Support landholders and public land managers in eradicating or implementing long term control over new and emerging weeds, priority weeds and controlled weeds, as per Weed Action Plan.	DPI/DSE, Parks Victoria	Weed Action Plan, Native Vegetation Plan
BD2	Support landholders in priority areas to undertake rabbit control programs as per Rabbit Action Plan so that long term rabbit control is extended in priority zones by 425 000 ha by 2008.	DPI	Rabbit Action Plan, Native Vegetation Plan
BD3	Encourage commercial nurseries to limit the sale of plants with environmental weed potential.	NCCMA	Native Vegetation Plan
BD4	Encourage responsible pet ownership by landholders in urban fringe and rural living areas to reduce predation on native fauna.	NCCMA, DSE, Local government	
BD5	Undertake integrated fox control programs in priority areas to reduce predation on native fauna	DPI	
<p>Biodiversity Package 2: Protecting and enhancing significant native vegetation communities.</p> <p>This package is concerned with delivery of key actions under the North Central Native Vegetation Plan and relevant Bioregional Plans. In addition, it is supported by activities under the Dryland Salinity Management Plan, the River Health Strategy and the Loddon-Murray Land and Water Management Strategy. The package emphasises the priorities of the Native Vegetation Plan, in that its primary focus is on identification and protective management of significant patches of remnant native vegetation. It addresses this objective through investigations, planning and priority setting, engagement with local government and land managers, by building land manager capacity to protect remnant vegetation and onground works.</p> <p>This package directly addresses RCTs BD1 to 4.</p>			
BD6	Identify areas supporting high conservation significance native vegetation that is threatened by sub-division and peri-urban development, fragmentation and tree decline, salinity and other processes. Develop and Implement Biodiversity Action Plans for these areas by 2006.	NCCMA, DPI/DSE, Local government	Native Vegetation Plan, Bioregional Plans, Loddon-Murray LWMS, Dryland SMP, River Health Strategy, Municipal Planning Schemes
BD7	Develop vegetation and environmental protection overlays (VPO/EPO) for priority threatened species and communities in all local government areas by 2006. Negotiate with local government to ensure planning schemes are amended by 2006 to protect high conservation value native vegetation. Ensure that an outcome of all future development activities (from 2003) is a net gain in remnant vegetation coverage.	NCCMA, Local government	Native Vegetation Plan, Bioregional Plans, Municipal Planning Schemes
BD8	Provide financial support to landholders wishing to protect and enhance remnant vegetation. Run annual Bush Tender auction process in biodiversity priority areas.	NCCMA, DSE	Native Vegetation Plan, Bioregional Plans
BD9	Promote the adoption of recommended management practice for remnant vegetation. Ensure that all remnant vegetation of endangered, rare or vulnerable EVCs and all populations of endangered, vulnerable or threatened native and fauna species are managed according to recommended practice by 2010.	NCCMA, DPI/DSE	Native Vegetation Plan, Bioregional Plans
BD10	Establish Public Authority Management Agreements (or similar environmental management arrangements) to ensure appropriate management of important sites of remnant vegetation on smaller blocks of public land (e.g. cemeteries and rail reserves) and public land managed by rural and urban water authorities.	NCCMA, DSE, Water Authorities	Native Vegetation Plan, Bioregional Plans,

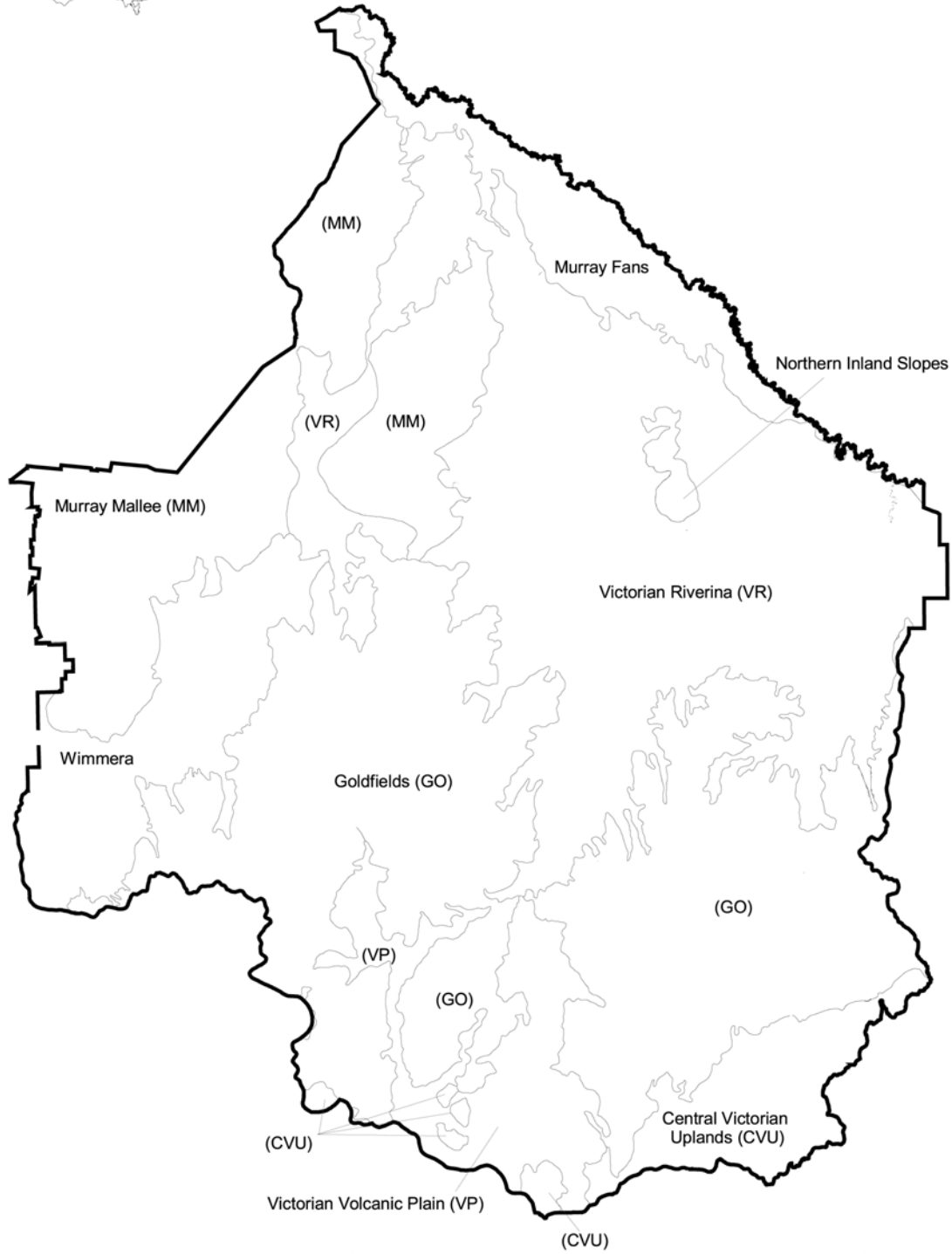
2 Biodiversity

Table 6: Management actions and targets for biodiversity (cont.)

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
BD11	Identify ecologically significant roadsides. Develop and implement roadside management plans for all local government areas by 2008.	NCCMA, Local government	Native Vegetation Plan, Bioregional Plans, Municipal Planning Schemes
BD12	Undertake assessments of threats to biodiversity from all existing and new programs and major projects under RCS, using Victorian biodiversity risk mitigation protocols, from 2003.	NCCMA, DSE/DPI	Native Vegetation Plan, Bioregional Plans
<p>Biodiversity Package 3: Ecological burning for remnant native vegetation.</p> <p>This package addresses the need to provide significant native vegetation remnants (particularly those on private land) with appropriate ecological fire regimes to ensure that ecosystem processes are sustained. This involves investigation, trialing and, ultimately, implementation of such fire regimes. The objectives of the package are supported by Public Land package 2.</p> <p>The package will contribute to the achievement of RCTs BD2 and 3.</p>			
BD13	Develop and implement appropriate fire management regimes to sustain ecological processes in key private land native vegetation remnants by 2008.	DSE/DPI, NCCMA	
Additional action			
BD14	Develop and implement region vegetation extent and condition monitoring program for remnant vegetation patches on private land by 2004. Review resource condition targets for biodiversity based on initial assessment by 2005.	NCCMA, DPI	Native Vegetation Plan, Biodiversity Monitoring Framework
Additional biodiversity priority issues dealt with by management actions listed under other assets include:			
Impacts of dryland and irrigation salinity on biodiversity assets (Dryland; Irrigated Land)		Impacts of water quality on aquatic biodiversity (Waterways and Wetlands)	
Impacts of changed water regime on biodiversity assets and their habitat, cultural heritage and recreational values (Waterways and Wetlands; Water Resources)		Influence of inappropriate recreation on cultural heritage values of biodiversity assets (Waterways and Wetlands)	

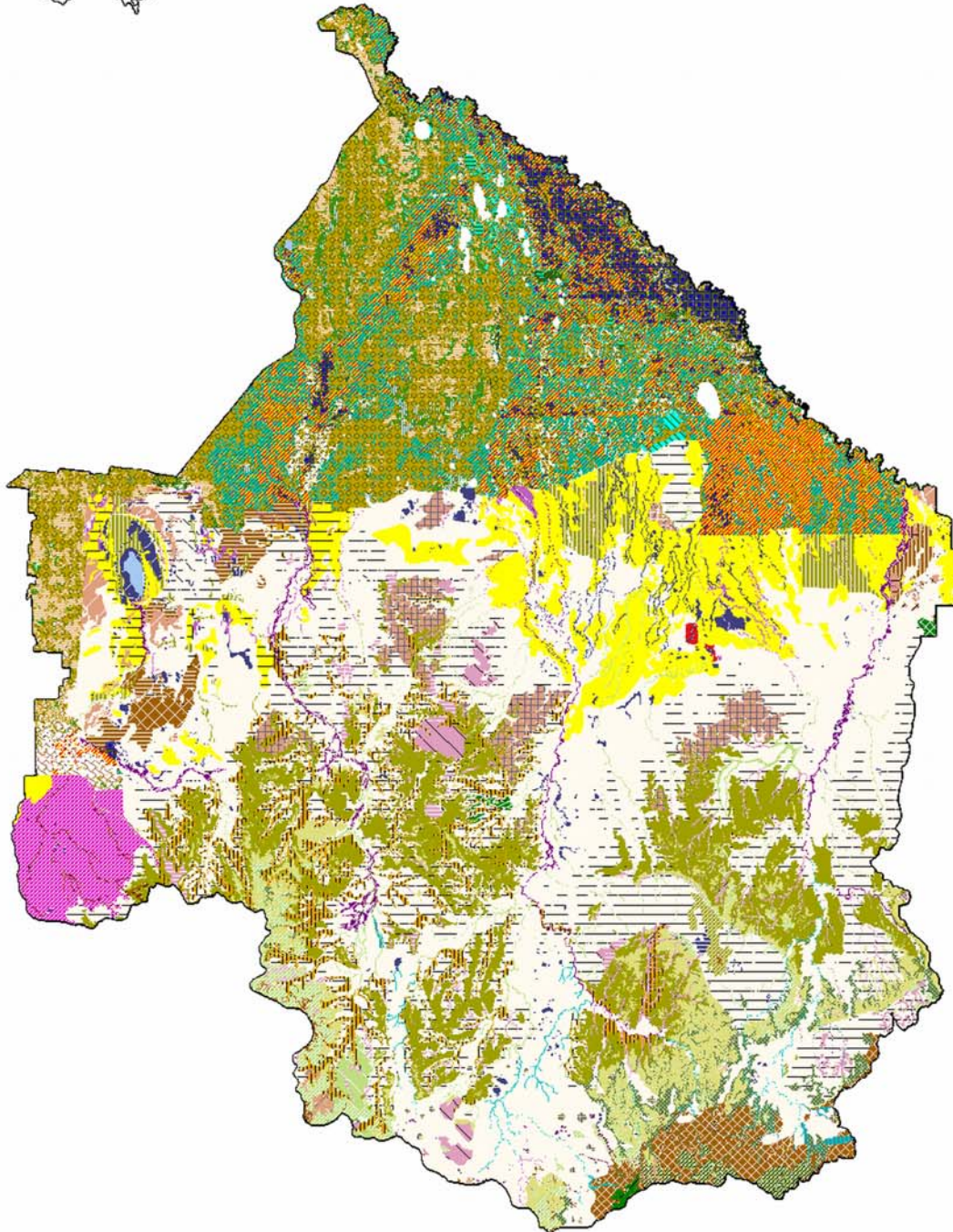
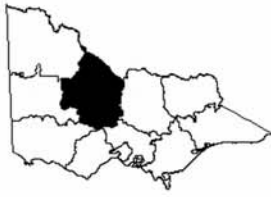
NORTH CENTRAL REGION

Bioregions



NORTH CENTRAL REGION

Pre 1750 Ecological Vegetation Classes



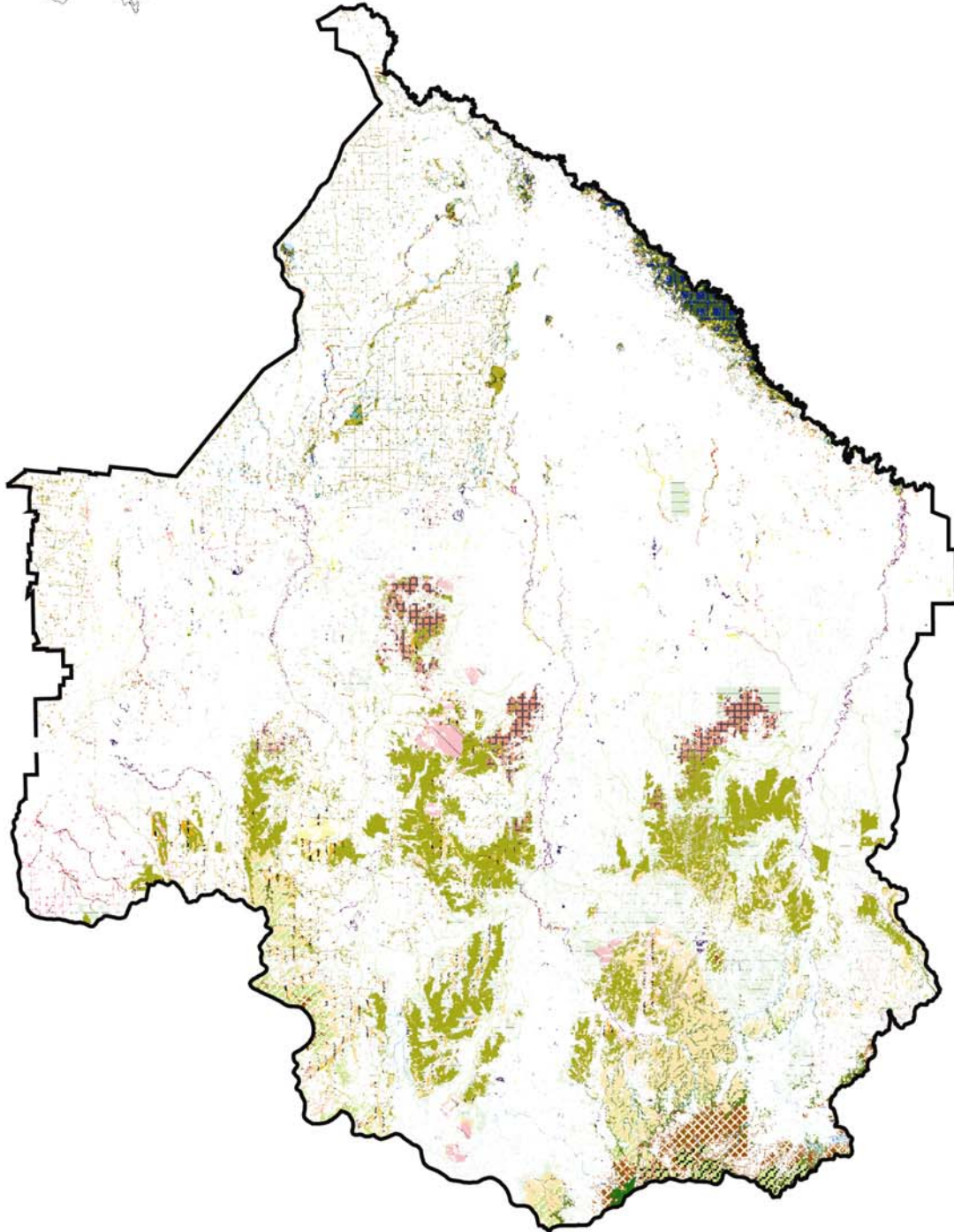
See North Central Catchment Condition Report for full EVC legend



NORTH CENTRAL REGION



Current Ecological Vegetation Classes



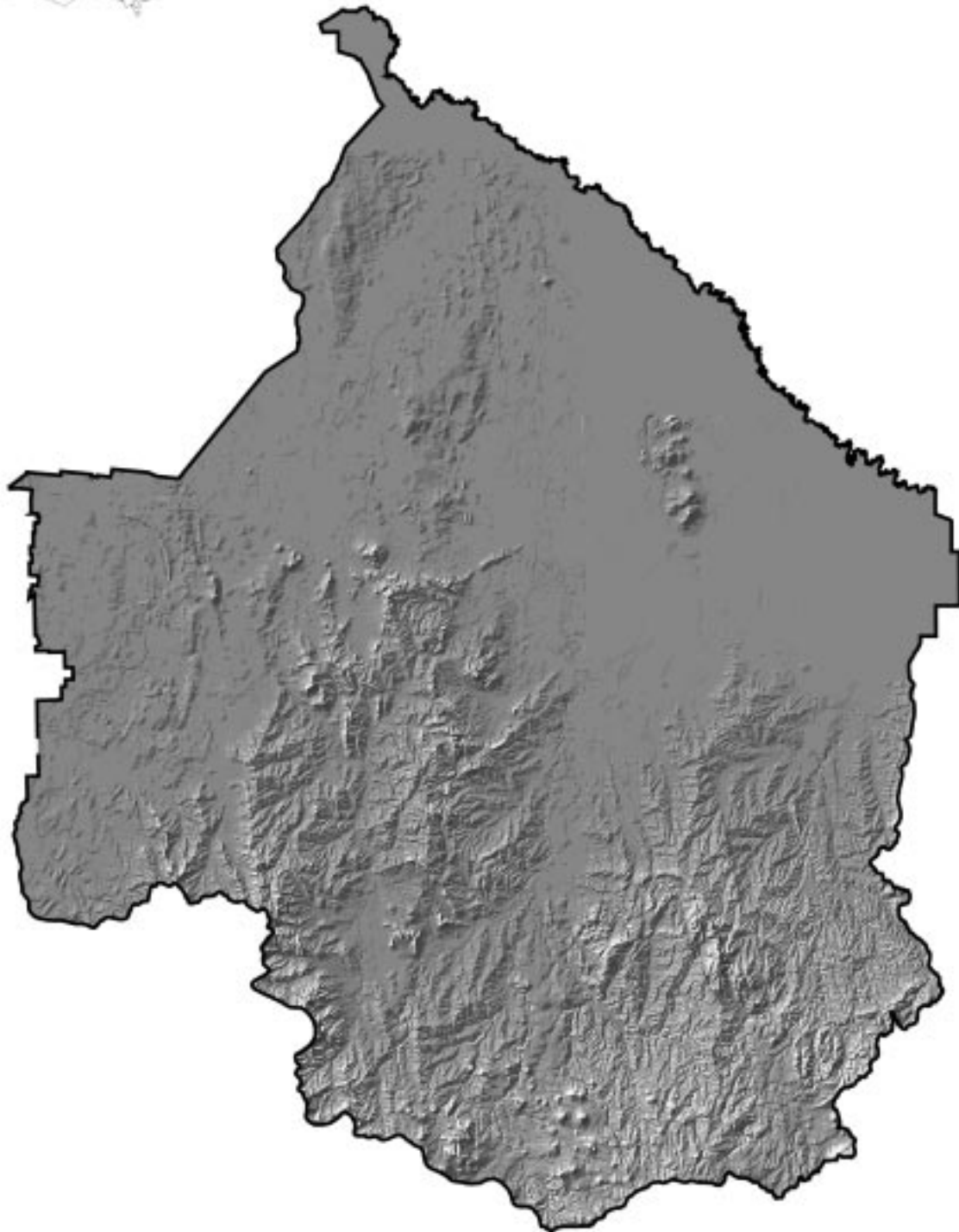
See North Central Catchment Condition Report for full EVC legend



NORTH CENTRAL REGION



Topography



3 Climate

A tank awaiting rain amongst a triticale crop.



Photo: Nicole Howie

3.1 Goal

The North Central region will have zero net greenhouse emissions. It will introduce management practices that improve the resilience of natural ecosystems and agricultural and other land uses in the face of climate change.

3.2 Resource condition targets

This chapter outlines some of the management actions that are needed to achieve the goal for climate. Tangible outcomes that can be expressed in terms of resource condition targets are difficult to derive for actions relating to more resilient land management systems. The resource condition target listed below relates only to reducing the region's contributions to greenhouse gas emissions, which are the key drivers for climate change. Management actions under other assets will also help to achieve the resource condition target for climate.

The resource condition target for climate is given in Table 7 below.

3.3 The threat of climate change

The region's climate is fundamental to its character. It is a key factor influencing the nature and distribution of the region's native flora and fauna, its water regimes, farming systems and even settlement patterns.

The purpose of this chapter is not to describe the region's climate, as has been the case for other assets. Rather, this chapter describes the threat that climate change poses to the region and the emerging regional response to this issue.

The Third Assessment Report of the International Panel on Climate Change (2001) confirms that the earth is warming in response to the release of greenhouse gases. By 2100, the average global temperature is forecast to increase by 1.4° to 5.8°C. In addition, the change in climate brought about by global warming will include increased variation in the weather. Extreme temperature events, for example, are likely to become more frequent.

In the North Central region, wetter conditions are expected in summer and drier conditions in winter and spring. Temperatures are expected to be from 0.5° to 2.2°C warmer by 2050 with extreme daily temperatures and rainfall events increasing in intensity and frequency. These changes are expected to have a major impact on ecosystems, affect the pattern of agriculture and reduce water supplies⁴.

Protection of the climate may seem a daunting task given the global scale of the problem – however, human populations everywhere should take responsibility for their impact on the climate.

In the North Central region, the NCCMA and DPI have initiated a response to climate change by sequestering carbon through revegetation and changing land use. This has been documented in an action plan⁴.

Carbon sinks, such as new plantations and revegetated areas offer potential returns from the sale of carbon credits or the rights to sequestered carbon.

Table 7: Resource condition target for climate

#	Resource condition target	Year to be achieved
RCT CL5	By 2010, the North Central region will reduce net greenhouse gas emissions by 30%, compared with 1999 levels.	2010

3 Climate

This mechanism is seen as a key tool for funding land use change and revegetation that will not only establish carbon sinks but also complement the aims of a range of other natural resource management plans.

The Climate Change Action Plan is an innovative approach that seeks to:

- ◆ raise awareness of climate change and its implications
- ◆ promote the role of native vegetation carbon sinks
- ◆ use carbon sequestration as a means of integrating the outcomes and resources of native vegetation programs
- ◆ support landholders to adopt and manage native vegetation carbon sinks
- ◆ facilitate investment in carbon sinks revegetation projects
- ◆ develop partnerships to increase regional carbon sinks capacity.

One partner in the action plan is the Central Victorian Greenhouse Alliance which coordinates a broad community response to climate change, including renewable power generation, energy conservation, clean fuels, modified farming practices and

revegetation. Its membership is drawn from ten local governments, La Trobe University, Bendigo and several other regional organisations.

3.4 Priority issues and management response

Priority issues for climate have not been defined by the same risk assessment process that was used for other natural resource assets. Indeed, the risk assessment process for those other assets did not highlight climate change as a priority issue, based on the long time frame and uncertain nature of impact. Nonetheless, it is a significant issue that does require an immediate response.

There are two priority issues for climate – improving the resilience of natural systems and land uses to climate change, and reducing the regional contributions to greenhouse gas emissions. Responses to these issues are given in Table 8. They represent progress towards the goal for climate. Only those actions which are specifically directed at the two key climate issues are given here. Other actions (e.g. under Native Vegetation, Dryland Salinity and Farm Forestry Action Plans) also contribute to achieving the climate RCT and sustainability goal.

Table 8: Management actions and targets for climate

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
Climate Package 1: Climate change response			
This package proposes actions that respond to the challenge of climate change by helping the North Central region to take responsibility for net greenhouse gas emissions, by developing an improved understanding of the impacts of climate change and thereby enabling actions that improve the resilience of natural systems and primary industry in the face of climate change. In part the package is based on implementation of the Regional Response to Climate Change Action Plan.			
This package addresses the resource condition target for climate, RCT CL5. The package also indirectly addresses RCT BD2 and BD3.			
CL1	Finalise the Regional Response to Climate Change Action Plan by 2004 and implement key actions by 2008.	NCCMA	Climate Change Action Plan
CL2	Develop understanding of implications of climate change scenarios for management of dryland and irrigated land and associated assets and services by 2008.	DPI	
CL3	Develop farming systems and management practices that increase resilience in the face of climate variability and climate change by 2008.	DPI	
CL4	Conduct a second comprehensive greenhouse gas emissions audit for the North Central region during 2005.	NCCMA	Climate Change Action Plan
CL5	Develop greenhouse gas emissions audit tool for use by individual landholders/primary producers.	NCCMA	
CL6	Assess the implications for climate change scenarios for flooding, water way management and riparian and wetland health and develop management response by 2008.	NCCMA, DSE	
CL7	Coordinate community participation in climate change activities to increase regional awareness of climate change.	NCCMA, Local government, CVGA stakeholders	Climate Change Action Plan, Municipal Greenhouse Action Plans
Note: Management actions from other packages (BD7, 8; DL1,3; WW1,2) will also help to achieve the RCT CL5.			

4 Community

Landcare tour participants overlook the headwaters of Axe Creek.



Photo: Claire Clapton, NCCMA

4.1 Goal

An informed and engaged community, managing natural resources sustainably.

4.2 Resource condition targets

This chapter outlines some of the actions needed to achieve the goal for community. For natural assets, the asset goal and these actions were used as a basis for setting resource condition targets. While setting resource condition targets per se is not appropriate for community, it is essential that targets are set so that progress towards the goal can be measured. These community engagement targets are given in Table 9. Achieving the targets is based on the actions outlined in this chapter (see Table 10) and in relevant actions proposed for other assets.

4.3 The community and natural resource management

The community includes everyone who lives and works in the North Central region, those who visit and those with some other connection to it. The community is responsible for managing the natural resources of the North Central region sustainably.

The future health of the environment is highly dependent on the people of the region – including

people who farm, those who live in towns, those who work in agribusiness or public sector natural resource agencies, school children, local government, members of the region's Indigenous community and Landcare volunteers.

Changing the way natural resources are managed requires leadership, knowledge, participation, resource wealth, grassroots action and accountability. Therefore, the North Central region needs people to be skilled, motivated and well-resourced. The region needs strong and effective networks and partnerships to effectively engage the community in decision-making and the development and implementation of responses to their natural resource management issues.

Investing in people – building their capacity – should seek to strengthen a community's ability to commit, resource and problem solve. This applies across the community – to individual landholders, the NCCMA and government agency personnel, local government, etc.

Table 9: Community engagement targets

#	Community Engagement Target (CET)	Year to be achieved
CET1	A community that is actively engaged in natural resource management processes and equipped to implement landscape change.	2012
CET2	A comprehensive network of self-directed Landcare and other community groups participating in natural resource management in rural, peri-urban and urban areas.	
CET3	Active participation by members of the Indigenous community in natural resource management processes and having Indigenous values, perspectives and approaches incorporated into implementation programs.	
CET4	High calibre natural resource professionals within both public and private sector organisations.	
CET5	Clear understanding of natural resource management roles and responsibilities of regional stakeholders and improved partnerships in project planning, resourcing and delivery.	

4 Community

As everyone has a role to play, investment in people is as important as investment in technical solutions. Increasingly, natural resource plans in the region reflect this need to build the capacity of the community to manage natural resources in a more sustainable manner.

The effective management of natural resources involves creating and managing effective working partnerships within and between the various levels of government, communities and community groups, Indigenous communities and private landholders. Only through effective collaboration will outcomes be achieved.

A core role of the NCCMA is the coordination and promotion of sustainable natural resource management. It must capture the imagination of the community and harness their energy. This can be achieved through creating and maintaining effective, flexible and responsive regional partnerships and structures. Foremost among these is the partnership that the NCCMA has sought to establish with the regional community. The NCCMA has also built successful partnerships with government agencies (e.g. DSE, DPI, EPA Victoria), urban and rural water authorities (Goulburn-Murray Water, Wimmera-Mallee Water, Grampians Water, Coliban Water, Central Highlands Water, Lower Murray Water) and local government.

The NCCMA has developed a communications strategy to support the implementation of the RCS. The strategy details the approach to be taken to ensure effective stakeholder involvement and communication of the progress and outcomes of the RCS and its supporting action plans. A community engagement strategy will be produced to ensure community engagement and involvement in the decision making associated with particular actions under the RCS.

Several of the key regional partnerships for natural resource management are described below. Discussion also considers how they will be developed under this RCS so that they help to achieve the desired natural resource outcomes for the region.

Landcare and other community partnerships

Landcare has evolved to become the largest community-based movement for natural resource management in Victoria. There are over 170 Landcare and other community groups involved in natural resource management in the North Central region alone (see Appendix 3).

The broad 'landcare' movement, including Landcare and other non-government organisations (e.g. Greening Australia, Conservation Volunteers Australia, VRFish, Birds Australia, etc.) has raised conservation awareness in rural and urban areas. The majority of onground action is undertaken in conjunction with Landcare and related groups. These groups represent a significant source of social capacity for addressing natural resource management and integrating environmental conservation into agricultural production. These groups are a vital component in engaging communities and require considerable and effective support. The regional Landcare Support team is important in supporting groups.

The RCS identifies natural resource management priorities to which Landcare and other groups can make a valuable contribution. Building on existing networks and their successes through ongoing support is a core component of the strategy. The draft North Central Landcare Support Plan promotes the need for groups to have access to high quality support so that natural resource management and group learning activities are more effective. The range of support required by land managers addressing environmental degradation includes improved cooperation of agencies, access to labour and technical support.

Indigenous communities

Indigenous communities have an important role in regional land management. Aboriginal communities control parcels of land of high environmental, historical and cultural value. There are thousands of sites and places of Aboriginal heritage in the region, and catchment restoration and protection works have the potential to impact heavily on these. Therefore, it is important that appropriate consultation be undertaken and partnerships formed with the appropriate Aboriginal land management groups. There is an urgent need to increase the capacity of Aboriginal groups to be directly involved in natural resource management and for landholders and land

4 Community

managers to understand their legislative responsibility to protect sites of significance through forming partnerships.

The NCCMA, Yorta Yorta Nation and North West Nations jointly developed a set of protocols to facilitate participation of Indigenous nations in natural resource management activities. The philosophy behind this development was derived from the Landcare aspiration of community participation in land and water management. In order to achieve sustainable resource management, it is recognised that remedial and protection programs must involve all land managers in decision-making and implementation. The outcome of this unique approach is the 'Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management', 2002.

The agreement is a major step in ensuring that Indigenous interests are recognised and represented in natural resource management in the region. The agreement paves the way for the establishment of culturally relevant processes to strengthen involvement of the North West Nations and Yorta Yorta Nation in developing land and water management policies, strategies and programs for action at local levels, and in implementing appropriate programs as well as local events and celebrations.

Local government

Local government has a significant and broad role in catchment management in a number of areas. Councils administering planning schemes, regulate and monitor development, manage rural roadsides and the vegetation they support, supporting Landcare, construct and regulate stormwater drainage, manage land, oversee heritage protection and participate in a range of other natural resource management activities.

A recent Municipal Association of Victoria study⁵ investigated how to improve the integration between regional catchment strategies and planning schemes. The study identified that closer links need to be developed between CMAs, other regional natural resource management stakeholders and municipalities. It indicated that the RCS and planning schemes need closer alignment and that CMAs should be the primary source of information for municipalities about natural resource management issues, e.g. identification of remnant vegetation areas. The establishment of a Local Government Coordinator at the NCCMA will be important in

assisting Councils in the North Central region to effectively deal with natural resource issues.

By providing information and support, the NCCMA can help harness resources for improved natural resource outcomes. There are opportunities for sharing of information, e.g. databases and map sets on assets, values and condition to support development of Municipal Strategic Statements, local policies and overlays of local government.

The Local Government Coordinator position has been established at the NCCMA through the Natural Heritage Trust. This role will seek to improve integration of catchment management and land use planning.

A local government steering committee has been established to oversee the project, including a coordination process between the respective reviews of council Municipal Strategic Statements and the RCS. The committee comprises representatives of NCCMA, local government, DSE, and DPI. Local government is also informed through the Loddon Campaspe Mayors and CEOs Forum. Water authorities are another important stakeholder that need to be able to contribute to improved alignment of the RCS and planning schemes.

There is an opportunity in the review of Municipal Strategic Statements to ensure that appropriate planning controls are included to protect valuable or sensitive natural assets, such as water supply catchments, wetlands, drainage lines, river frontages and high value agricultural land.

Industry

Targeting partnership formation with major companies and industry groups may make a big difference to natural resource outcomes. Major companies and industry groups have direct and indirect powers and influences over the styles of land management and production processes adopted by producers. Industry can identify and create a number of financial inducements to reward environmental best practice. People in the North Central region are increasingly recognising the need to minimise environmental risk and the market advantages of being perceived as 'clean and green' producers. Consequently, suppliers and producers support more sustainable practices and whole-farm environmental management plans. Support and information about what constitutes best environmental practice and the requirements of an auditable environmental management system is required. This issue has been

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addressed via management actions in the irrigated and dryland chapters.

Educational organisations

Strengthening partnerships between natural resource managers and educational organisations is vital to achieving strategy targets. Programs such as Waterwatch and Junior Landcare have targeted primary and secondary schools. The success of these programs in influencing 'land managers of the future' highlights the need for ongoing partnership development and program delivery in schools and centres for higher learning. There are opportunities for building closer relationships with training providers to address training needs of primary producers and related industry.



Photo: NCCMA

Sweep sampling for macroinvertebrates.

Loddon Murray Community Leadership Program

The Loddon Murray Community Leadership Program operates under the auspices of the NCCMA. It seeks to develop community leaders and through them build the capacity of rural communities to address local issues and respond positively to change.



Photo: Julie Slater

Loddon Murray Community Leadership Program participants (2003) meet with Governor John Landy and Mrs Landy at Government House.

Other partnerships

There is an opportunity to work and establish partnerships with people and agencies not normally associated with natural resource management, but who can contribute human and social capacity building knowledge that adds value to existing approaches. These groups include rural counsellors, Department of Victorian Communities, Volunteering Victoria and the Department of Family and Community Services.

4.4 Priority issues and management response

A series of responses to the priority issues for community have been developed (Table 10). Some pull together community participation and capacity building themes from action plans under the RCS and others address key gaps in the current response. Many of the issues addressed operate across management responses for each of the natural resource assets.

The actions in Table 10 are grouped by implementation 'packages'. These packages are complementary actions that address the priority issues for community. Community engagement targets are linked with each package.

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Table 10: Management actions and targets for community

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Community Package 1: Integration between RCS and land use planning.</p> <p>This package focuses on achieving greater integration between the RCS, its supporting action plans and land use planning. It also seeks to build more effective partnerships between local government, the NCCMA and other regional natural resource management stakeholders.</p> <p>It directly addresses CET 7 and 11.</p>			
CO1	Run process to improve integration between NCCMA strategies and local government planning schemes by 2004 and have outcomes incorporated into planning schemes. Implement key outcomes from process to ensure protection and sustainable use of natural resources by 2008.	NCCMA, Local Government	Municipal Strategic Statements, RCS Action Plans
<p>Community Package 2: Community participation and education.</p> <p>This package is concerned with the community being actively engaged in natural resource management planning and processes and equipped to implement landscape change.</p> <p>It directly addresses CET 7 and 8.</p>			
CO2	For all natural resource projects, ensure that the development of community capacity is a component of the project objectives from 2003.	NCCMA, DPI	RCS Action Plans
CO3	Complete the draft Regional Landcare Support Plan by 2003 and implement. Continue to provide coordinators and other support programs for Landcare groups.	NCCMA	Draft Regional Landcare Support Plan
CO4	Implement consultation and decision-making processes that genuinely engage the community and stakeholder organisations from 2003.	NCCMA	RCS Action Plans
CO5	Implement NCCMA communication strategy from 2003	NCCMA	NCCMA Communication Strategy
CO6	Support delivery of Waterwatch and other education programs from 2003.	NCCMA	
<p>Community Package 3: Indigenous participation.</p> <p>This package is concerned with implementation of the Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management.</p> <p>It directly addresses CETs 7, 9 and 11.</p>			
CO7	Implement the Protocols Agreement for Indigenous Involvement in Land and Water Management from 2003	NCCMA	Protocols Agreement for Indigenous Involvement in Land and Water Management
<p>Community Package 4: Natural resource management leadership.</p> <p>This package addresses the need for strong community and agency leadership in natural resource management.</p> <p>It directly addresses CET 7 and 10.</p>			
CO8	Design and implement a professional development program for state and local government, water authority and NCCMA personnel to improve retention rates and capacity by 2007.	NCCMA	
CO9	Continue delivery of the Loddon Murray Community Leadership Program.	NCCMA	
<p>Other actions</p>			
CO10	Develop a business case to facilitate sharing of critical Geographical Information Systems (GIS) across all levels of government (including agencies) to improve natural resource management decision-making by 2005.	NCCMA	

4 Community

Discussing water management at Fish Point Weir near Swan Hill



Photo: Tim Shanahan, GMMW

Loddon Murray Land and Water Strategy

For a premier example of community participation in land and water management planning, look no further than the Loddon Murray region in northern Victoria.

Initiated in 1986, the Barr Creek Salinity Management Plan provided the first real opportunity for the community to participate in decision-making about the future of natural resource management in the area. Since then, the broader regional community has been represented by more than 140 individuals participating formally in preparing and implementing plans for the Tragowel Plains, Kerang-Swan Hill, and Boort West of Loddon areas. (In 1996 the Barr Creek became part of the Torrumbarry East of Loddon Land and Water Management Plan).

The 2003 Loddon Murray Land and Water Management Strategy builds on the success of these four 'first generation' Salinity Management Plans.

A Loddon Murray Forum was established by the NCCMA to bring together the Chairs of the previous plans, the Executive Managers from both Goulburn-Murray Water and the (then) Department of Natural Resources and Environment, and community members representing biodiversity and agricultural production.

The Forum held a series of workshops late in 2001, engaging the active local community in starting to prepare a joint regional strategy to take the four plans forward in an integrated way.

A Loddon Murray project team facilitated the involvement of 93 community representatives plus agency staff in nine issues-based task groups. These groups reviewed the previous four land and water management plans and helped set a common direction for the future.

More than 1,200 hours of community input produced issues papers, which were combined by the Loddon Murray Forum into five themes:

- ◆ Biodiversity enhancement
- ◆ Land management
- ◆ Planning and development
- ◆ Social capacity
- ◆ Water management

These themes provided the framework for the new Strategy.

The Forum's vision is for: 'a diverse, proud and resourceful Loddon Murray community achieving social, environmental and economic well-being firmly grounded in sustainable resource management.'

In October 2002, the new Strategy was released for public comment during a community celebration involving 300 people at the base of Pyramid Hill – the same landmark where Major Mitchell set his own vision for the surrounding plains in 1836.

Community comment received during the consultation period has been incorporated into the final Strategy – adopted by the NCCMA as an action plan under this RCS.

During the development of the Strategy, all task groups recognised the need to engage a wider cross-section of the community, particularly the urban residents, to achieve the full benefits of implementation. Plans are now being developed to build the capacity of the community and encourage people in urban areas to engage in the decision-making about the region's future.

CASE STUDY

5 Cultural heritage

Historical ruins at Clunes remind us of our rich cultural heritage.



Photo: Geoff Park, NCCMA

5.1 Goal

Indigenous and non-Indigenous cultural heritage is valued by the community and is protected and maintained.

5.2 Resource condition targets

Targets will be set for cultural heritage during the first year of the RCS implementation. They will be based on actions reported under this asset class and those for other assets. Some preliminary areas in which targets may be set are indicated below (Table 11).

5.3 Cultural heritage

The North Central region includes very important sites and places of Indigenous and non-Indigenous cultural heritage. They maintain spiritual, physical and emotional links to the region's history and environment.

Indigenous cultural heritage sites and landscapes

The Indigenous people of the North Central region have occupied its landscapes for millennia and continue to have a strong affinity with it. There is an abundance of physical evidence of the activities of Indigenous people, including shell middens, scatters of stone artefacts, oven mounds, scarred trees, shelters, places of burial, axe-grinding grooves, and flaked stone tools. Within the North Central region, there are 3188 registered sites of Aboriginal cultural significance register by Aboriginal Affairs Victoria. However, it is highly likely that additional places exist

within the region but have not been located or registered. Numerous Indigenous cultural landscapes have also been identified. Of these, 15 places have been listed on the Register of the National Estate².



Photo: Angela Gladman, NCCMA (reproduced with permission from the Jaara Jaara Corporation).

A scarred tree, a culturally significant site within Terrick Terrick National Park

Table 11: Preliminary resource condition targets for cultural heritage

#	Area for resource condition target
RCT6	The number of listed cultural heritage sites under protective management.
RCT7	The number of Indigenous and non-Indigenous communities/people (as appropriate for the asset/site) involved in management of cultural heritage.
RCT8	The number of heritage sites threatened by or protected from impacts of salinity and/or shallow water tables.

5 Cultural heritage

These areas or landscapes also hold importance for Aboriginal people due to the traditional activities undertaken at these areas. Such activities included hunting, gathering of bush foods, preparation of bush medicines, use of fire in managing the environment, construction of tools, boats, shelters and production of other artefacts used in ceremonies and rituals. Other heritage sites and areas include places of ceremonial and spiritual significance, traditional plant, animal and mineral resources, trade and travel routes. Burial sites in the Kow Swamp area are reported to date from 12,000 to 15,000 BC.

The waterways and wetlands of the region provided a ready supply of water, fish and other fauna. Aboriginal camps tended to be in close proximity to water and so there is a high concentration of Aboriginal artefacts along watercourses, billabongs, wetlands, floodplains, levees, swamps and lunettes. As the locations of watercourses and wetlands have changed over time, these sites may not now be closely associated with waterways.

Poor documentation of the locations of Indigenous cultural heritage sites and a lack of understanding of their significance to the Aboriginal people have meant that many such sites have been damaged or destroyed by agricultural activities and infrastructure development.

Aboriginal cultural heritage sites and areas are protected by legislation. However, there continues to be concern over the adequacy of legislation and local planning processes in identifying and protecting significant sites and areas. For example, sites may be damaged or destroyed in undertaking deep ripping for a revegetation project if heritage sites are not identified at the project planning and approval stage.

It should also be noted that, as Indigenous heritage sites and places are at the core of Indigenous people's physical, spiritual and cultural existence and identity, they must be consulted regarding their identification, protection and enhancement.

Connection and belonging to places, landscapes and community

For Aboriginal people it may be difficult to separate the social and environmental services provided by cultural heritage sites as the people, their environment and their cultural beliefs are strongly interlinked. According to Aboriginal Dreaming, Aboriginal people were descended from the land at the time the earth was created. The people, therefore,

are a natural part of the environment from which they are born. This creates a sense of belonging, attachment, custodianship and responsibility for the maintenance of the natural environment.

This sense of belonging to significant places and landscapes is important for much of the community throughout the North Central region.

European cultural heritage sites and landscapes

Sites of European cultural heritage significance are well documented within the North Central region. The Victorian Heritage Inventory, which lists all known historic archaeological sites and relics, has 2023 records for the regionⁱ. These sites and relics include cemeteries, mine sites, diggings, workings and mullock heaps. In addition, 758 places of significant heritage value have been placed on the Register of the National Estateⁱⁱ (for further information, see North Central Catchment Condition Report, NCCMA 2003). The Victorian Heritage Register lists 373 archaeological sites of state significance. These include sites such as botanic gardens, bridges, cemeteries, buildings, gold mines, water supplies and railway stations.

Non-Indigenous cultural landscapes within the region include old stock routes and expedition trails of early explorers.



An historic photo of Enders Bridge, Coliban River.

Research and education resources

Historic sites provide a resource for research and education on human history and interaction with the environment. It allows an assessment of how past management practices have impacted on the environment and may help to develop improved management options.

ⁱ Heritage Victoria, *Victorian Heritage Register and Heritage Inventory Online* (as viewed 11 February 2003) at <http://www.doi.vic.gov.au/doi/hvolr.nsf>

ⁱⁱ Australian Heritage Commission, *Register of the National Estate* (as viewed 14 April 2003) at <http://www.ahc.gov.au/register/easydatabase/database.html>

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Community enrichment

There is a social value in understanding the background history, beliefs and cultures of other members of society. Historic sites and areas provide a rich resource for use in education, which aids in nurturing mutual understanding and respect of the diversity of cultural heritage within the community.



Historical images of salt harvesting in the Kerang Lakes area.

Profound changes to the landscape occurred at the time of European settlement. Land clearing and occupation by the settlers, particularly along watercourses, displaced the Aboriginal people from their traditional land and deprived them of access to many of their most abundant food and water sources. An understanding of these historic relationships between Indigenous groups and colonists form an important base for cross-cultural education programs.

Tourism and recreation

The tourism industry in the North Central region is substantially based on a regional heritage theme and provides a recreational amenity, employment in the tourism industry and tourism revenue.

5.4 Threatening processes

The major threatening processes and their impact on cultural heritage are described in this section.

Inadequate engagement of Indigenous groups

The recognition that greater involvement of Indigenous groups is required in land and water management is encapsulated in the Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management⁶. Implementing this agreement will foster open communication between Indigenous groups and natural resource agencies.

In maintaining Indigenous cultural heritage, it is vital that opportunities for Indigenous groups to rebuild their connections with the land are enhanced.

Damage to unregistered and registered sites

Much of the past damage to heritage sites and places stems from a lack of awareness of the locations of sites and of their significance. This is particularly true for Indigenous sites. These issues can be addressed through building strong partnerships between Indigenous communities and natural resource management agencies, and being involved in program planning and implementation. Education of all stakeholders in natural resource management on Indigenous culture and its significance is a priority.

In order to prevent further loss of undocumented Indigenous sites, processes need to be developed by Indigenous groups to capture and store information relating to sites and landscapes of significance.

Landholders may be deterred from registering potentially significant sites, fearing restrictions on agricultural practices and future development opportunities. This may be addressed through awareness programs and consideration of financial incentives for identification, protection and management of registered sites.

Urban development and intensification of agriculture, especially in areas close to watercourses and previously uncultivated areas, pose a major threat to Aboriginal heritage sites. It is vital that adequate protection is provided for these sites prior to the approval of projects in these areas. Growth in agriculture, irrigation infrastructure and water-based tourism and recreation potentially continue to threaten the region's cultural heritage.

Local government planning and the heritage register provide the mechanisms for retaining heritage sites of value.

5 Cultural heritage

Inappropriate access and recreation

Inappropriate access and recreation has the potential to cause damage to heritage sites. Planning and management of these sites should aim to minimise any potential impacts.

Altered flow regimes

The manipulation of flow regimes can expose Aboriginal burial sites in lake beds and water bodies during periods of drought or low flow. The exposure of Aboriginal ancestral remains causes distress to some Indigenous people.

Salinity and heritage sites

Several significant cultural heritage sites within the region are located in areas threatened by rising water tables. Based on water table depths in 2000, approximately 186 Victorian Heritage Register sites and 150 Victorian Heritage Inventory sites are at high risk of salinity with a water table depth within two metres of the natural surface. The predicted salinity

risks to heritage sites are presently unquantified. Research into salinity impacts on heritage listed sites is warranted.

5.5 Priority issues and management response

Several actions are proposed to address the threats faced by sites and places of cultural heritage (see Table 12). Some reflect actions recommended under regional natural resource management planning frameworks, while others are an attempt to fill perceived gaps in that framework. No specific link is drawn to resource condition targets, since none have been developed yet for cultural heritage.

Table 12: Management actions and targets for cultural heritage

#	Management action and targets	Key implementation agency(s)	Referring Plan(s)
Cultural Heritage Package 1: Protection of cultural heritage values.			
This package seeks to build on recent developments in the North Central region to strengthen engagement of Indigenous people in natural resource management, as well as increasing cultural heritage awareness and management strategies. This package also addresses community engagement target 3.			
CH1	Strengthen engagement of Indigenous groups in natural resource management decision making processes by implementing the 'Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management' between the NCCMA, North West Nations Clans Aboriginal Corporation and the Yorta Yorta Nation Aboriginal Corporation from 2003.	NCCMA, North West Nations Clans Aboriginal Corporation, Yorta Yorta Nation Aboriginal Corporation	Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management Agreement
CH2	Ensure there is consideration of altered flow regimes causing exposure of Indigenous burial sites in lakes or wetlands when deciding water regimes or environmental allocations from 2004.	NCCMA	
CH3	Increase awareness of the significance of heritage sites in recreational areas and develop strategies to minimise disturbance by 2005.	Parks Victoria, NCCMA	
CH4	Assess hazard faced by Indigenous and non-Indigenous heritage sites from salinity by 2005.	DPI, NCCMA	Dryland SMP, Loddon Murray LWMS
CH5	Establish management agreements for all significant cultural heritage sites in areas where on-ground works under the RCS area to be undertaken. Agreements to be between NCCMA, landholders, heritage authorities and, for Indigenous sites, traditional owners.	NCCMA	

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Figure 4: Regional cultural heritage program of the North Central region.

6 Dryland

A typical dryland landscape at the headwaters of Myrtle Creek.

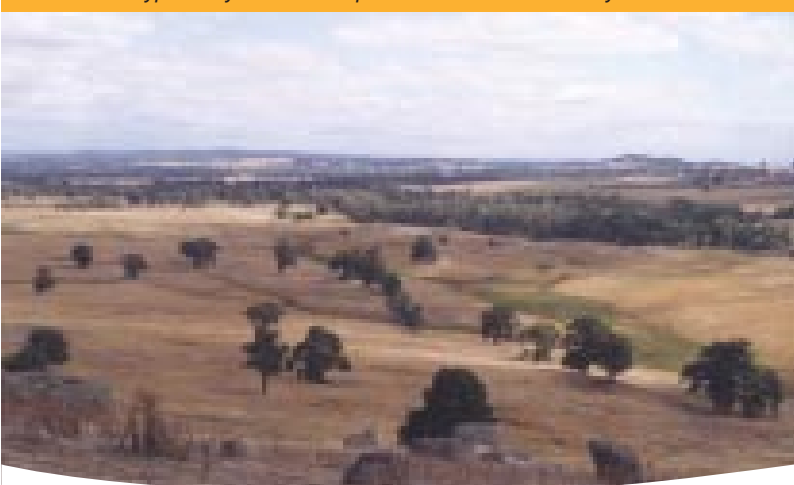


Photo: Geoff Park, NCCMA

6.1 Goal

The use and management of the land resource for agriculture, rural living and other purposes will be consistent with its capability, will be undertaken in an ecologically sustainable manner and provide economic and social benefits.

6.2 Resource condition targets

This chapter outlines some of the management actions that are needed to achieve the goal for dryland. Resource condition targets (table 13) have been developed to indicate the expected outcomes from implementing those actions over the next 10 – 20 years. In this sense, they reflect how the ‘condition’ of dryland might change over that period. The targets

listed below are those that relate directly to dryland. The management actions described in this chapter will also influence the condition of other assets, particularly biodiversity, waterways and wetlands and water resources. Related resource condition targets for those assets are indicated in Table 14.

Table 13: Resource condition targets for drylandⁱⁱⁱ

#	Resource condition target	Year to be achieved
RCT DL9	No net increase in the area of land with water table depths < 4 m and with rising trend in the upper Bet Bet, Bulabul, Carapooee, Redbank, Pental Hills and Reedy and Paradise dryland salinity targeted project areas.	2012
RCT DL10	Increase the area of land with water table >4 m depth by 50% in the Avon-Upper Richardson, Glenloth and Natte Yallock dryland salinity targeted project areas.	2012
RCT DL11	Greater than 90% currently salt-affected agricultural land within the dryland salinity targeted project areas in the Loddon, Avoca and Avon-Richardson catchments will be stabilised with vegetation and either restored to agricultural production or revegetated with native salt tolerant species.	2012
RCT DL12	Reduce salt load export from dryland salinity targeted project areas ^{iv} : <ul style="list-style-type: none"> ◆ Upper Bet Bet (Loddon R) – by 3000 t/y ◆ Timor West (Loddon R) – by 2000 t/y ◆ Natte Yallock (Avoca R) – by 5000 t/y ◆ Bulabul (Loddon R) – by 3500 t/y. Avoid future salt load export into from the Glenloth project area (Avoca River).	2010 from 2003
RCT DL13	Maintain long-term trend for real increase in the gross value of agricultural production from mid-catchment broadacre farming areas	2012

ⁱⁱⁱ Resource condition targets for soil health will be developed as part of the revised regional Soil Health Plan (Table 14, DL11).

^{iv} Salt load reduction targets only provided for project areas for which there is adequate monitoring and/or process information.

6.3 Dryland: an overview of the asset and the services it provides

Definition

Dryland includes all private land not owned or managed by irrigation farmers and so accounts for almost all privately owned, non-urban land outside the Loddon-Murray, Campaspe and Rochester irrigation areas. It includes rural living zones that are not commercially farmed, but does not include irrigated land in upper and mid catchment areas.

Agriculture

Agriculture is the predominant use of dryland in the North Central region. Almost 90% of agricultural holdings (some 2 million ha) are not irrigated, although under the above definition for dryland, some of this land is irrigated land. The North Central Catchment Condition Report⁷ estimated that there was approximately 1.4 million ha of dryland agricultural land in the region. Dryland includes this area and an unknown area of not commercially farmed rural living zone.

The capital value of dryland is difficult to estimate with any precision. The most recent information for land on which dryland agriculture is practised suggests that capital value is between \$1.7 and 3.2 billion⁸. The current capital value is considered to be substantially greater, with land prices escalating rapidly in the more intensively settled areas in the south of the region and along the Calder Highway corridor. They now bear little relation to the agricultural productivity of the land.

Agriculture is practised across a range of soils and landscape settings. The most productive soils are the rich volcanic ferrosols found in the far south of the region and the vertosols of the floodplains of the Avon-Richardson and Avoca rivers. Soils developed on the Palaeozoic sediments of the hill and rising country of the southern half of the region (tenosols and sodosols) are often poorly productive, acidic and prone to a range of degradation hazards, including salinity, erosion, acidification and fertility decline.

The annual gross value of agricultural production from dryland is estimated to be \$380 million⁷. Almost 60% is derived from cropping, occupies less than 30% of the dryland area. Employment generated from agriculture supports the economies of most of the smaller towns outside the south-east of the region.

Most commercial scale dryland farming operations are located in mid-catchment areas of the Loddon, Avoca and Avon-Richardson catchments. Farm enterprises in upper catchment areas, particularly in the Campaspe, Loddon and Avoca catchments, tend to be of a smaller scale, with farming families more reliant on off farm employment than those in mid-catchment areas.

Other land uses

Landholding in upper catchment areas in the south-east of the region is increasingly characterised by lifestyle rather than commercial objectives. While agriculture may be practised, the scale and intensity of production is often much less than in commercial operations.

In addition to agriculture and rural living, the other main uses of dryland are for plantation forestry and mining. The area occupied by these alternative uses is relatively small.

Remnant vegetation

Dryland landscapes support approximately 240,000 ha of remnant native vegetation, which is only 30,000 ha less than the area found on public land. Around half of remnant vegetation on dryland is of an ecological vegetation class that is endangered or presumed to be endangered. A large number of threatened native plants are located in patches of remnant vegetation on dryland. Remnant vegetation provides habitat for populations of native fauna, including many threatened species. Native vegetation on private land also provides an important connection to the larger but fragmented tracts of public land that are found throughout the dryland area.

Water resources

Much of the water run-off generated and harvested within the catchment is derived from dryland and adjoining areas of public land. Harvesting of surface water resources is concentrated in the upper catchment areas of the Campaspe and Loddon rivers.

While groundwater is the key driver of the region's salinity issues, it is also an important resource. There is quite extensive use of groundwater for irrigation in the upper and middle reaches of the Loddon and Campaspe catchments. The Daylesford region (in the upper Loddon and Campaspe catchments) also has the most concentrated and intensively utilised mineral springs reserves in Victoria. Dryland and adjacent

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public land are the major intake or recharge areas for the region's Groundwater Management and Water Supply Protection Areas.

Cultural heritage

There are numerous sites and places of Indigenous cultural heritage within the dryland area, although there is a greater concentration of more intact sites on public land and associated with waterways and wetlands. Non-Indigenous cultural heritage on dryland is reflected by remnants from the gold mining era and structures associated with agricultural development and settlement. Agriculture and agricultural landscapes themselves also form an important part of the region's cultural heritage.

Landscape

The varied landscapes of dryland areas, particularly in the uplands of the south of the region, are attractive and add to the amenity value of non-agricultural dryland and peri-urban or rural living areas.

6.4 Dryland condition and threatening processes

The condition of dryland and the value of services it provides are threatened by a range of landscape processes and cultural practices. Several of the threatening processes and their impact on dryland condition are described below.

Salinity

Almost 32,000 ha of land have been mapped as being affected by dryland salinity within the North Central region. Around half of this is located in the Avon-Richardson catchment. While the area currently affected by dryland salinity comprises just 1% of the North Central region, over 10% is considered to be at risk of developing shallow water tables and salinity⁹.

Dryland salinity threatens agricultural production across the region. Annual losses in agricultural gross margins could increase threefold if the worst case salinity projections are realised (i.e. with a prolonged period of above average rainfall). It also threatens native vegetation and dependent fauna, particularly in remnants located in mid-catchment areas and in lower landscape positions.

Water tables across much of the region are now at their lowest levels since the mid-1980s. The dry climate sequence that has prevailed since the mid-1990s is largely responsible for this. While the fall in

water table levels has allowed some previously salt affected land to be restored to productive use, this has not generally been the case.

Flooding

A 1-in-100-year^v flood along watercourses in the dryland areas is estimated to cause around \$21.5 million in damage. This would include damage to pastures, crops and fences, stock losses, erosion and the loss of topsoil. Damage in more frequent events would be substantially less. There is some evidence that the frequency of flooding had increased in at least the Avoca catchment in the 1970s and 1980s¹⁰.

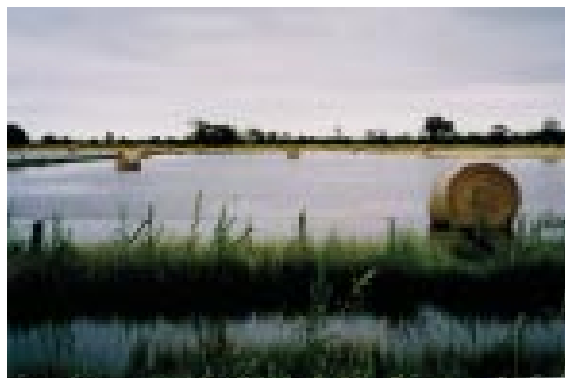


Photo: Tim Shanahan, G-MW

A flooded paddock at Murrabit.

Recharge associated with river flow and flood events is believed to be an important driver for salinity processes in the floodplains of the Avoca and Avon-Richardson catchments. It is also an important ecological process for floodplain and other wetland ecosystems. Lack of flooding, due to regulation and diversion of surface water flows and the construction of artificial levees and other flood diversion structures is implicated in the decline of remnants of such ecosystems that are located in dryland.

Soil health decline

There is a range of soil health issues, other than salinity, that threaten agricultural production and environmental services generated by dryland. They include acidification, water and wind erosion and fertility and soil structure decline. The North Central region includes substantial areas that are moderately or highly susceptible to these processes¹¹.

Cleared hill country across the region is particularly susceptible to water erosion. This has resulted in soil loss, gullying and sediment deposition in water storages, waterways and wetlands. These sediments are, in turn, a major source of nutrients carried by streams and contribute to algal blooms. While there are extensive areas of dryland showing symptoms of

^v A 1-in-100-year flood is equivalent to a 1% probability flood event.

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water erosion, only a relatively small proportion of these areas are still eroding at rates that threaten water quality or river health.

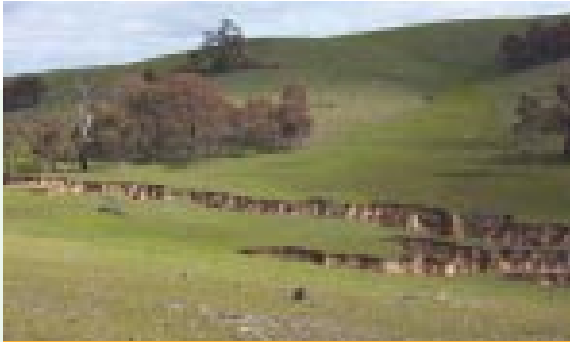


Photo: Matt Jackson, NCCMA

Gully erosion within the Wild Duck Creek catchment, Campaspe Basin.

Soils across much of the upper catchment and on hill country in mid-catchment areas are characteristically at least moderately acidic. Agricultural systems practiced across these areas and much of the dryland region are inherently acidifying. Product removal (by grazing, hay cutting or grain harvesting), the use of sub-clover in pastures and/or nitrogenous fertilisers and the maintenance of cover by annual (as opposed to perennial) species all contribute to acidification. In the absence of widespread use of lime, soils across much of the southern part of the region are expected to become acidic to the point where agricultural production is affected and the choice of crop or pasture species is constrained¹². Acid soils alone are already estimated to cost the region \$45 million per annum in lost agricultural production.

Reduced agricultural production could lead to increased recharge and/or erosion and could exacerbate existing issues. Acidification of soils may also lead to acidification of streams and could have adverse impacts on aquatic ecosystems.

Soils across much of the dryland region are considered to be highly susceptible to soil structure decline¹¹. Cropping soils are generally the worst affected. This condition mainly impacts on farm production and is readily addressed by conservation tillage practices. There is no clear indication as to whether this issue is having increasing or declining impact on soil health.

Light textured soils in the north of the region are susceptible to wind erosion, as evidenced by the severe dust storms striking the region during early and mid-2003.

Pest plants and animals

Pest plants and animals impact on agricultural productivity and the cost structure of managing dryland properties. Pest plants displace native species from patches of remnant vegetation. Overgrazing by rabbits has, in the past, contributed to erosion and sedimentation and the loss of native species. Foxes and domestic pets hunt and kill native fauna and may threaten populations in some areas. Problems with these species are generally worse in peri-urban or rural living areas with dryland.

Rabbits have been a major pest species across the region. However, the control of rabbits has improved markedly with the release of rabbit calicivirus disease and development of the 'Rabbit Buster' control programs. The region is now classed as being in good condition in relation to rabbit infestation. Control of foxes has been less effective.

Agricultural production and biodiversity on dryland are threatened by several pest plants. Five species of new and emerging weed (including Chilean Needlegrass and Serrated Tussock) have been listed for the region. There are 20 species of 'priority' and 'controlled' status weeds¹³.

Land management practices

Land management practice has potential to either exacerbate or ameliorate the process described here that threatened dryland condition. Practices currently promoted under regional natural resource management programs, such as liming, establishment of perennial pastures, protection of remnant vegetation, revegetation, farm forestry, conservation cropping and riparian fencing and revegetation (for example) may help to contain or reverse the decline in dryland condition. However, inappropriate practices such as maintenance of annual pastures, overgrazing, clearing and uncontrolled grazing in patches of native vegetation continue and detract from the value of services provided by dryland.

Reaching the audience of part-time and rural living landholders requires new approaches to natural resource management extension and possibly new land management options. Since they may be less focussed on commercial outcomes from dryland land use, recommendations based on farming systems change will not necessarily be appropriate.

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Firewood collection on dryland can add to pressure on biodiversity values. Standing dead timber and fallen trees are important habitats for a variety of native fauna and are particularly targeted by collectors. While reduced firewood availability from public land adds to pressure on remnant vegetation in dryland areas, it also improves opportunities for establishing commercial plantations that can supply firewood and other forest products and help to address some of the region's natural resource issues.

Population growth/rural residential expansion

The difference in land value between that based on use for commercial agriculture and that for rural residential use is likely to continue to increase as population and the demand for rural living areas grow. This places further pressure on the viability of dryland agriculture in affected areas, as farm expansion to maintain a commercial scale becomes increasingly difficult. In addition, lifestyle expectations of people in rural residential areas can be in conflict with the needs of adjoining commercial farming activities.

The level of attention to pest plant and animal control is often less in rural living zones than in nearby commercial farming areas. In some instances this may impact on the agricultural productivity or enterprise choices (e.g. lack of action on fox populations may mean that sheep farming is no longer viable). Uncontrolled domestic animals (especially dogs) can exacerbate this conflict.

If it is not planned and managed carefully, peri-urban and rural living developments can lead to increased fragmentation of patches of remnant vegetation and attendant loss of biodiversity values.

In the dryland area of the region, the challenge of rural residential/lifestyle land use is particularly acute in upper Campaspe and Loddon catchments, as far north as Bendigo.

Farm business viability and attitudes

The commodity price collapse of the mid-1990s resulted in substantial numbers of farms becoming financially unviable. This was particularly true for grazing properties, where less than 5% are estimated to be of a large enough scale to support a full-time business. Cropping businesses tend to be more viable, which may be reflected in their location further away from the parts of the region where land values have been inflated by rural residential values. However, the gross value of agricultural production for

pastoral industries grew by an average of 4.2% p.a. between the 1997 and 2001, compared with just 0.8% for cropping enterprises in dryland areas of the region⁷.

Fire

Rural residential and peri-urban development in upper-catchment areas result in both increased fire hazard and the likelihood of greater economic and/or human loss should a fire occur.

The isolation of native vegetation remnants in dryland areas means that they experience a different fire regime to that prior to European settlement. While the impact of this is unknown, it is likely to affect ecological processes.

Climate change

Climate change models suggest that average annual temperatures might rise by around 1.5°C by 2030 and by up to 5°C by 2070. Average spring rainfall is expected to decrease, resulting in more frequent dry years towards the end of the century. Variability in weather and the frequency of extreme events are also expected to increase.

There could be profound impacts for dryland agriculture in the region if climate change proceeds as expected. Higher temperatures and reductions in spring rainfall may reduce pasture and crop production, limit variety choices and add to pressure on profitability. New weed, pest and disease problems could emerge.

If it results in increased evaporation and reduced spring rainfall, climate change could reduce recharge and lead to sustained drops in water tables. This will help to reduce the threat of land salinity. However, the lack of dilution flows may, in the short to medium term, contribute to increased stream salinity.

6.5 Priority issues and management response

Priority issues for dryland have been defined by a comprehensive risk assessment process. This process considered the range of services provided by dryland, the likelihood of those services being affected by various threatening processes and the potential impact on service values should the threat be realised. The priority issues for dryland are based on combinations of likely threats and the expectation of a significant decline in service values. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

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Priority issues for dryland are based around threats to:

- ◆ economic activity, mainly based on agricultural land use
- ◆ habitat values and ecological function in remnant vegetation communities
- ◆ Indigenous cultural heritage, associated with remaining scarred trees and other sites of significance
- ◆ generation of surface water and groundwater, particularly in upper catchment areas, in the quantities and at the quality required for human and environmental uses
- ◆ visual and residential amenity.

These services are threatened by agents such as land use change, inappropriate land management practice, salinity and declining soil health, fragmentation and loss of native vegetation and pest plant and animal infestation. Collectively, these threats represent the main impediments to achieving the sustainability goal for dryland. While most operate across the dryland region, the impacts of land use change on dryland are mostly related to urban expansion and rural living development in the upper reaches of the Loddon and Campaspe catchments.

Although climate change is recognised as a threat to dryland, the risk assessment did not flag it as a priority issue, due to uncertainty about its impacts and because of the long timeframe over which they are likely to be expressed. However, responses to the threat have been developed and are outlined in the chapter on climate (Part B, Chapter 3).

A series of responses to the priority issues for dryland have been developed (Table 14). They are mostly based on the relevant regional or sub-regional action plans, but include some actions that address key gaps in the current response. Responses are not completely comprehensive: some actions are only the preliminary actions, that form part of a longer term response to the issue. Several of the issues and proposed responses overlap with those relevant to assets other than dryland. To avoid repetition, Table 14 only includes responses that primarily address dryland issues. Other responses are given in the chapter for the relevant asset.

The actions in Table 14 are grouped by implementation 'package'. These packages are simply complementary actions that address the priority issues for dryland, particularly the main threatening processes. Further details on implementation packages are given in Part C. Resource condition targets that link with each package are also indicated.

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Table 14: Management actions and targets for dryland

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Dryland Package 1: Managing the impacts of dryland salinity</p> <p>This package is largely concerned with implementation of key actions related to dryland under the Second Generation Dryland Salinity Management Plan. Implementation activities are concentrated at present in 10 'targeted project areas', which are located in the upper and middle reaches of the Loddon, Avoca and Avon-Richardson catchments. These projects emphasise engagement with local communities, building capacity for management of natural resources and on-ground works that lead to improved land and water salinity outcomes and improvements in biodiversity and wetland and waterway health. The package also includes research and investigations activities.</p> <p>It directly addresses RCTs DL9 – 12.</p>			
DL1	Complete targeted salinity projects in upper Bet Bet, Redbank, Carapooee, and Reedy and Paradise Ck priority areas by 2008 and Timor West, Bulabul, Natte Yallock, Pental Hills, Glenloth, and Marnoo targeted priority areas by 2012: by building community capacity for natural resource management and implementing recommended management practice for multiple environmental benefit.	DPI, NCCMA	Dryland SMP
DL2	Investigate salinity processes in key dryland salinity research priority areas: upper Loddon/Campaspe basalt groundwater flow system areas, Wild Duck Ck catchment and Lower Avon-Richardson catchment. Assess and report on opportunities to protect environmental, agricultural and water resource assets by 2004.	DPI	Dryland SMP
DL3	Develop and implement opportunities for third party investment in dryland natural resource management programs. By 2005, undertake pilot project in upper Bet Bet catchment to: <ul style="list-style-type: none"> ◆ define third party investment mechanisms for environmental services, agricultural commodities and forest products ◆ develop institutional and operational arrangements for third party investment ◆ accelerate the pace of land use and management practice change in the project area, achieving >500 ha of farm forestry and/or new revegetation/remnant protection by 2005. Establish 5000 ha of third party funded plantation by 2008 in priority areas able to deliver multiple benefit according to mechanisms/arrangements defined in pilot and established program guidelines.	DPI, NCCMA, MDBC, DSE	Dryland SMP, Farm Forestry Action Plan, Native Vegetation Plan
DL4	Undertake research to develop farming systems that suit floodplain environments and natural resource issues and report by 2008.	DPI	
<p>Dryland Package 2: Managing the impacts of pest plant and animal populations</p> <p>This package reflects the regional Rabbit and Weed Action Plans and activities to address other pest animals. Priority areas have been set for rabbit control and priority weed species have been identified. Implementation is based around priority issues, where there is strong community commitment to achieving long term control of pest populations. It is proposed that targets for pest management activities be updated. An upper catchment specific pest plant and animal program is to be developed, that reflects the pest management priorities and constraints and opportunities of urban and rural living development. Key outcome areas are related to biodiversity and economic activity in agricultural areas.</p> <p>It addresses RCT DL13 and RCT BD2 and 3.</p>			
DL5	Adapt Rabbit and Weed Action Plans to peri-urban issues by 2004 and implement programs appropriate to land uses, management practices and community characteristics. Undertake strategic pest plant and animal control programs where public investment is warranted. Develop relevant management action and resource condition targets.	DPI	Weed Action Plan, Rabbit Action Plan
DL6	Support landholders in broadacre agricultural priority areas to undertake rabbit control programs as per Rabbit Action Plan. Long term control extended in priority zones 1 and 2, with new targets set by 2004.	DPI	Rabbit Action Plan
DL7	Support landholders on broadacre agricultural lands to eradicate or implement long term control over new and emerging weeds, priority weeds and controlled weeds as per Weed Action Plan. Increased area of priority and controlled weed infestation eradicated or under control by 2008. New targets set for regional pest plant program by 2004.	DPI	Weed Action Plan
DL8	Undertake integrated fox control programs in priority areas to reduce impacts on agricultural production and enterprise flexibility.	DPI	

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Table 14: Management actions and targets for dryland (cont.)

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
Dryland Package 3: Responding to the challenge of rural residential development.			
There has been an acceleration in land use change towards lifestyle or 'residential' development in upper catchment areas across the region. This package responds to the challenges this poses for natural resource management. It seeks to apply in a uniform manner the recommendations of the recent Victorian Rural Zones Review to ensure local government planning is consistent with natural resource objectives. It also seeks to develop and deliver guidelines for more sustainable land management practice for non-agricultural landholdings in this part of the region. There are no direct dryland RCTs attributable to this package, although it will contribute to the goal for dryland.			
DL9	Undertake a dryland regions, 'Future land use' study that will assist councils to develop a 'Rural Strategy' consistent with that recommended under recent Victorian Rural Zones Review (DSE, 2003). The study will include an audit of rural lands, a land capability and productivity analysis, the identification of lands to be incorporated within Rural Industry, Environmental Rural, Rural Mixed Use and Rural Living zones and the setting of appropriate resource condition targets. The studies are to be completed, results incorporated into municipal planning schemes and resource condition targets set by 2008.	Local government, DSE, NCCMA, DPI	Local government planning schemes
DL10	Develop guidelines for sustainable management of rural residential land by 2005. Guidelines should address biodiversity, salinity, groundwater and surface water resource management, water quality, river health, pest plant and animal and farming practice.	NCCMA, DPI, DSE	Native Vegetation Plan, Dryland SMP
Dryland Package 4: Safe and environmentally sustainable fire regimes			
This package addresses the need for safe and environmentally sustainable fire regimes in broadacre agricultural landscapes and rural living zones. It is intended that it lead to fire management practices that address community safety issues. It also seeks to develop guidelines that allow reinstatement (where appropriate) of environmental fire regimes for large blocks of remnant native vegetation. There are no direct dryland RCTs attributable to this package, although it will contribute to the goal for dryland.			
DL11	Review fire hazard reduction practices and fire regimes on private land. Develop and implement appropriate regimes in conjunction with stakeholders across all local government areas by 2008.	NCCMA, DSE/DPI, CFA	
Dryland Package 5: Improved dryland management practice (also DL4)			
There is substantial overlap between this and the dryland salinity package. Apart from addressing dryland salinity, it has three main focus areas: improving soil health, using environmental management systems (EMS) to support more sustainable agricultural land use and the development of saline resource use industries in areas where salinity issues are intractable. Its primary concern is with economic activity, however several activities address natural resource issues, including biodiversity, river and wetland health and water quality. Actions DL12 and DL13 are intended to support achievement of RCTs DL9 to 12. Targets are to be developed for soil condition as part of the process of preparing a regional soil health plan.			
DL12	Review regional soil health issues. Conduct land resource assessment for North Central region. Prepare revised dryland soil health plan that evaluates need/case for public investment in a soil health program by end 2004. Plan is to include appropriate resource condition targets for soil health in dryland areas and appropriate monitoring and evaluation program.	DPI	Draft Soil Health Plan
DL13	Develop and implement regional EMS process, linked to RCS, dryland salinity and other key action plans, to demonstrate adoption of sustainable land use and management practice by 2005. Negotiate local government support for adoption of EMS via rating system by 2005.	DPI, NCCMA Local government	Dryland SMP, Local government planning schemes
DL14	Support the development of saline resource use enterprises in mid catchment areas, where 'living with salinity' is the only feasible management option. At least two new saline resource enterprises established in salinity hazard area by 2008.	DPI, NCCMA	Dryland SMP
Dryland Package 6: Improving natural habitat and ecosystem function in dryland areas (See DL -1,3,5)			
This package comprises actions under the dryland salinity program, which contribute to the improvement in the size, connectivity and function of native vegetation communities and associated fauna. All on-ground components of this package are carried out within the dryland salinity targeted project areas. The package complements related activities within the dryland area that are described in Part B, Chapter 2, Biodiversity. Actions are intended to support the achievement of RCT BD4.			
Additional dryland priority issues dealt with by management actions listed under other assets include:			
<ul style="list-style-type: none"> ◆ Expansion of horticultural land use change (Water Resources) ◆ Impacts of erosion on water quality (Waterways and Wetlands) ◆ Impacts of flooding (Waterways and Wetlands) 			



CASE STUDY

Photo: DPI North Central Dryland Salinity Team

Bulabul paddock plans map out farming future

Kevin and Katrina Alexander have a dream to hand over their farm to their sons in better environmental condition than when they took it over.

The Alexanders are developing paddock plans for their mixed farming business at Lanelly, 6 km from Tarnagulla, to help them work towards their dream.

The plans are being developed and implemented with assistance from the DPI North Central Dryland Salinity Program. This program is supported by the NCCMA and is funded by the National Action Plan for Salinity and Water Quality, a joint State-Commonwealth program.

Kevin supports the landscape-scale approach to land management being taken by the Dryland Salinity Program and he has joined other local farmers on a steering committee for the Bulabul sub-catchment area, which has been targeted under the program.

This year, the Alexanders have converted a 65 ha paddock of cropping and grazing of annual pasture to a deep-rooted perennial pasture system alternately sown with oats, which will help reduce groundwater recharge in the Bulabul catchment.

Other treatments on the paddock will include fencing of native remnant vegetation and re-establishment of native vegetation along a gully that runs through the paddock. The works being carried out by Kevin and Katrina will improve the water quality in the local area and help reduce the 7,000 tonnes of salt that the Bulabul creek contributes to the Loddon River each year

Kevin will be testing soil acidity across the whole farm and addressing any problem areas. Other works planned for the next two years include the fencing of other remnants and creeks, particularly in areas where there is a problem with salt discharge.

Inspection of the native vegetation remnants on the farm by a vegetation officer from DPI has identified an ecologically valuable stand of Buloke trees. Buloke Woodlands are classified nationally as an endangered ecological community.

"I don't mind fencing these remnants and re-establishing vegetation that used to be here because I see it as an important part of securing the future of our farming business", said Kevin.

7 Infrastructure

Regulators provide infrastructural support to irrigated areas.



Photo: Tim Murphy, G-MW

7.1 Goal

Infrastructure assets will be protected by land and water management practice from the impacts of natural resource degradation. Infrastructure development will be carried out in ways that minimise and offset adverse environmental impact.

7.2 Resource condition targets

There is insufficient information on the nature of threats to infrastructure assets to set specific resource condition targets. Implementation of relevant management actions under the RCS and referring plans will help fill those gaps and is expected to provide a more sound basis for setting targets. Targets will be set based on this work during the first year of implementation of the RCS. A key area for target development would relate to the level of salinity expenditure maintenance or repair expenditure by local government and utilities.

7.3 Infrastructure: overview of the asset and the services it provides

Infrastructure assets are most heavily concentrated in, and in many cases, most highly valued in, the region's urban areas. There are many types that may be affected by natural resource degradation issues, such as salinity, water quality decline, fire, flooding and soil erosion. They include housing, public buildings, industry, roads, railways, public parks and gardens, urban and rural water supply, rural drainage, energy and communications infrastructure.

Infrastructure, and in particular the development of new infrastructure, can also pose a hazard to the services provided by other assets. Its role as a threatening 'process' is described in other chapters.

Infrastructure provides a range of important services. In addition to the specific function of the infrastructure (e.g. transport, energy, communications, recreation,

shelter), this asset is intimately linked with the wealth and prosperity of the community, economic development opportunities, the amenity afforded by living in and/or travelling through particular areas and cultural heritage.

7.4 Threats to infrastructure

Salinity

Salinity poses a major threat to the region's infrastructure. It is known to be responsible for damage to roads, footpaths, parks, cemeteries and public buildings in some urban centres. Housing and industrial developments in several parts of Bendigo are also located on salt affected land. Damage to roads, parks and other public infrastructure is a significant expense to some local governments within the region, through increased maintenance or construction costs and greater maintenance frequency. Rising saline watertables in urban residential areas threaten to substantially diminish the value of what is generally the principal asset of householders. Reductions in real estate values, if they apply to a substantial area, may also reduce the rate base for councils.

Recent work estimated that annual costs of dryland salinity to households, businesses and local government were almost \$10 million¹⁴. Major cost items were costs of saline town water supplies to households, damage to housing, increased maintenance expenditure on roads and other infrastructure and costs associated with shortened road life spans. It is estimated that 2,800 km of the region's road network traverses land at risk from salinity and shallow water tables.

7 Infrastructure

Flooding

The North Central region is highly flood prone. Although occupying 13% of the State, it experiences 23% of the average annual flood damage of non-metropolitan Victoria. It is estimated that a 1:100 year flood would cause \$113 million damage to buildings and \$80 million damage to roads and related infrastructure. The total impact, including agricultural and other losses, would exceed \$300 million. Lesser and more frequently recurring floods would have a smaller localised impact.

Soil Erosion

Soil erosion, particularly that associated with the bed and banks of streams and gullies, can threaten roads and bridges. Much of the damage is linked with flooding, since most major erosion events occur during or after intense rainfall.

Plantation forestry development

Development of forestry plantations may have implications for rural infrastructure, particularly roads. The concentration of use by heavy trucks on roads leading to plantations during harvesting can be particularly damaging. The problem is likely to be experienced in the restricted parts of the upper catchment that are suited to larger scale commercial plantations.

Water allocation and trade

One outcome of the separation of title to water from ownership of land has been the shifting of demand for irrigation water supply from one location to another. In more (financially) marginal irrigation areas, this has left supply infrastructure 'stranded'. The infrastructure remains, but now supplies few or no irrigators and it is no longer financially viable to maintain.

Fire and changed fire regime

The 2003 bushfire season demonstrated the vulnerability of infrastructure to fire. Powerlines, fences and private dwellings in more isolated areas are particularly vulnerable in bad fire seasons.

7.5 Priority issues and management response

An assessment has been undertaken of the main threats faced to services provided by infrastructure. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

A suite of management actions and targets (Table 15) addresses some of the issues challenging infrastructure assets. Most relevant actions are dealt with in the response to priority issues for other assets (e.g. flooding in Waterways and Wetlands). At this stage, none of the management actions link to resource condition targets.

7 Infrastructure

Table 15: Management actions and targets for infrastructure

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
Infrastructure Package 1: Managing impact of salinity. The package includes actions designed to identify the impact of salinity on infrastructure and develop some preliminary responses. The focus is on urban and rural infrastructure.			
IN1	Identify urban areas most threatened by salinity and undertake risk assessment for all centres by 2005. Develop guidelines for planners and developers to deal with salinity hazards. Incorporate appropriate responses into planning schemes by 2006.	DPI, NCCMA, Local government	Dryland SMP, Loddon-Murray LWMS, Municipal Planning Schemes
IN2	Develop salinity management plan for Bendigo by 2005 and implement key recommendations in conjunction with City of Greater Bendigo by 2008.	DPI, NCCMA, City of Greater Bendigo	Dryland SMP
IN3	Develop monitoring and reporting protocols for infrastructure assets threatened by salinity and for salinity caused expenditure by 2004.	DPI, NCCMA, Local government, VicRoads	Dryland SMP
Infrastructure Package 2: Managing the impact of forestry industry development. This package seeks to provide a strategic and early response to potential local government concerns about the impacts of plantation expansion on roads infrastructure.			
IN4	Engage with local government in implementation of West Victoria Regional Forest Agreement. A farm plantations process to ensure that relevant road and road maintenance issues are resolved by 2004.	DPI/DSE, Local government	West Victoria Regional Forest Agreement

8 Irrigated land

An irrigated vineyard near Swan Hill.



Photo: Tim Murphy, G-MWV

8.1 Goal

The use and management of land for irrigated agriculture, rural living and other purposes will be consistent with its capability to support those uses. The use and management of both land and water provides sustainable economic and social benefits and improves environmental values.

8.2 Resource condition targets

This chapter outlines some of the management actions that are needed to achieve the goal for irrigated land. Resource condition targets will be developed in the first year of RCS implementation to indicate the expected outcomes from implementing

those actions over the next 10 – 20 years. Some preliminary areas in which targets may be set are indicated in Table 16. They will be set at a sub-regional level, as irrigated land within the North Central region is not managed as an integrated whole.

Table 16: Preliminary resource condition targets for irrigated land

#	Area for resource condition target
RCT IR14	Increase the average value of agricultural production per ML or water on irrigated land to between 100%(double) and 200% (treble) current levels by the year 2023; while maintaining (worst case) or trebling (best case) the total economic value of production from the region.
RCT IR15	Reduce the irrigated area of salt affected land (C and D class) to a specified % and increase the % of irrigated area that is A and B class soils by the year 2023.
RCT IR16	Reduce the percentage of the irrigated area subject to waterlogging losses due to inadequate surface water management to zero and increase the area served by adequate surface water management (including on-farm systems) to 100% by the year 2023.
RCT IR17	Manage the salt load exported from land to the River Murray and regional waterways and wetlands within EC credits and ecological limits.
RCT IR18	Reduce the nutrient loads exported from land to the River Murray and regional waterways and wetlands by between 30% and 50% by the year 2023.
RCT IR19	Reduce regional irrigation tailwater flows and accessions to groundwater by between 20% to 50% by the year 2023.

8 Irrigated land

8.3 Irrigated land: an overview of the asset and the services it provides

Definition

Irrigated land is defined as land managed by irrigation property owners. It is mostly located in the lower catchment areas of the Campaspe, Loddon and Avoca basins and includes both the Loddon-Murray region and parts of the Shepparton Irrigation region (Rochester Irrigation Area and Campaspe Irrigation District). It also includes the irrigated land in upper and mid catchment areas, such as the potato growers in the Central Highlands area, river diverters and the vineyards of Bendigo and Avoca districts.

Coordination of natural resource management initiatives (including the integration of the Kerang-Swan Hill, Boort West of Loddon, Torrumbarry East of Loddon and Tragowel Plains Land and Water Management Plans) has been achieved through the Loddon Murray Land and Water Management Strategy (LMLWMS). Salinity and surface water management in areas to the east of the Loddon Murray region are managed as part of the Shepparton Irrigation Land and Water Management Plan. Those aspects of that area are serviced through the Goulburn Broken rather than the North Central CMA. There are important works now undertaken by the North Central service delivery team in those areas to improve water use efficiency and irrigation water management skills. Those elements are aligned with the strategic priorities in the LMLWMS for planning, management and budget purposes.

Irrigated land in the upper and mid catchment areas has not been specifically covered by previous irrigation land and water management strategies.

Agricultural production and economic activity

In a typical year the estimated area of land under irrigation is between 300,000 and 350,000 ha¹⁵ (10% of the North Central region), depending on the irrigation allocation made available. In addition, this asset class includes the approximately 150,000 ha to 300,000 ha of dryland managed by irrigation farmers (5% to 10% of North Central region). This gives a total area of irrigated land of approximately 700,000 ha or 23% of the North Central region. At present, irrigated land is associated with 900,000 ML of water right entitlement and 1,425,000 ML of annual water use for irrigation.

Irrigated land is important for providing agricultural production and for supporting regional employment. The main industries are dairying, horticulture and mixed farming (combinations of cropping, lucerne, wool and meat production from beef and sheep). The size of these industries is estimated in Table 17 and further information given in the North Central Catchment Condition Report².

Environment and amenity

The land also supports flora and fauna habitat, cultural heritage, landscape and a rural living environment. Adjacent to the irrigated land are some of the region's key natural assets, including the internationally significant Kerang Wetlands and Gunbower Forest Ramsar Sites.

Table 17: Irrigated land

Land Use	Area (ha) ^{vi}	Water used (ML)	Estimate Gross income (\$/ML) ^{vii}	Value of Production (\$m)	No. properties
Dairying	133,000	752,000	500	376	1,400
Mixed	275,000	563,000	150	84	1,300
Horticulture	6,700	15,000	2,000	30	270
Dryland	275,000	–	–	28	(included in above)
Private diversion and groundwater usage outside main irrigation districts (GMID)	16,000	95,000	500	48	3,500 (est.)
Total	700,000 (ha)	1,425,000 (ML)	3,150 (\$/ML)	518 (\$m)	approx 6,500

^{vi} Derived from background papers prepared on Loddon Murray by S Lottkowitz, corrected for Irrigated Land outside Loddon Murray.

^{vii} Derived from Rendell McGuckian farm financial surveys.

8 Irrigated land

8.4 Irrigated land condition and threatening processes

The condition of irrigated land and the value of services it provides are threatened by a range of landscape processes and cultural practices. Several of these processes and their impact are described below.

Water trade

Water trade is a major activity. Temporary water trade occurs on a large scale, most of which is internal to the region. However, there has been a net permanent water trade out of the region.

Mixed irrigation farming is a major user of water in the region, but this is a low value use and currently the market value of water is generally higher than the returns that mixed irrigation justify. Consequently, permanent trading has generally shifted water from mixed farming areas in the region to higher value dairying and horticulture external to the region. Since 1991 – 92, 22,500 ML¹⁶ of water right has been lost to the region. The continuing loss is turning previously irrigated land into 'new dryland'. It is also reducing the viability of some irrigation supply systems.

The loss of permanent water has been partially offset by increased water sales, when available, and more temporary water purchases. However, net use is declining in the region. This trend is not evenly spread. The water right in dairy areas at Cohuna and Rochester has increased, while water right has reduced in the mixed areas around Kerang and Pyramid Hill. Some dairy farmers have purchased land in traditional mixed areas and transferred water to the dairying area.

Water allocation

It is suggested that up to 1,500,000 ML of current water allocations in the Murray-Darling may be needed for environmental flows to maintain biodiversity. This represents a significant loss of water for irrigation and is approximately equivalent to the annual volume in three Torrumbarry irrigation areas. If this occurs, even more 'new dryland' areas may be created. The actual water loss to irrigation in the North Central region is likely to be much greater than in most other irrigated regions because low value mixed areas would be under increasing pressure to sell as the market readjusts to lower allocations. It is possible

that dairy and horticulture would be the only remaining major users. This would have significant economic, social and environmental impacts.

Salinity

Salt has been a major threat to irrigated land. Land becomes saline when watertables are consistently within 2 m of the natural surface. More than 50% of irrigated land in lower catchment areas is estimated to be affected, although this represents an improvement over the last decade. In the Loddon Murray irrigation region, the area affected by watertables less than two metres has fallen from 74% to 59%. This improvement is thought to be due to drier than average conditions, water trade impacts and improved irrigation practices. A series of wet years may reverse this trend.

Economic impacts of salinity have also been reduced by targeting water to low salinity soil and by improving surface drainage. The irrigation salinity management plans have been successful in achieving or exceeding their original objectives. However, the high rate of recharge to groundwater on some of the lighter soil types that are currently being flood irrigated is yet to be addressed.

Horticulture has largely converted from furrow to micro irrigation systems and in so doing reduced the risk of salinisation. Spray and improved flood methods (pipes and risers) are also being considered for traditional flood irrigated areas.

Salinity of water supplied to irrigators can also impact on soil health and production.

Flooding

Flooding is a major threat to irrigated land. Much of the lower catchment land and infrastructure is located on floodplains and is prone to damage in large flood events. The total cost of a 1-in-100-year flood on irrigation areas is estimated to be \$26.2 million. Future land use projects are looking at the impacts of changing land use, including floodplain regeneration.

Land and irrigation management practices

The trend to more efficient irrigation practices is reducing damage caused by recharge to groundwater and surface run-off. However, nutrient run-off to waterways, particularly from dairying, remains a major contributor to water quality decline.

8 Irrigated land

Better management practices, such as the adoption of drainage recycling, have provided significant improvement over the last decade. The adoption of these is likely to continue with the strong economic imperative to be water efficient and the encouragement of current extension and natural resource management programs.

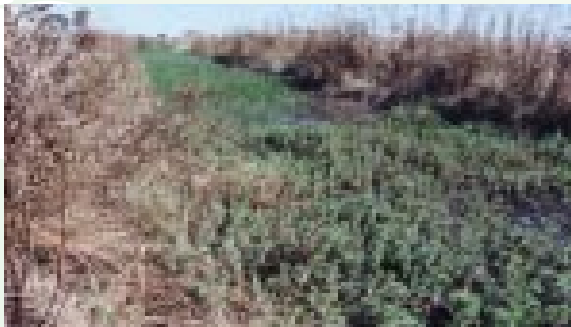
The trend towards pressurised irrigation from gravity systems leads to improved water use efficiency, but also means higher costs and increased energy consumption. Irrigation efficiency needs to apply triple bottom line analyses to ensure that greenhouse impacts are considered.

Reaching part-time and residential property owners requires new approaches to natural resource management extension models.

Pest plants and animals

Weeds can pose a significant threat to irrigated land and associated wetlands and water supply systems. New weeds such as arrowhead, parramatta grass and mullumbimby couch are serious threats to irrigated pasture production. Parrot's feather, arrowhead and alligator weed pose even greater threats to the water delivery systems.

Pest animals have relatively minimal impact on this asset.



Parrot's feather choking an irrigation drain.

Soil health

Soil erosion is generally not an issue in irrigated land, except for the upper catchment cropping and potato growing areas. Soil structure decline, especially soil sodicity, can severely limit plant growth in irrigation areas. Recent research into soil moisture following irrigation indicates that root pruning and physical or chemical barriers in the soil profile can significantly restrict the ability of plants to utilise water and limit irrigation efficiency. Soil health is an emerging issue for water use efficiency and in areas where waterlogging

has reduced and the depth of soil available for root growth should have improved (e.g. on the 'new dryland' areas formed after irrigation is removed).

Farm business viability and attitudes

Based on 2001 ABS figures, approximately 60 – 70% of dairy farms are large enough to be viable full-time, but horticulture and mixed irrigation farms tend to be smaller businesses and are dominated by part-time farmers and growers. Growth needed to maintain agricultural viability is hampered by competition for land in areas that appeal to rural residential use.

Population growth/rural residential

Increasingly, irrigation areas are being used as rural residential land. Already significant parts of the irrigation supply system serve part-time or hobby properties. Areas near towns with high amenity (e.g. with water views or near rivers) are particularly attractive for rural residential purchasers. The Tyntynder Flats area near Swan Hill and the lakeside areas are examples. Rural residential users also dominate the Coliban irrigation area and most major towns.

Climate change

Although the impact of climate change is uncertain, it may be reasonable to predict lower water allocations, increased summer rainfall intensity and decreased winter chill. These changes will affect flower and fruit horticulture.

Fragmentation of habitat

There are few remaining patches of the remnant vegetation on irrigated land. These areas are therefore very important for maintaining flora and fauna habitat. Any landscape change, such as new irrigation development or rural residential growth, needs to be undertaken in ways that prevent further habitat fragmentation or loss of biodiversity.

8.5 Priority issues and management response

Priority issues for irrigated land have been defined by a comprehensive risk assessment process. This process considered the range of services provided by irrigated land, the likelihood and potential impact on those services of various threatening processes. The priority issues for irrigated land are based on combinations of likely threats and the expectation of

Photo: Ian Higgins, NOCMA

8 Irrigated land

a significant decline in service values. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

Priority issues for irrigated land are based on:

- ◆ land use change, as a result of rural residential expansion, which limits the ability of irrigation businesses to expand and remain viable, and also impacts on visual amenity
- ◆ water allocation and trade, which threatens the viability of irrigation supply systems, impacting on the environment, and threatening the services to remaining irrigators
- ◆ declining farm business viability impacting on economic activities and rural living lifestyle
- ◆ pest plants impacting on flora and fauna values
- ◆ salinity, which threatens farm output, habitat values and cultural heritage
- ◆ flooding which threatens farm output and damages other infrastructure
- ◆ fragmentation of habitat which threatens flora and fauna, landscape amenity and rural living services

- ◆ inappropriate land management practice, which impacts on economic output, flora and fauna, and cultural heritage.

Most of the irrigated land is situated in the lower catchment, with smaller areas dispersed in the upper catchment.

A series of responses to the priority issues for irrigated have been developed (Table 18). They are mostly based on implementation of the Loddon-Murray Land and Water Management Strategy and relevant components of other issue based action plans (e.g. Native Vegetation Plan, River Health Strategy, Floodplain Management Strategy), but also include some actions that address key gaps in the current response. Responses are not completely comprehensive: some actions are only the preliminary steps in a longer term response to the issue. They operate over the period of the RCS and Loddon-Murray Land and Water Management Strategy.

8 Irrigated land

Table 18: Management actions and targets for irrigated land

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Irrigated Land Package 1: Salinity management</p> <p>This package implements specific salinity related activities under the Loddon Murray LWMS, including the maintenance and operation of existing salt interception infrastructure and actions to reduce groundwater recharge and tailwater discharges.</p> <p>The package addresses RCT IR16, 17 and 19</p>			
IR1	Salt Interception. Continue to address impacts of salt accumulation, new opportunities for commercial salt harvesting and saline water reuse. Seek opportunities for new and/or improved salt interception to protect water resources environmental values and land resources.	G-MW, MDBC	Loddon Murray LWMS
IR2	Improve irrigation efficiency to reduce groundwater accessions and irrigation tailwater discharges. Audit energy demands and availability for pressurised irrigation.	DPI, G-MW	Loddon Murray LWMS
<p>Irrigated Land Package 4: Land management for sustainable irrigated agriculture.</p> <p>The package seeks to improve land management practice in irrigation areas and so reduce impacts on water resources and the environment. It operates across the lower catchment irrigation regions and, in parts, across irrigation properties in mid and upper catchment areas.</p> <p>The package addresses RCT IR14 to 19.</p>			
IR3	Provide extension on land and water management to upper catchment irrigators	DPI	
IR4	Development of irrigation EMS (environmental management systems) by 2005	DPI	
IR5	Investigate the inclusion of land and water management practice or EMS in conditions for the re-issue of irrigation licences/permits by 2005	G-MW, DPI	
IR6	Continue to encourage adoption of current recommended practice in lower catchment, eg drainage reuse	DPI	Loddon-Murray LWMS Shepparton Irrigation Region Catchment Strategy (SIRCS)
IR7	Continue farm programs to reallocate water to best soils and higher value crops using soil salinity surveys (2,700 ha/y)	DPI	
IR8	Implement agreed 5 year work program under sustainable agriculture project of Loddon-Murray LWMS, including reuse schemes, whole farm planning (FARMAP concept) and drainage diversion by 2008. Implement agreed farm programs under SIRCS.	DPI	Loddon-Murray LWMS SIRCS
IR9	Implement agreed 5 year work program under surface water management project of Loddon-Murray LWMS by 2008. Implement agreed programs under SIRCS (including surface water and tail water management strategies).	DPI, G-MW	Loddon-Murray LWMS, SIRCS
<p>Irrigated Land Package 3: Farm business for sustainable agriculture.</p> <p>The package addresses the potential impacts of farm business viability on water resources and the environment.</p> <p>The package addresses RCT IR14 to 18.</p>			
IR10	Investigate new high value crops by 2008	DPI	Loddon-Murray LWMS
<p>Irrigated Land Package 4: Flood plain management.</p> <p>The package implements aspects of the regional floodplain management strategy that relate to the lower catchment irrigation area.</p> <p>The package addresses RCT IR14 to 17.</p>			
IR11	Implement floodplain and flood flow management plans including restoration of floodplain packages under future land use package in Irrigated Land Package 1. Implement agreed programs under SIRCS.	NCCMA	Loddon-Murray LWMS, SIRCS

8 Irrigated land

Table 18: Management actions and targets for irrigated land (cont.)

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Irrigated Land Package 5 : Future Land Use – Water allocation and Trade</p> <p>This package addresses the need to increase the viability of services and farm businesses to match the changes in irrigation demand.</p> <p>The package addresses RCT IR14 and 15.</p>			
IR12	Encourage 5,000 ha of new environmentally sustainable high value irrigation development on prime development zones by 2005	DPI, G-MW, Local Government, NCCMA	
IR13	Implement assistance for adjustment with future land use packages (based on Kerang Swan Hill model) across region by 2004	DPI, G-MW, DSE	Loddon-Murray LWMS
<p>Irrigated Land Package 6: Managing expansion of rural residential land use.</p> <p>This package seeks to manage the potentially adverse impacts of rural residential growth in lower catchment irrigation areas on water trade and infrastructure viability.</p> <p>The package addresses RCT IR14.</p>			
IR14	Future Land Use Plan zoning land for rural residential growth outside of viable irrigation systems. Develop by 2005 and implement a plan from 2006 for appropriate rural residential and lifestyle developments while protecting agriculture.	G-MW, DPI, Local Government, DSE, NCCMA	Loddon-Murray LWMS
IR15	Develop new extension techniques and target rural residential and part time land managers	DPI	Loddon-Murray LWMS
<p>Irrigated Land Package 5: Pest plants and animal control for sustainable agriculture.</p> <p>The package addresses the threat of pest plants (particularly) for agricultural production and associated irrigation infrastructure and environmental assets.</p> <p>The package addresses RCT IR14.</p>			
IR16	Develop and implement control strategies for pest plants in areas of high habitat value by 2006	DPI, DSE, Parks Victoria	Weed Action Plan, Rabbit Action Plan

9 Public land

Headwaters of the Loddon River.

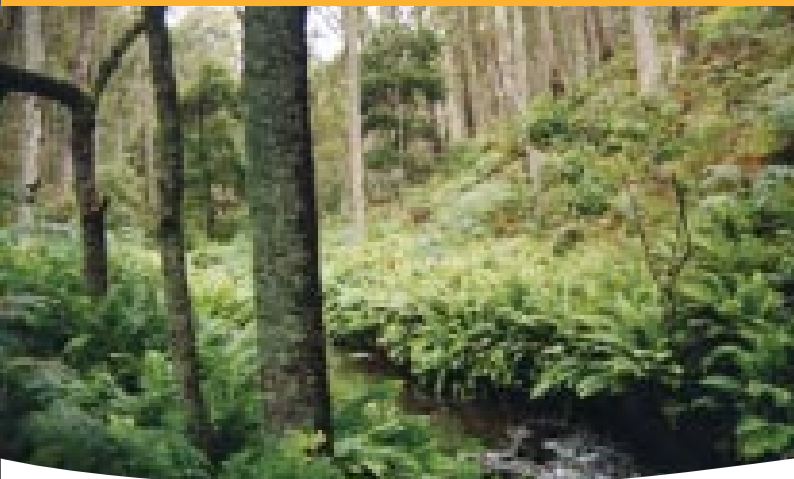


Photo: Greg Chant

9.1 Goal

The uses and management of public land will lead to improved environment condition and provide the services required and agreed to by government and the community.

9.2 Resource condition targets

This chapter outlines some of the management actions that are needed to achieve the goal for public land. Implementing these and complementary actions described in other chapters (particularly for Waterways and Wetlands, and Biodiversity) is expected to result in changes in the condition of public land. However, due to the overlap with these other assets, specific resource condition targets for public land have not been set. This situation will be reviewed during the first year of implementation of the RCS and additional public land specific targets may be set.

9.3 Public land: an overview of the asset and the services it provides

Definition

The asset includes all public land within the North Central region, regardless of its use or management status.

Approximately 13% of the region (over 360,000 ha) is public land. While there are many classes of public land, larger blocks fall into one of six categories: national, state or regional park, nature conservation reserve, historic and cultural features reserve and state forest. These larger parcels include state forests and parks in the Daylesford-Castlemaine-Maldon, Maryborough-Dunolly-Inglewood, Bendigo-Eppalock-Heathcote, St Arnaud and Pyrenees Ranges, Mitiamo, Kerang and Gunbower areas. While the use of all blocks of public land is prescribed by various Land Conservation Council or Environment Conservation Council reports, many of the larger areas of public land have specific management plans.

There are also hundreds of smaller (2 – 100 ha) parcels of public land across the North Central region, including road reserves and Crown water frontage. While they are small, they often retain native vegetation and are significant from nature conservation and river health perspectives. Wetlands and riparian land located on public reserves are dealt with in greater detail in the chapter on waterways and wetlands.

Biodiversity and nature conservation

Important biodiversity assets are located on public land. It supports native vegetation communities and wetlands, which in turn provide habitat for native fauna. Large blocks of public land provide core habitat and are a key landscape element in a region that is dominated by agricultural land use.

While much of the remaining native vegetation is located on public land, these reserves are not fully representative of the many ecological communities found across the region. Those ecosystems typically located on land most suited for agriculture (e.g. those on more fertile, moisture rich parts of the landscape, and natural grasslands and grassy woodlands) are under-represented in conservation reserves.

Native vegetation communities in linear reserves, such as road corridors or Crown water frontages are often the only remaining examples of indigenous biodiversity in agricultural landscapes.

Further information on the biodiversity values of Public Land are provided in Part B, Chapters 2 and 11, Biodiversity and Waterways and Wetlands, respectively, as well as the North Central Catchment Condition Report, 2003.

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Economic activity

Direct economic output from public land is substantial and varied. The major products are sourced from forestry production and extractive industries and include: timber from native forests and pine plantations; other forest products, such as honey, firewood and Eucalyptus oil; stone, sands, clay and gravel; and salt and gypsum. Public land also provides a range of services that add directly or indirectly to the regional economy. They include the provision of: water; visual amenity; recreational and tourism opportunities; corridors and sites for water supply, drainage, transport, power, mining and communications infrastructure and support sites of Indigenous and non-Indigenous cultural heritage. The total value of services generated by public land and its capital value are yet to be fully quantified.

Recent State Government decisions on the use and management of public land in the region have resulted in reduced areas of land being available for hardwood timber production and larger areas being available for nature conservation, recreation and tourism and protection of cultural heritage. Softwood plantations growing on public land are now owned and managed by private interests.

Water resources

Public land parcels in the south-east of the region are important catchment areas and generate significant volumes of surface water. Native vegetation across public land catchments and along Crown water frontages helps to maintain water quality, by filtering nutrients and sediment from inflows.

Public land in upper catchment areas of the Loddon and Campaspe basins also contain important recharge areas for mineral springs aquifers.

Landscape

Blocks of public land are often significant landscape elements. Land suitability and historical factors have meant that much of the land that was retained in public ownership is located in visually prominent positions: particularly along ridges and drainage lines and in frequently inundated areas.

Cultural heritage

Many of the remaining sites of Indigenous cultural significance are associated with the region's waterways and wetlands, which are generally public land. Public land also contains many important sites of non-Indigenous cultural heritage, including old

mine workings, public buildings and water resource infrastructure. Former gold diggings on public land in the Castlemaine area are to become a National Heritage Park.

9.4 Public land condition and threatening processes

The condition of public land and the value of services it provides are threatened by a range of landscape processes and cultural practices. Several of the threatening processes and their impact on the condition of public land are described below.

Salinity

Shallow groundwater and salinity discharge are major issues affecting the environmental values of many smaller blocks of public land and public land corridors, especially those in floodplain and other lower landscape positions. Many wetlands in both dryland catchments and irrigation areas, some of international significance, are either threatened by dryland salinity or have already been impacted.

The public land assets such as waterways and wetlands that are threatened by salinity are often located in lower landscape positions. Groundwater flow systems operating in these areas are mostly of a regional scale. Salinity processes may be effectively intractable in some areas because of the large scale of management response required and the slow catchment response to change.

Salinity may also impact on infrastructure, particularly roads, where corridors traverse saline or waterlogged land.

Ecological systems decline

Native vegetation communities and associated fauna populations on much of the public land in the region have been degraded by historical human activity, in particular, from mining, grazing and timber harvesting and symptoms of natural resource decline such as salinity. As a result there are few veteran trees, depleted understoreys and a lack of large woody debris and other habitats that are vital for many fauna species. Natural ecosystems on public land, particularly those in large blocks, are generally in better condition than those on private land. However, they remain vulnerable to a range of threatening processes.

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Small blocks and narrow corridors of public land are particularly vulnerable to pest plant and animal infestation and fragmentation.

Pest plants and animals

Pest plants and animals are a major threat to the environmental value of public land. Foxes and cats are major predators of small native resident mammals and birds. Public land, particularly that severely disturbed by historic land uses, is often dominated by pest plants and provides poor habitat for native fauna. Pest plants, particularly, also reduce landscape and recreational values.

Managing the impacts of pest plants and animals on public land and minimising impacts on adjoining freehold land continue to be important challenges in the North Central region.



Photo: Garry Cheers, NCCMA

A reduced number of hollow bearing trees on public land has contributed to the threatened status of the Squirrel Glider.

Inappropriate recreation

Public land provides many opportunities for recreation which do not have an adverse impact. However, some recreational activities can be detrimental when conducted inappropriately, such as off-road driving, trail bike riding, horseriding, off-track bushwalking, fossicking and prospecting, illegal shooting and illegal camping (coupled with associated littering problems). Inappropriate recreational uses are most concentrated in public lands adjoining towns and major provincial centres, as well as near streams and wetlands.

Inappropriate recreational activities can contribute to loss of understorey vegetation and habitat simplification, soil loss, water quality decline and weed invasion. Often associated with increased fire hazard, such high impact activities may also threaten both environmental and economic values of public land.

Changed flow regime

Many vegetation communities on public land in mid and lower catchment areas are highly water dependent – that is, their distribution and ecological processes are strongly influenced by flooding. Changes in water regime may be associated with changes in rainfall-run-off relationships in upper catchment areas, construction of banks and levees to alter flood pathways, or with irrigation or stock and domestic water management. These changes threaten habitat, ecological processes such as recruitment and succession and influence the suitability of lakes and wetlands for recreational uses.

Fire and changed fire regime

Although native vegetation communities within the region have adapted to and will generally survive wildfire, an extensive fire has potential to severely impact on populations of less mobile and/or strongly territorial fauna. Softwood plantations would be severely damaged by wildfire, particularly if too young for salvage logging. Wildfires may also impact on the amount and quality of surface water generated. High flows and poor water quality may follow fires if rainfall is relatively high during the following autumn and winter. Subsequent reductions in streamflow are unlikely to be as great as in some other forests (e.g. Mountain Ash).

The isolation of native vegetation remnants means they and the fauna they support are more affected by fire, should one occur, than larger, contiguous communities that prevailed pre-European settlement.

Infrastructure development

Public land has typically been used for infrastructure corridors. In mid and lower catchment areas, most public land comprises either wetlands or linear road or stream reserves. These often comprise the only substantial areas of native vegetation habitat. Careless development of infrastructure (e.g. road widening for public safety, installation of new energy or telecommunications infrastructure) in these areas has potential to damage or further fragment important native vegetation remnants.

Land management practice

Inappropriate forestry operations on public land and on road corridors and Crown water frontage may threaten service values of public land. Forestry operations on public and private land are governed by a Code of Practice¹⁷ which sets, for example,

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requirements for riparian buffers, forest roading and slope limits on logging. Failure to comply with this Code could result in soil erosion, site contamination and/or reductions in water quality.

Vandalism, rubbish dumping and illegal firewood collection are common practices on public land, particularly in areas close to towns and provincial centres. These practices threaten habitat, landscape and recreational values and may lead to contamination of water resources.

Crown water frontages and road reserves may be licensed to adjoining landholders and used for agricultural purposes. Cultivation and/or uncontrolled grazing may lead to the loss of any residual biodiversity values in such areas and reduce the effectiveness of stream frontages in filtering sediments and nutrients from overland flows.

Climate change

Regional public land assets are key reservoirs of biodiversity. Large public land blocks may provide vital bioregional-scale corridors of flora and fauna species responding to climate change. Climate change is likely to alter the regional water regime, including the size and timing of flows and flooding. Although the impacts of this are uncertain, it may add to the environmental stresses already experienced by the regions wetlands and floodplains.

9.5 Priority issues and management response

Priority issues for public land were defined by a comprehensive risk assessment process. This process considered the range of services provided, the likelihood of their being affected by various threatening processes and the potential impact on service values should threats be realised. The priority issues for public land are based on combinations of likely threats and the expectation of these resulting in a significant decline in service values. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

Priority issues for public land are based around threats to:

- ◆ habitat values and ecological function in vegetation communities
- ◆ generation of surface water and groundwater, particularly in upper catchment areas, in the quantities and at the quality required for human and environmental uses
- ◆ values and use of public land as infrastructure corridors
- ◆ visual and residential amenity.

Of the threatening processes listed above, it is considered that achievement of the goal for public land is most threatened by agents such as inappropriate land management practice and recreational use, salinity, changed water flow and fire regime, fragmentation and loss of native vegetation, development of new infrastructure, pest plant and animal infestation. Many of the threatening processes operate across the North Central region. However some threatening processes (e.g. salinity, changed flow regime) impact most on public land in mid and lower catchment areas.

Although climate change is recognised as a threat to public land, the risk assessment did not flag it as a priority issue, due to uncertainty about its impacts and because of the long time frame over which they are likely to be expressed. However, responses to the threat have been developed and are outlined in Part B, Chapter 3 Climate.

A series of responses to the priority issues for dryland have been developed (Table 19). They are mostly based on the relevant regional or sub-regional action plans, but include some actions that address key gaps in the current response. Responses are not necessarily comprehensive: some actions represent only the preliminary steps towards a more comprehensive longer term response. Several of the issues and proposed responses overlap with those relevant to assets other than public land. To avoid repetition, Table 19 only includes responses that primarily address public land issues. Other responses are given in the chapter for appropriate assets (as indicated in Table 19).

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The actions in Table 19 are grouped by implementation 'package'. These packages are simply complementary actions that address the priority issues for public land, particularly the main

threatening processes. Further details on implementation packages are given in Part C. Resource condition targets that link with each package are also indicated.

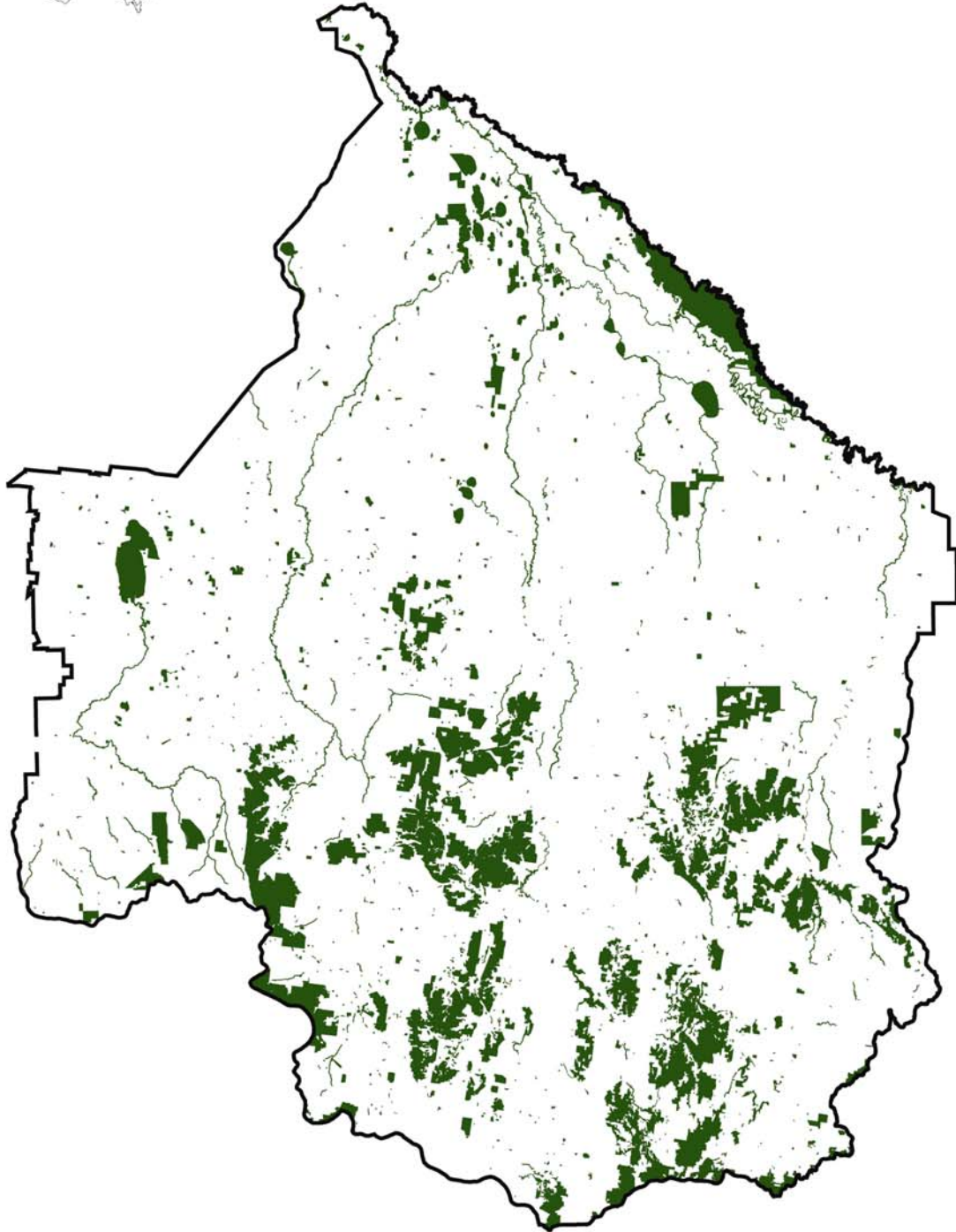
Table 19: Management actions and targets for public land

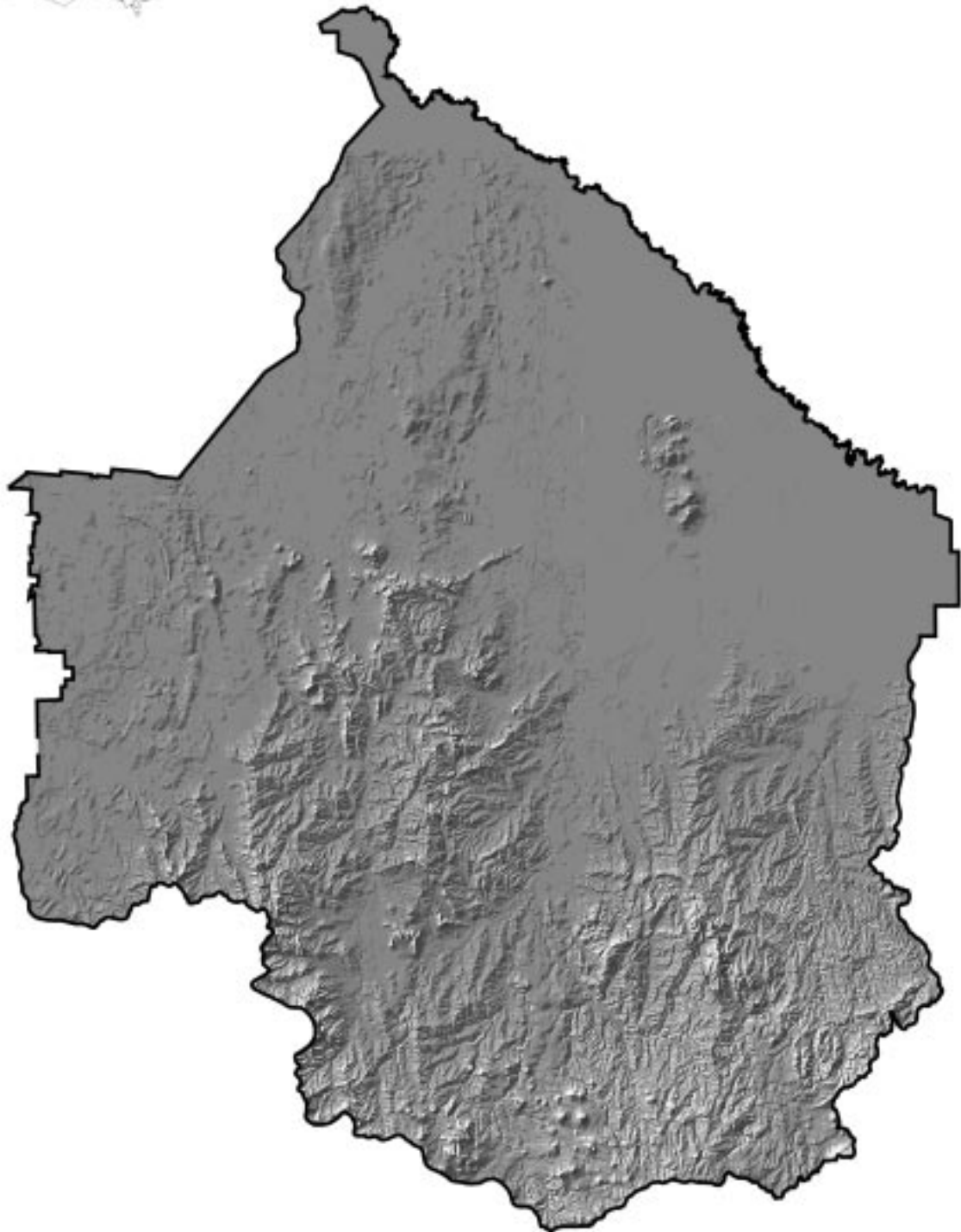
#	Management actions and targets	Key implementation agency(s)	Referring plans
Public Land Package 1: Sustainable management of public land			
This package is primarily concerned with the sustainable management of public land. In timber production areas, it is concerned with implementation of Forest Management Plans and Codes of Practice for Timber Production and Fire Management. In conservation and recreation reserves, it is concerned with implementation of Park Plans. Within these and other areas of public land it is concerned with ensuring management practice helps to achieve community and government environmental, economic and social objectives. Outcomes include protection of indigenous biodiversity, maintenance of the quantity and quality of surface water and groundwater resources and protection of landscape values.			
No specific public land RCTs are addressed by this package, although it does support the achievement of several that are more directly related to biodiversity and water resource assets.			
PL1	Implement forest management plans in all timber production areas on public land.	DSE/DPI	Midlands and Mid-Murray FMPs
PL2	Audited 95% compliance with Code of Forest Practice for Timber Harvesting in all hardwood and softwood forestry operations on public land from 2004.	DSE/DPI, HVP, EPA	Midlands and Mid-Murray FMPs
PL3	Develop and implement fire management plans or strategies for all conservation reserves and large blocks of public land by 2008.	DSE, CFA	
PL4	Implement existing management plans for parks and conservation reserves. Develop management plans for all major reserves with significant environmental and/or recreational values for which plans do not currently exist, by 2006. Consider dryland and/or irrigation salinity as required.	Parks Victoria, DSE	Park and Wetland Management Plans
PL5	Prepare environmental management plans for all new infrastructure developments on public land, having regard to biodiversity, river health, water resource and visual amenity values and potential impacts on threatening processes.	DSE/DPI, VicRoads, Local Government	
Public Land Package 2: Safe and environmentally sustainable fire management (also PL3)			
This package includes actions that specifically relate to the management of fire on public land. The actions included (also see Package 1) address implementation of the Code of Practice for fire management, safety issues, asset protection ecosystem function and maintenance of water quality.			
No specific public land RCTs are addressed by this package, although it does support the achievement of several that are more directly related to biodiversity assets.			
PL6	100% compliance with Code of Practice for fire management in management of public land from 2004.	DSE/DPI, HVP	
Public Land Package 3: Minimising impacts of pest plants and animals			
This package specifically addresses issues associated with the management or control of pest animals on public land. It seeks to do this from the perspective of reducing impacts on biodiversity, visual and recreational amenity values on public land itself and from the perspective of reducing the impacts of pest plant and animal populations on public land on the adjoining private land. No specific public land targets are addressed by this package, although it will help to achieve RCT DL13.			
PL7	Adapt Rabbit Action Plan and Weed Action Plan principles to public land by 2005 and implement strategic pest plant and animal control programs where public investment is warranted. Develop relevant management action and resource condition targets.	DPI/DSE, Parks Victoria	
Public Land Package 4: Managing the impacts of dryland and irrigation salinity on public land (see PL4)			
This package recognises the need for actions that address the threat faced by public land assets from salinity and shallow water tables. The main threatened public land assets include mid and lower catchment wetlands, Crown water frontages and road reserves in irrigation lands and in lower landscape positions in dryland areas. At this stage the only specific additional actions under public land that are proposed to address this threat is to incorporate salinity, where relevant, as an issue in park or other public land management plans. The package will benefit by actions under dryland and irrigation salinity packages.			
There are no specific public land RCTs that are addressed by this package.			

(continued page 78)

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Table 19: Management actions and targets for public land (cont.)

#	Management actions and targets	Key implementation agency(s)	Referring plans
<p>Public Land Package 5: Improving habitat and biodiversity values on public land (also PL1,2,4,5,7)</p> <p>This package comprises actions that lead to the maintenance and/or improvement of habitat and biodiversity values on public land. It includes: preparation of appropriate management plans, compliance with the code of practice for timber harvesting and implementation of weed and pest animal control strategies. The package addresses large blocks of public land including parks and other nature conservation reserves, state forests and linear reserves. It should help to avoid or reduce habitat fragmentation of remnant native vegetation on linear reserves.</p> <p>There are no specific public land RCTs that are addressed by this package, although it does support the achievement of several that are related to the biodiversity and dryland assets.</p>			
PL8	Apply net gain principles for native habitat on public land, for all infrastructure, mining, extractive industries and other developments from 2003.	DSE/DPI, VicRoads, Local Government	Native Vegetation Plan
PL9	Avoid development of any new utility corridors on roadsides supporting significant native vegetation from 2003.	DSE/DPI, Local Government, VicRoads	Native Vegetation Plan
<p>Additional action</p>			
PL10	Develop appropriate resource condition targets for large public land areas and appropriate monitoring program by 2004.	DSE/DPI, NCCMA	
<p>Additional dryland priority issues dealt with by management actions listed under other assets include:</p> <ul style="list-style-type: none"> ◆ Impacts of changed flow regime on flora and fauna habitat and amenity uses of wetlands and waterways (Water Resources) 			

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Cairn Curran Reservoir, 2003.



Photo: Matt Jackson, NCCMA

10.1 Goal

Water will be shared equitably between environmental and consumptive uses, water quality will match users' requirements and water will be used efficiently.

10.2 Resource condition targets

Twenty year target figures will be set for water resources in the first year of RCS implementation.

Some preliminary targets are shown below as examples, the actual target numbers are subject to technical review in the first year of the RCS. Regional targets are not available as the region has historically been managed as a series of separate systems and there is not an amalgamated data set. This will be addressed as part of the first year review.

Table 20: Resource condition targets for water resources

#	Resource condition target
RCT WR20	Reduce the frequency and duration of algal blooms as per the nutrient management plan targets for each river system.
RCT WR21	Achieve agreed Murray-Darling Basin 2015 within-valley and end-of-valley water quality targets. Meet SEPP Waters of Victoria chemical and physical water quality objectives on a high proportion of the region's streams. Meet water quality targets for regional River Health and Water Quality Strategies.
RCT WR22	Meet SEPP Groundwater water quality objectives.
RCT WR23	Full compliance with MDBC Cap on diversions and with Living Murray and other environmental flow allocations.
RCT WR24	Avoid long term reduction in level or pressure of water resource aquifers within groundwater management or water supply protection areas.
RCT WR25	Reduce the amount of water lost by evaporation and seepage during transportation and storage to realistic target figures to be developed by each water authority.
RCT WR26	Reduce per capita urban consumption by between 10% and 20% by 2010.
RCT WR27	Improve environmental and economic measures of water use efficiency on irrigated land.

10.3 Water resources: an overview of the asset and the services it provides

Surface water and groundwater resources

The region is an important part of the Murray-Darling Basin. It has a significant role in protecting downstream communities along the River Murray by managing salt loads, nutrients, floods and water diversions.

The River Murray is important enough to warrant being treated as an asset in its own right. However, it is included with other water resources in this section, because its services, and the threats to those services require the same management actions as those needed to manage the other water resources.

Water resources within the region occur as groundwater and surface water systems. Rivers include the Avon-Richardson, Avoca, Campaspe and Loddon. The Campaspe and Loddon flow into the River Murray, while the Avon-Richardson terminates at Lake Buloke and the Avoca discharges into the Avoca Marshes and Lake Boga near Swan Hill.

Lakes include Lake Buloke and Lake Batyo Catyo, near Donald in the region's far west, Lake Boort, Lake Meran, Kangaroo Lake, Lake Charm, Lake Lalbert and Lake Boga – all in the north. Reservoirs in the region include Lake Eppalock between Bendigo and

Heathcote, the Upper Coliban, Lauriston, Malmesbury, Hepburn Lagoon, Newlyn, Cairn Curran, Tullaroop and Laanecoorie, all of which are situated in the upper catchment area.



Photo: NCCMA

Lauriston Reservoir, upper Campaspe catchment.

Groundwater occurs within shallow shoestring sands (Shepparton Formation) of the Riverine plain to the north. In the north west Mallee area the shallow aquifer is the saline Parilla Sands aquifer. The quality of groundwater improves further south. Deep leads in the Loddon and Campaspe basins (Calivil/Renmark aquifer) provide medium to good quality water. Within upper catchment areas, water resource aquifers may occur in the new Volcanics, Quarternary alluvial deposits and the aquifers of the Palaeozoic basement rocks. Groundwater of suitable quality is used extensively for stock, irrigation and for town water supplies.

Table 21: Water resources of the North Central region

Water source by river or groundwater	Approximate annual volume of regional water resource (ML/yr)	Approximate average allocated consumption for economic activity within the region (ML/yr)
Murray	River is outside of region, but water is imported for irrigation within (Torrumbarry and Murray)	600,000
Goulburn	River is outside of region, but water is imported for irrigation within (Rochester, Campaspe, Pyramid, Boort).	550,000
Loddon	263,000	150,000
Campaspe	315,000	140,000
Avoca	85,000	5,000
Avon Richardson	30,000 (est.)	
Groundwater ^{viii}	120,000 (most too saline)	60,000
Locally harvested surface water in dams	(not included in total)	–
Waste water	15,000	6,000
Total	828,000	1,511,000

Source: Australian Bureau of Statistics 2000, *Water Account for Australia* (calculated irrigation usage figures, estimates of wastewater flows). Groundwater data from *Water Victoria: A Resource Handbook*.

^{viii}Goulburn-Murray Water submission on the Draft North Central Regional Catchment Strategy

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Groundwaters in some Palaeozoic basement rocks in upper catchment areas are the basis of the region's valuable mineral springs industry. This area has approximately 80% of Australia's mineral springs, including some south of the divide. Mineral springs and other local features draw over 100,000 people to the Daylesford area each year, a figure that has been growing by 10% per year.

Table 21 illustrates the scale of the resource. Salinity and water quality decline threaten the value of this asset. The groundwater resource is many times greater than that shown in this table – however much is too saline for economic extraction.

Regional consumptive use of water greatly exceeds the volume harvested. More than 75% of consumptive use comes from water imported from the Goulburn and upper Murray catchments. Some water used in the west of the region is imported from the Wimmera system.

Environmental and non-consumptive uses

Environmental or non-consumptive uses of water include flows for the environment, recreation and its habitat value. This aspect is covered in greater detail under in Part B, Chapter 11, Waterways and Wetlands.

Consumptive uses

Consumptive use includes mineral water, domestic and stock, town water supplies, fire fighting and irrigation. By far the biggest use is irrigation, which accounts for more than 95% of the water consumed in the region and 85% of that harvested. Most imported water is drawn from the Murray and Goulburn catchments and most locally harvested water is taken from the Loddon and Campaspe catchments. Services that flow from the use of water for irrigation are described in Part B, Chapter 8 – Irrigated land.

Urban water supplies are crucial to the catchment community, industry and regional development. Urban and industry users use approximately 40,000 ML/year. This use occurs across the region as follows:

- ◆ Coliban Water services approximately 130,000 people in the region, most of whom are in Bendigo, Castlemaine and Echuca. At 0.23 ML/year/person this is 30,000 ML per year.
- ◆ Central Highlands services approximately 22,000 people in the region, most of whom are in

Maryborough and Daylesford. At 0.16 ML/year/person this is 3,500 ML per year.

- ◆ Lower Murray Water services approximately 18,000 people, mostly in Kerang and Swan Hill. At 0.3 ML/year/person this is 5,000 ML per year.
- ◆ Grampians Water services approximately 6,000 people, mostly in Wycheproof, Charlton, St Arnaud and Donald. At 0.22 ML/year/person, this is 1,000 ML per year.
- ◆ Western Water services approximately 4,000 people, mostly in Woodend. At 0.19 ML/year/person, this is 800 ML per year.

Urban usage varies with rainfall and evapotranspiration. Consumption is lowest in the Central Highlands in the south of the region and highest in the Lower Murray area in the north. The consumption per head is similar to the regional Victorian average of 0.23 ML/year/person and, as would be expected due to climatic differences, is higher than the Melbourne usage of 0.13 ML/year/person.

Waste water from urban sewerage and industry is increasingly being seen as a community resource to be used for irrigation rather than to be disposed. The volume of wastewater produced in the region is estimated to be approximately 15,000 ML/year, of which less than half is recycled by irrigation. Treated wastewater can have high nutrient loadings, which can benefit agriculture but are a detriment if released into waterways.

10.4 The condition of water resources and the threatening processes

Water allocation and trade

The volume of water used for irrigation is declining as water is traded to other areas (as covered in the Irrigated Land chapter). This means less water is imported from the Goulburn and Murray systems rather than lower demand from regional resources.

Irrigation demand for regional water resources is expected to continue to grow alongside the trend to irrigate tree crops such as olives, vines and more intensive land use in peri-urban areas. However, the recent farm dam legislation will provide a 'cap' to this growth. New irrigation will need to source water from other areas through water trade.

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Bulk water entitlements and stream flow management plans for surface water and permissible annual volumes for groundwater provide the State's framework for sharing the resource. These frameworks are being implemented to provide clearer definitions of entitlements to water. They are fundamental to proper water resource sharing and management.

Bulk entitlements have been prepared for the Campaspe and are in preparation for the Loddon, Avoca, and Avon-Richardson. Groundwater investigations enabled 7,000 ML of additional water being auctioned in 2002 from the Loddon Deep Lead. The development of a new groundwater management plan for this area has also been initiated.

These frameworks provide opportunities to change current flow regimes to better achieve aquatic and floodplain environmental outcomes. Balancing this with consumptive requirements, and providing 'water savings' is a challenge that could generate benefits all round.

Projects to reduce water losses such as evaporation and seepage are becoming more important e.g. pipelining of channel systems. This can also impact on recreation or environmental values, for example, when lake systems are 'by-passed'. Similarly, wastewater recycling is expected to continue.

Salinity

Salinity has a major impact on the value of water resources. Without intervention, it is likely that the salinity levels of surface waters generated in the upper and mid catchment areas will continue to increase. This will impact on aquatic biodiversity and consumptive users. Horticultural production is considered to be most sensitive to irrigation salinity, but it may also increase other irrigation, industry and domestic users' costs.

Water quality in many smaller streams is already affected by salinity. Annual salt exports from large parts of the dryland region range between 150 and 300 kg/ha, but may be as much as 1000 kg/ha or more from some smaller sub-catchments.

The region is accountable for the salinity impact of its irrigation areas on the River Murray. The irrigation areas are currently using 2.13 salt disposal entitlements (EC units), but this is expected to

increase to 9.62 as future works are implemented¹⁸.

End of valley targets have been proposed for dryland areas of the Avoca, Loddon and Campaspe catchments under the Murray-Darling Basin Salinity Management Strategy. Interim 15-year targets require that the year 2000 salinity and salt loads should not be increased by more than 1 – 3% (depending on location).

Water quality decline

Nutrient levels are already high in surface waters and this region has the highest incidence of blue green algal blooms in Victoria. The future cost of algal blooms without any water quality management is estimated to be \$10 – \$20 million per year. Recreation, tourism, domestic, stock and irrigation users will incur costs. There will also be additional costs in terms of reduced biodiversity. Blue green algal blooms also pose a public health risk.

As well as algae, nutrients and salinity, other water quality concerns include turbidity, bacteria, pathogens, organic pollution, heavy metals and chemical contamination.

Water quality decline is a major issue for groundwater resources, as well as surface water. This is particularly true in the mineral springs areas and those parts of the region where groundwater is the main source of urban water supply. This means that the management of recharge areas for water resource aquifers is crucial.

Urbanisation and increasing intensification of agriculture are increasing the risk of polluted run-off. However, implementing programs to arrest water quality decline is expensive. In some area, the cost of implementing the programs exceeds the benefits and programs will need to be strategically targeted to provide the greatest benefit for the resources available.

Many of the pollution risks are incremental in nature, no single development will be the cause of any problem. Waterway pollution can be the cumulative impact of a large number of small developments. Restoration can be slow and expensive as it involves addressing a large number of small projects. Therefore, any new development must be required to implement best practice for the management of polluted run-off.

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Population growth/rural residential

Urban demand for water is expected to grow as population increases in the major centres such as Bendigo, Castlemaine and Echuca. This has to be contained within the bulk entitlements. Growth in demand will ultimately need to be met by transfers of water between users (i.e. water trade), as there is almost no scope for further harvesting. This means the pressure to improve water use efficiency by both supply systems and users is increasing.

Urban and rural residential growth and insensitive or inappropriate development increases the potential for water quality decline in surface and groundwater resources. Growth must be managed to minimise these risks.

Pest plants and animals

Pest plants and animals are issues for water resources as well as land. Carp and aquatic weeds pose significant threats to the resource and need to be managed to avoid future costs.

10.5 Priority issues and management response

A risk assessment considers both the consequence and likelihood of services being adversely affected by threatening processes. A risk assessment for water resources was used to identify priority issues and as the basis for developing the management response². Threatening processes which pose the highest risk include:

- ◆ water allocation and trade impacting on water availability for flora and fauna, recreation and tourism, irrigation, groundwater and environmental services (or beneficial use).

- ◆ pest plants and animals (e.g. carp and aquatic weeds) impacting on the water quality and availability for services
- ◆ salinity for irrigation and groundwater services
- ◆ water quality decline affecting all water services.

The significance of each issue varies across the region. Water quality decline affects the services offered by water resources across the entire region. However, water allocation and trade mostly affects lower catchment irrigation areas.

A series of responses to the priority issues for water resources have been developed (Table 22). They are mostly based on the relevant action plans, including the Water Quality and Nutrient Management strategies and plans, and the Loddon-Murray Land and Water Management Strategy. Some actions address key gaps in the current response. Table 22 only includes responses that primarily address water resource issues.

The actions in Table 22 are grouped by implementation 'packages'. These packages are simply complementary actions that address the priority issues for water resources, particularly the main threatening processes. Further details on implementation packages are given in Part C. Resource condition targets that link with each package are also indicated.

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Table 22: Management actions and targets for water resources

#	Management actions and targets	Key implementation agency(s)	Referring plans
<p>Water Resources Package 1: Water Quality.</p> <p>This addresses water quality for urban, irrigation and commercial users and the environment. It largely comprises implementation of key actions under water quality strategies and nutrient management plans at a regional or river basin scale. Implementation activities include physical works, stakeholder engagement processes and capacity building activities.</p> <p>The package addresses RCT WR20, 21 and 22</p>			
WR1	Finalise nutrient management strategies and nutrient action plans for Campaspe, Loddon, Avoca and Avon-Richardson catchments. Implement agreed annual works and extension program from 2003.	NCCMA	Water quality strategies and nutrient management plans
WR2	Develop and implement stormwater management plans in all local government areas by 2008.	NCCMA, Local government	Water quality strategies and nutrient management plans
WR3	Achieve 100% routine reuse/recycling of water from waste water treatment plants (unless water treated to appropriate SEPP Waters of Victoria standard) from 2005.	EPA, urban water authorities	Water quality strategies and nutrient management plans
WR4	Work with local government to ensure all new development approvals include conditions requiring best practice for controlling pollution of drainage water by 2005. Also ensure all high priority domestic water supply catchments, domestic water aquifer intake areas are included in local planning schemes and appropriate planning controls are introduced to prevent inappropriate development. By 2005	NCCMA, local government, water authorities	Municipal Planning Schemes
<p>Water Resources Package 2: Water Sharing (Allocation) and Trade.</p> <p>This addresses water allocation shares for urban, irrigation, commercial and also non-consumptive use such as the environment. The package complements Waterways and Wetlands Package 2: Maintaining and restoring appropriate flow regimes, particularly WW8-10.</p> <p>The package addresses RCT WR23 to 26.</p>			
WR5	Effective farm dam licensing and planning control system in place in upper and mid catchment areas by 2004. Ensure sustainable diversion limit (SDL) recognised as upper limit for allocation in each SDL sub-catchment by 2004.	DSE, WMW, GMW,	Streamflow management plans, Bulk Entitlements
WR6	Develop and implement management plan for mineral springs recharge area by 2005 to ensure protection of yield, water quality and associated water harvesting and tourist industries.	DSE, Local government, GMW	Municipal planning schemes
WR7	Develop and/or implement management plans for all groundwater management/water resource protection areas within the North Central region. These plans should also include water quality protection through management of recharge areas as per Package 1.	GMW, DSE	Groundwater management plans, Municipal planning schemes
WR8	Fully comply with the MDBC cap on diversions in each of the river basins of the North Central region	DSE, GMW, WMW	

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Table 22: Management actions and targets for water resources (cont.)

#	Management actions and targets	Key implementation agency(s)	Referring plans
<p>Water Resources Package 3: Water Salinity</p> <p>This addresses water salinity for urban, irrigation and commercial users and the environment. The primary focus of the package is on meeting regional requirements under the Murray-Darling Basin Salinity Management Strategy. Its main focus is on lower catchment irrigation areas.</p> <p>The package addresses RCT WR21.</p>			
WR9	Manage salt disposal infrastructure to meet agreed water quality targets and maximise economic opportunity for lower catchment irrigation regions, as per agreed actions under water management program (salt interception project) of Loddon Murray Land and Water Management Strategy.	GMW, DPI/DSE	Loddon Murray LWMS
WR10	Define appropriate within- and end-of-valley water quality targets (for salinity and nutrients) and monitoring sites for Campaspe, Loddon, Avoca and Avon-Richardson river basins and supporting surface water monitoring program by 2004.	NCCMA, GMW, WMW, DPI/DSE	Dryland SMP, Loddon Murray LWMS, Water Quality Strategies
WR11	Implement agreed five year works program under the irrigation supply system management and surface drainage management projects of the Loddon-Murray LWMS to protect water resources from salinity. Also implement priority irrigation and drainage programs under the Shepparton Irrigation Region Catchment Strategy.	GMW, DPI/DSE	Loddon Murray LWMS, SIR Catchment Strategy
<p>Water Resources Package 4: Water Resource Efficiency.</p> <p>The purpose of this package is to identify and where feasible address opportunities for water savings. It applies primarily in the lower catchment irrigation areas, but also includes urban water users.</p> <p>The package addresses RCT WR25, 26 and 27.</p>			
WR12	From 2003, implement recommendations of Kerang-Swan Hill Future Land Use pilot project to minimise loss of water and associated economic and environmental opportunity through water trade out of region.	GMW, DPI/DSE	Loddon Murray LWMS
WR13	Develop portfolio of regional water savings projects for irrigation, stock and domestic and/or urban supply systems by 2005. Implement agreed priority projects from 2006.	DSE, rural and urban water authorities	
WR14	Implement community education and other mechanisms to encourage reduced urban water consumption and reduced losses of water in supply systems.	Urban water authorities	
<p>Water Resources Package 5: Pest plant and animal management for water resources.</p> <p>The package addresses pest plant and animal issues associated with water supply infrastructure.</p> <p>This package addresses RCT WR24.</p>			
WR15	Identify and achieve long term control of all infestations of regional priority and other problem weeds and pest animals such as carp in irrigation supply channels and waterways.	G-MW, NCCMA	Weed Action Plan, Rabbit Action Plan
<p>Additional water resource priority issues dealt with by management actions listed under other assets include:</p> <ul style="list-style-type: none"> ◆ Impacts of water allocation and trade on flora and fauna, recreation and tourism and environmental flow (WW6,8-11) 			

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Bells Swamp (2000), upper reaches of the Loddon catchment.



Photo: Geoff Paik, NCCMA

11.1 Goal

Waterways and wetlands will be managed to enhance their environmental function and, where appropriate, provide opportunities for economic, recreational and amenity use.

11.2 Resource condition targets

This chapter outlines some of the management actions that are needed to achieve the goal for waterways and wetlands. Resource condition targets (Table 23) have been developed to show how these management actions will influence the condition of the region's waterways and wetlands over the next

10 – 20 years. The targets listed in Table 23 include only those that relate directly to waterways and wetlands. Those relating to water quality are given in Part B, Chapter 10 – Water Resources.

The management actions described in this chapter will also influence the condition of other assets, particularly biodiversity and water resources. Links to related resource condition targets are given in Table 24.

Table 23: Resource condition targets for waterways and wetlands^{ix}

#	Resource condition target
RCT WW28	Significant improvements achieved in environmental flow regimes of five high value reaches currently flow stressed through Bulk Entitlement (BE), Stream Flow Management Plan (SFMP) and the Living Murray Processes.
RCT WW29	An increase of 300 km in the length of rivers in excellent or good condition, as assessed by the Index of Stream Condition (ISC).
RCT WW30	Improvement of one point in ISC riparian condition score for at least 500 km of stream length.
RCT WW31	Overall improvement in ISC rating of 1000 km of streams.
RCT WW32	95% of all upland and 60% of all lowland monitoring sites will meet SEPP environmental quality objectives.
RCT WW33	Improvement in condition of high environmental value wetlands, as measured by the Index of Wetland Condition (in development).
RCT WW34	No further decline in the extent of wetlands within the region.
RCT WW35	Reduce long-term average annual economic losses due to flooding by 25%, relative to the no-intervention scenario.

^{ix} The North Central River Health Strategy has not yet been finalised. Targets may be revised following completion of that strategy.

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11.3 Waterways and wetlands: an overview of the asset and the services it provides

Definition

Waterways, wetlands and floodplains are those parts of the region's natural landscapes where water collects and through which it flows. The asset includes the Campaspe, Loddon, Avoca, Avon and Richardson rivers, their tributaries and the region's lakes and wetlands. This asset class focuses on the habitat provided for riparian, wetland and aquatic ecosystems and their function in conveying and retaining water. The biodiversity of these habitats is dealt with under that asset class and the quantity and quality of water conveyed or stored by wetlands and waterways is dealt with under Water Resources (Part B, Chapter 10).

Waterways, wetlands and ecosystem services

Waterways, wetlands and floodplains are key life support systems in their own right and help to protect water resources. In doing so they provide a range of ecosystem services. These services include:

- ◆ maintenance or improvement of water quality – riparian vegetation helps to capture sediment and nutrients in surface run-off and reduces the amount entering streams. It also helps to stabilise stream banks and reduce the contribution of bank erosion to sediment load
- ◆ maintenance of channel form and flow capacity – the roots of riparian vegetation help to stabilise stream banks and maintain channel morphology. This helps to slow channel migration and maintain the capacity of the stream to convey water
- ◆ provision of habitat – wetland and waterways are focal points for mobile fauna in a generally dry landscape. They provide refuge in summer and during times of drought. Riparian vegetation also modifies aquatic habitats by providing shade and woody debris
- ◆ provision of energy and nutrients for aquatic ecosystems – leaf litter from riparian vegetation is a key source of carbon and nutrients for aquatic ecosystems. They collect sediment, build soils, recycle nutrients, assimilate wastes and filter water

- ◆ soil formation – silt carried by streams during overbank flood events helps to build up soils on floodplain area. Many of the region's most productive agricultural soils are located in such areas.

Nature conservation

Many of the region's wetlands, particularly those in mid and lower catchment areas, have international conservation significance. The Kerang Wetlands and Gunbower Forest have been listed under the International Convention on Wetlands (the 'Ramsar Convention'). Other wetlands are significant at national or state level. Many wetlands attract birds that are protected by international migratory bird treaties, such as JAMBA, CAMBA (and the Bonn Convention). While the treaties are concerned with protection of the bird species, they do require government to protect habitat.

Waterways and wetlands are often the only areas of retained native vegetation in mid and lower catchment areas of the region. However, even these communities are mostly substantially depleted and have high conservation status. They also provide habitat for native fish and water birds.

Cultural heritage

The availability of water and food meant that waterways and wetlands have been focal points for human populations for millennia. These places retain great cultural significance for Indigenous communities. A number of Aboriginal and archaeological sites have been identified across the region and registered on the Aboriginal Affairs Victoria database. These sites may include isolated artefacts, rock shelter/caves, burial sites, shell middens and scarred trees. Kow Swamp is a particularly important regional archaeological site.

Recreation and amenity

The region's natural lakes and wetlands provide important recreational opportunities to tourists and members of the local community. They are used for fishing, boating, swimming, bird watching, camping, as meeting places and for hunting. In drawing visitors to an area, they can contribute to economic activity. Recreational fishing alone has been estimated to inject \$78 million/y into the economy of north-west Victoria.

During the hot and dry summers of the region's north, the availability of water (outside of some extended

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drought periods) and shade improve the amenity of rural living. These values are also reflected in increased pressure for rural residential development and higher property values for residences along waterways and lakes, particularly in lower catchment areas.



Photo: Angela Gladman, NCCMA

In addition to other services, waterways provide aesthetic and recreational values to regional communities.

Flooding

The region's floodplains are the natural paths by which floods are conveyed to the River Murray or lower catchment lakes and wetlands. Development on floodplains has resulted in average annual damage bills from flooding, running to over \$23 million.

Flooding is an important natural process in lowland river systems. It helps to maintain channel form and is often an essential ingredient for regeneration events. Periodic flooding also flushes salts from the root zone of riparian and floodplain vegetation and is essential in preventing the soils from becoming salinised.



Photo: NCCMA

A flooded Axe Creek, November 2000.

Salt disposal

Several of the region's wetlands are used for salt disposal. Salt interception schemes involving Lakes Tutchewop, Kelly, Little Kelly, and William, near Kerang, contribute to a 13 EC unit reduction in River Murray salinity (measured at Morgan in South Australia). While damaging to the natural environment of these wetlands, this use provides substantial

benefits for downstream communities and helps to protect irrigated agricultural land, the River Murray and other waterways and wetlands from the effects of salinity. Wetlands used for salt disposal may also present opportunities to develop commercial salt or mineral harvesting or saline aquaculture enterprises.

Some streams in the lower catchment irrigation areas form part of the regional drainage network and help to protect adjacent land from waterlogging and salinity. There has been a dramatic reduction in natural wetland area since European settlement. Thirty-seven percent of Victoria's wetland area has been lost, primarily as a result of drainage¹⁹.

Water supply infrastructure

Many of the region's lakes and waterways have been incorporated into the supply network for domestic, stock and irrigation water supplies. This has resulted in substantial changes to the character and values of a range of wetlands due to the change in hydrology. Some wetlands experience more frequent wetting cycles and even permanent inundation, whilst other wetlands have been cut off from supply and are subject to much drier regimes.

11.4 The condition of waterways and wetlands and threatening processes

There are 6,400 km of major waterways within the North Central region, not including the length of the River Murray that forms its northern boundary. There are 85,000 ha of wetlands and 500,000 ha of land subject to inundation in a 1-in-100-year flood.

The waterways, wetlands and floodplains of the North Central region have been degraded by a range of processes, including historical mining and clearing operations, agriculture, irrigation and water supply development. Many have been transformed by urban development, irrigation and water supply infrastructure, drainage and changes in flow regime. Some of these wetlands have adapted to long term changes in their environment and now offer a different suite of values and services that need to be protected.

The Index of Stream Condition (ISC) is a comprehensive measure and incorporates assessments of stream hydrology, physical form, riparian habitat, water quality and aquatic biodiversity. ISC assessments were undertaken for the rivers and

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major tributary streams contained within the North Central region in 1999. They showed that the region's streams are predominantly in poor to very poor condition. Across the North Central region only 2% of the waterways are considered to be in a good condition; 45% are in a marginal condition; 36% poor and 17% in very poor condition. There are no waterways considered to be in excellent condition.

The following discussion highlights some of the factors that contribute to this state.

Salinity

Waterways, floodplains and wetlands are characteristically located lower in the landscape where they are most exposed to threat from elevated water tables and direct saline discharge. Many of the larger lake and wetland systems (e.g. Lake Buloke, Avoca Marshes) are also end points of surface drainage networks. They are effectively 'sumps' into which the salt carried by streams is deposited.



Photo: NCCMA

Aerial view of Ramsar-listed Second Avoca Marsh – Kerang Wetlands (1998).

Changes in rainfall run-off relationships in upper catchment areas (due to clearing and poor pasture and soil cover) has resulted in increased frequency of waterway flooding and lake filling events. Enhanced flood recharge has led to groundwater mounds forming below some lakes (e.g. Lake Buloke) and floodplains (e.g. Avon River, lower Richardson River, Avoca floodplain at Glenloth). In the lower reaches of the Richardson catchment, water tables are so shallow that they have extensively damaged floodplain and wetland environments.

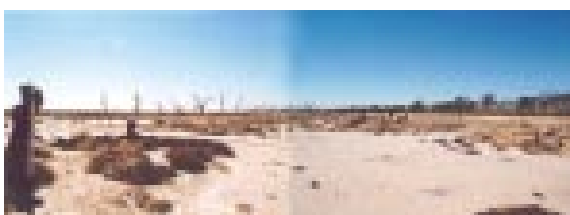


Photo: Craig Clifton

Symptoms of severe dryland salinity at Lake Buloke

Shallow regional water tables have also developed in and around lower catchment irrigation areas for the Avoca, Loddon and Campaspe riverine plains. This has resulted in groundwater intrusion, more prolonged water-logging of wetlands and floodplain depressions, and gradual salinisation as the opportunity for leaching of salts during flood events is diminished.

Altered hydrology

Flow regimes across the region have been changed by river regulation, groundwater flow, altered surface drainage patterns and changed rainfall run-off relationships. The impact of these changes is pronounced on floodplains, waterways and wetlands.

The flow in a river is fundamental to its ecosystem, providing habitat for many organisms and supporting a variety of critical ecological processes. This aquatic ecosystem can be threatened when significant alterations to the natural flow regime occur, through changes in magnitude, timing and duration of flows²⁰. Changed flow and flooding regimes (and construction of artificial levees) have resulted in some wetlands and floodplain becoming isolated from flooding flows. The increasing aridity and concentration of salt associated with this has created gross changes in species composition and ecological function in some areas (e.g. Avon Plains lakes).

In other areas, changed water regimes associated with the use of wetlands in water supply systems have transformed ephemeral waterbodies into (almost) permanent bodies of open water. While this may favour some species and provides improved recreational opportunity, it is to the detriment of the original wetland ecosystem and may contribute to salinisation of surrounding areas.

Drains have been constructed in some wetlands in basalt plains areas of the upper Loddon catchment to enhance agricultural values. Direct damage by agricultural use and reductions in the extent and duration of inundation have both contributed to their decline.

Other wetlands have been used as drainage disposal basins and as a consequence, water levels have been maintained at artificially high levels. This has impacted on wetland values, particularly for ephemeral wetlands.

Transfer of water entitlements out of irrigation districts, environmental flow initiatives (e.g the Living Murray²¹), water savings initiatives and increases in

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water use efficiency means that wetland water regimes may change, particularly where they form a part of the water distribution, storage or drainage system. While the current water regime may not be natural, change due to transfer of water can threaten wetland values that may have developed as a result of long-standing water regime alterations.

The North Central region forms part of the Murray Darling Basin, with the Loddon, Campaspe and Avoca Catchments all contributing flows to the River Murray. Consideration will be required to assess the contribution of flows from these river systems to the overall environmental flow needs of the Murray through the Living Murray process²¹. The Living Murray process has the potential to provide river health benefits to the region's waterways through improved environmental flow regimes. The Victorian Water Management Framework, that includes processes such as the Bulk Entitlement process for regulated streams, Stream Flow Management Plans for unregulated streams and the Stressed River Process for flow stressed rivers, will also consider requirements for environmental flows with linkages to the Living Murray process.

Current climate change scenarios for the region suggest that the amount, seasonal distribution and variability of rainfall will alter. While this will influence flow regime in streams, the nature of the changes and their impact on waterway and wetland ecosystems is difficult to predict.

Fragmentation and ecological systems decline

Decline in ecological function of waterways and wetlands is both a consequence of other threatening processes and a cause of further decline. Direct actions, such as clearing, cultivation, grazing, drainage and the construction of artificial levees, has isolated remnant vegetation and dependent fauna from other populations and the water that is integral to ecological function. This increases the risk of predation and weed invasion, reduces reproduction and recruitment and has over time resulted in the simplification of ecosystems.

Loss of riparian vegetation and removal of woody debris from streams impairs the function of aquatic ecosystems. This is exacerbated by increased water salinity, reduced flows and elevated nutrient concentrations. Deposition of sediment, sand and gravel in upper catchment streams reduces the quality of instream habitat and can lead to further simplification of ecosystems.

Water quality decline

Water quality decline, particularly nutrients, has impacted on the ecological and recreational value of lakes and streams. Blue green algal blooms occur frequently and regularly in waterbodies throughout the region, with some waterbodies almost permanently in bloom. Major sources of nutrients include run-off from agricultural land, stream and gully erosion, discharge from waste water treatment plants, dairy shed effluent and runoff from urban areas. Upgrades to wastewater treatment plants have reduced contributions from this source. However, inputs from intensively developed agricultural lands and urban areas are increasing.

Surface water monitoring stations indicate that water quality often fails to meet the State Environmental Protection Policy water quality objectives, particularly for nitrogen, phosphorus and electrical conductivity (salinity).

Low off-takes from reservoirs can also cause cold water pollution, which can disrupt freshwater ecosystems. While locally significant, this issue only affects reaches downstream of major storages in the Campaspe and Loddon catchments.

Inappropriate recreation

Wave action from water skiing and boating activities can cause bank erosion, and fuel and oil use or spillage can create water quality problems. Illegal camping and associated littering and other issues can also contribute to losses in water quality and riparian vegetation. The impact of inappropriate recreation on water quality is particularly an issue in those storages that are used for urban water supplies.

Inappropriate adjoining land management

Inappropriate land management and development can impact on the condition of riparian vegetation and change surface and sub-surface drainage flows into streams and wetlands. The most threatening activities include irrigation developments, grazing, cultivation, land clearing and residential developments that include septic tanks and/or alteration of drainage patterns.

Water trade, increased rural living demand and lack of awareness have increased exposure to this threat.

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Population growth/rural residential development

Visual amenity and recreational opportunity is resulting in increased residential development around lakes in lower catchment areas and around Lake Eppalock. This development, if not properly controlled, can be a threat to ecological and cultural heritage values and to water quality.

Pest plants and animals

Pest plants and animals threaten terrestrial and aquatic ecosystems and water quality. European carp are a particular nuisance, by diminishing water quality and displacing native species. Aquatic (e.g. Parrot's Feather, Arrowhead) and terrestrial (e.g. willows, blackberries) weeds also displace native species, reduce ecological values of waterways and wetlands and affect flow characteristics.

11.5 Priority issues and management response

Priority issues for waterways and wetlands have been defined by a comprehensive risk assessment process. This process considered the range of services provided, the likelihood of those services being affected by various threatening processes and the potential impact on service values should the threat be realised. The priority issues for waterways and wetlands are based on combinations of likely threats and the expectation of a significant decline in service values. The outputs from the risk assessment process are given in the North Central Catchment Condition Report².

Priority issues are based on threats to:

- ◆ habitat values and ecological function in riparian, floodplain and wetland fringe vegetation communities and to aquatic ecosystems
- ◆ Indigenous cultural heritage, particularly sites of archaeological significance
- ◆ recreation, tourism and visual amenity
- ◆ flood protection
- ◆ water supply infrastructure
- ◆ salt disposal.

These services are threatened by agents such as land use change, inappropriate land management practice and recreation, fragmentation and loss of native vegetation, salinity, soil erosion and declining water quality, pest plant and animal infestation, changed flow regime and the impacts of historical mining activities. When combined with failure to strategically intervene to protect river health and water quality, these threats represent the main impediments to achieving the sustainability goal for waterways and wetlands. While the majority of threats operate across the region, a significant proportion relate to either lowland streams and wetlands in mid and lower catchment areas, including irrigation areas (e.g. changed flow regime).

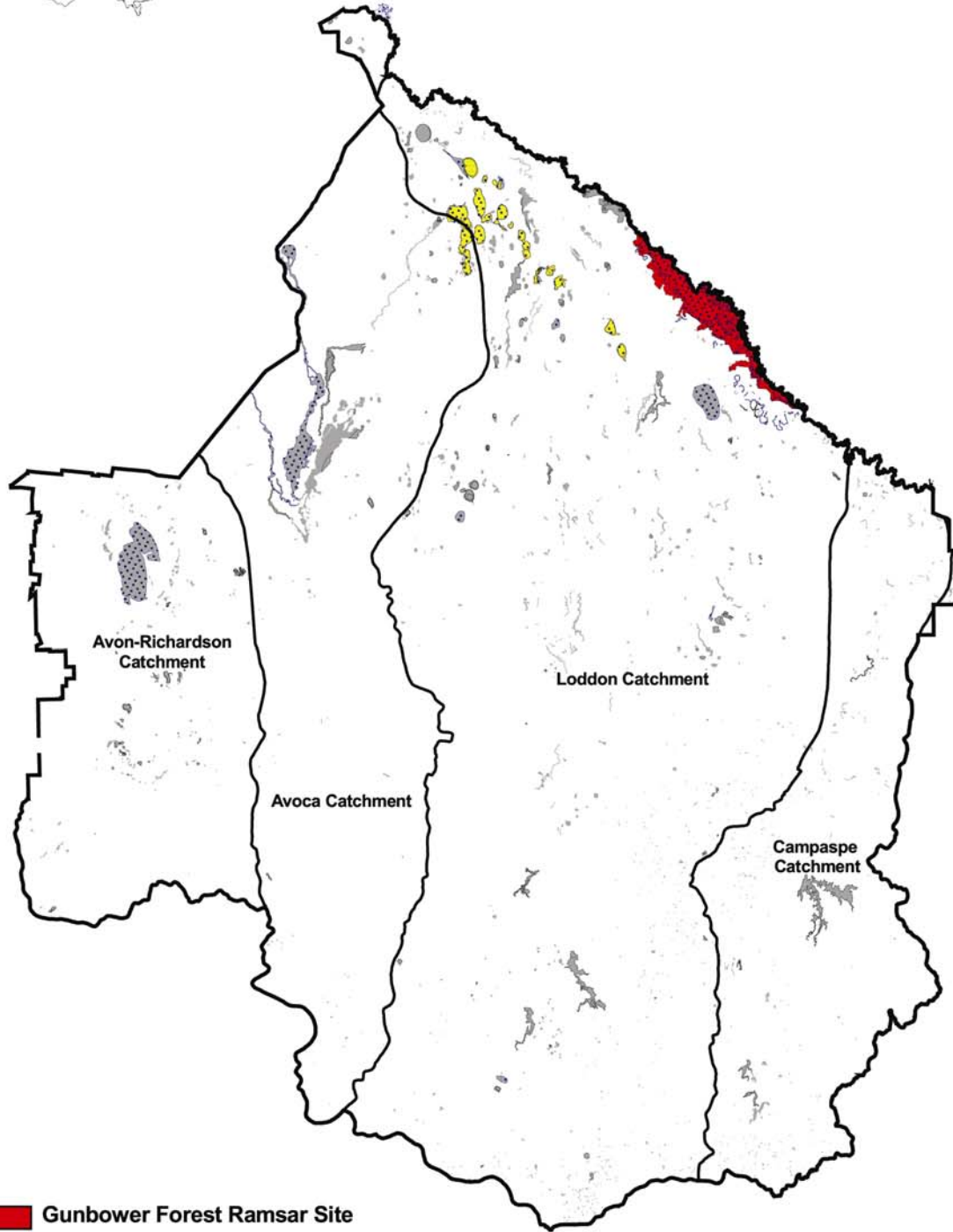
A series of responses to the priority issues for waterways and wetlands have been developed (Table 24). They are mostly based on the relevant regional or sub-regional action plans, but include some actions that address key gaps in the current response. Responses are not completely comprehensive. Some actions are only the preliminary stages of a longer term response to an issue. Several of the issues and proposed responses overlap with those relevant to other assets. To avoid repetition, Table 24 only includes responses that primarily address waterway and wetland issues. It covers environmental water regimes, but not water quality, which is described in Part B, Chapter 10 Water Resources. Other responses are given in the relevant chapters (as indicated in Table 24).

The actions in Table 24 are grouped by implementation 'packages'. These packages are simply complementary actions that address the priority issues for waterways and wetland, particularly the main threatening processes. Further details on implementation packages are given in Part C. Resource condition targets that link with each package are also indicated.

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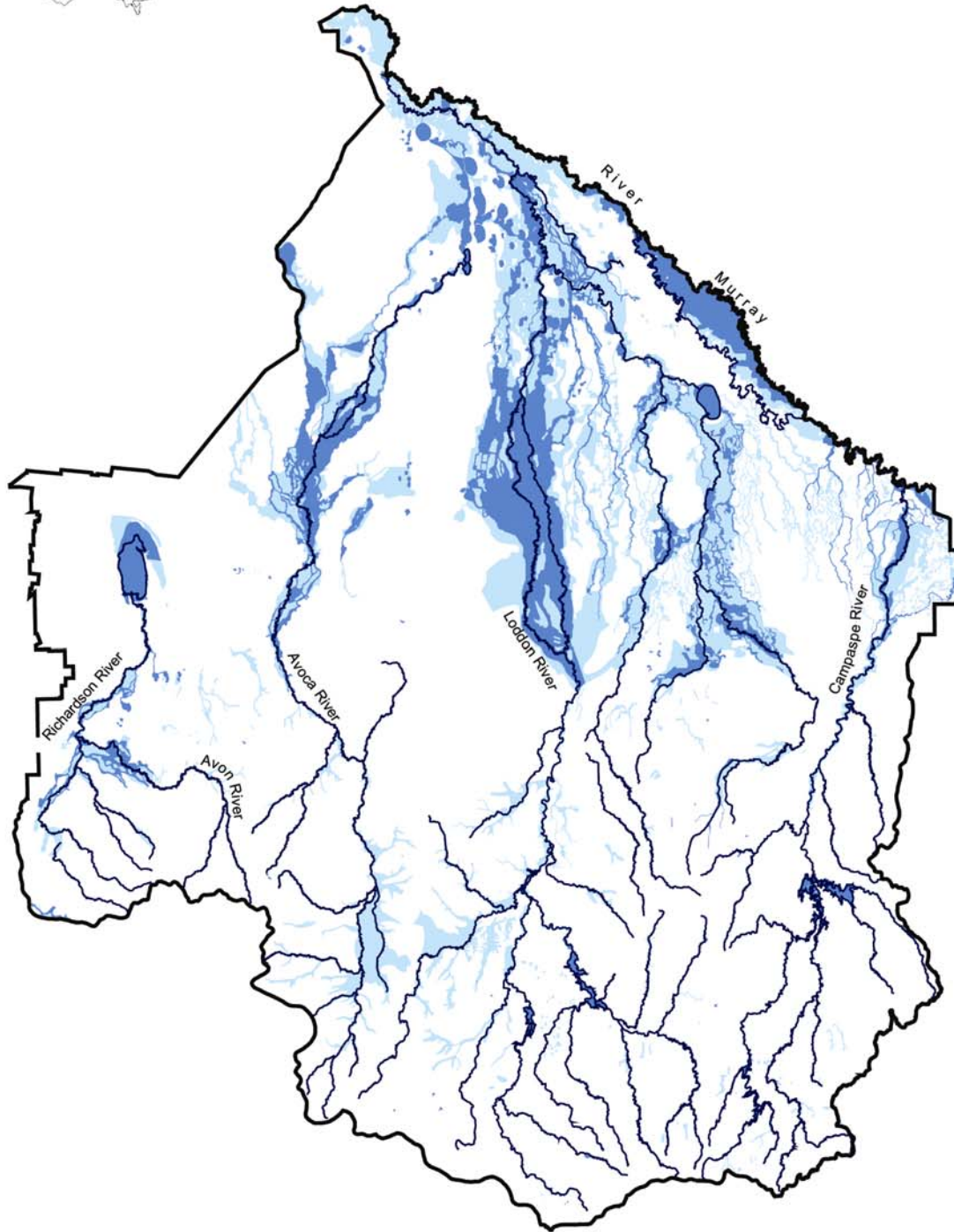
Table 24: Management actions and targets for waterways and wetlands

#	Management actions and targets	Key implementation agency(s)	Referring plan(s)
<p>Waterways and Wetlands Package 1: Protecting and improving riparian and wetland habitat (also WW6, 8–11)</p> <p>This package is primarily concerned with completion and implementation of the North Central River Health Strategy. The Strategy will direct on-ground works to regional priority areas. The Strategy has several main areas of focus, including protection and restoration of riparian habitat and the maintenance and improvement of channel and gully stability. Both actions are intended to improve biodiversity and water quality outcomes. It includes capacity building activities for adjoining landholders to improve their management practice and involves engagement with Indigenous communities. The package also addresses habitat issues associated with the region's two Ramsar wetland sites. The package is supported by actions under the biodiversity (BD1,6-10), dryland (DL1,5-6,12), irrigated land and public land (PL4-5,9) assets.</p> <p>The package addresses RCTs WW29 to 34.</p>			
WW1	Finalise North Central Regional River Health Strategy by 2004. Implement agreed annual works and extension program to 2008.	NCCMA	River Health Strategy
WW2	Develop River Health Plans for the Loddon, Campaspe, Avoca and Avon-Richardson catchments by 2004. Implement the four catchment plans, based on regional priorities from the Regional River Health Strategy.	NCCMA	River Health Strategy
WW3	Implement Kerang Wetlands and Gunbower Forest Ramsar Sites Strategic Management Plans	Parks Victoria, NCCMA, DSE	Ramsar Site Strategic Management Plans
WW4	Develop and/or implement management plans for all priority wetlands by 2006. Priorities for wetlands in Loddon Murray region based on wetlands prioritisation framework. Undertake an inventory and condition assessment and determine priorities for wetlands in mid and upper catchment areas by 2006.	Parks Victoria, DSE	Loddon Murray LWMS
WW5	Identify environmentally sensitive waterways, wetlands and flood plain areas for each local government area by 2004. Develop planning controls with local government by 2005 to avoid inappropriate development in these areas and to manage the cumulative impact of any approved developments.	NCCMA, urban and rural water authorities, local government	Municipal Planning Schemes
<p>Waterways and Wetlands Package 2: Maintaining or restoring appropriate flow regimes (also WW3,4)</p> <p>This package is concerned with the determination and provision of appropriate flow and flooding regimes in the region's wetlands and waterways. It implements parts of the region's River Health and Floodplain Management Strategies. The package will involve extensive consultation with stakeholders. By providing water, it helps to address habitat issues associated with aquatic ecosystems. The package is supported by actions under the biodiversity (BD1,6-10), dryland (DL1,5-6,12), irrigated land and public land (PL4-5,9) assets.</p> <p>The package addresses RCTs WW28 to 31, 35.</p>			
WW6	Restore proper floodplain function to lower catchment wetlands and floodplains affected by artificial banks and levees, as recommended in approved floodplain management plans by 2008.	NCCMA	Floodplain Management Strategy
WW7	Implement agreed 5 year program under regional and sub-regional Floodplain Management Plans by 2008.	NCCMA	Floodplain Management Strategy
WW8	Develop streamflow management plans for upper Avon-Richardson, Avoca and Loddon catchments by 2004 and make environmental flow allocation by 2005.	NCCMA, G-MW, WMW, DSE	River Health Strategy
WW9	Finalise the Loddon Bulk Entitlement (BE) process and implement by 2004.	NCCMA, G-MW, CHW, Coliban Water, DSE	River Health Strategy
WW10	Develop Stressed River Plans for the Loddon by 2005 and Campaspe by 2007. Implement actions from these plans by 2012.	NCCMA, G-MW, CHW, Coliban Water, DSE	River Health Strategy
WW11	Finalise the Gunbower Forest Water Management Plan by 2004 and implement recommendations by 2005.	NCCMA, Parks Victoria, G-MW, DSE	Gunbower Forest Ramsar Site Draft Strategic Management Plan
<p>Additional waterway and wetland priority issues dealt with by management actions listed under other assets include:</p> <ul style="list-style-type: none"> ◆ Impacts of pest plants and animals on waterway and wetland habitat (Biodiversity, Dryland, Public Land, Infrastructure) ◆ Impacts of salinity on waterways and wetlands (Dryland and Infrastructure) 			
<p>Priority issues not specifically addressed at this stage:</p> <ul style="list-style-type: none"> ◆ Impacts of past mining activities on river health and water quality 			



-  Gunbower Forest Ramsar Site
-  Kerang Wetlands Ramsar Site
-  Major Wetlands
-  Directory of Important Wetlands in Australia
-  National Land & Water Audit of Bioregionally Important Wetlands

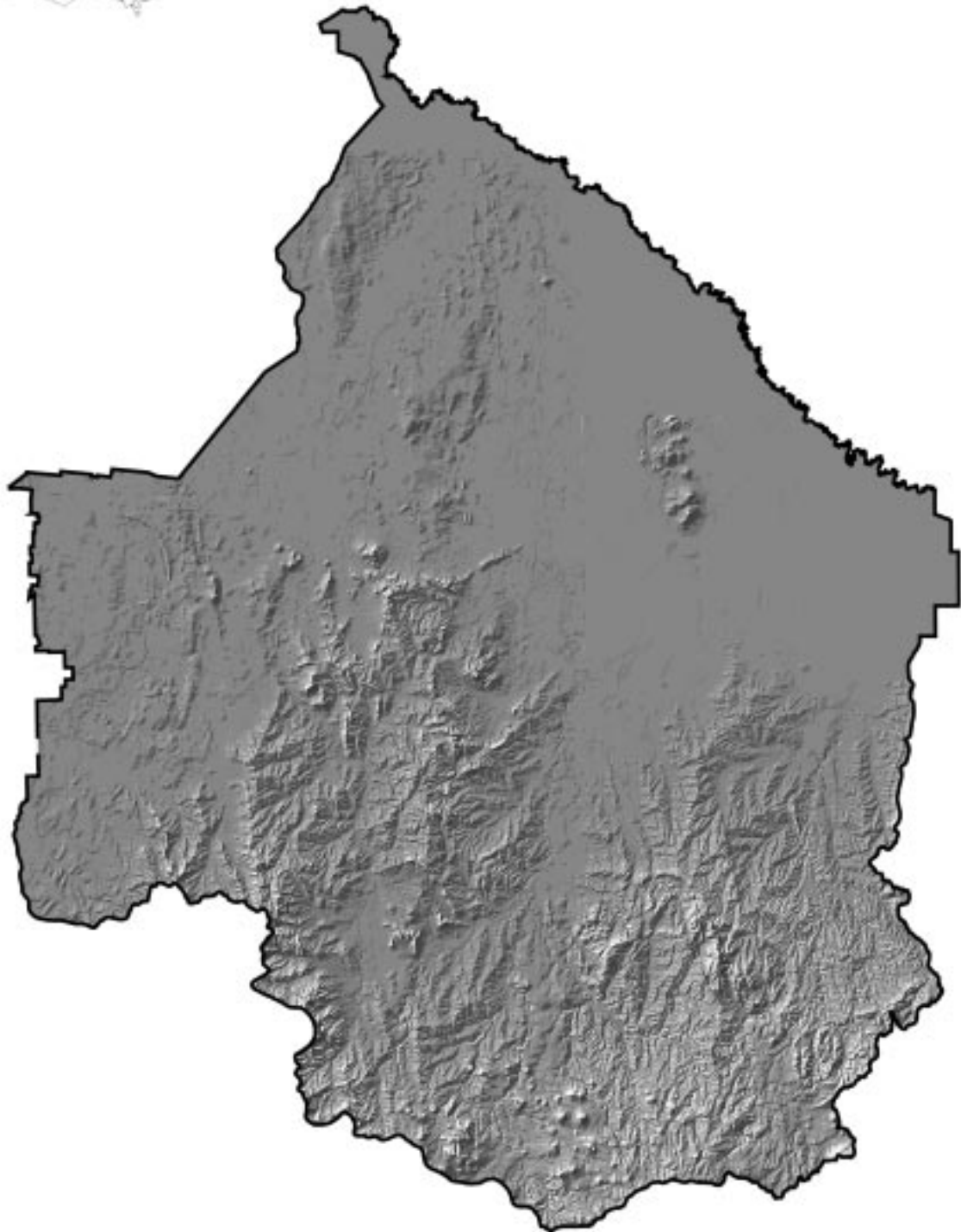




NORTH CENTRAL REGION



Topography



11 Waterways and wetlands

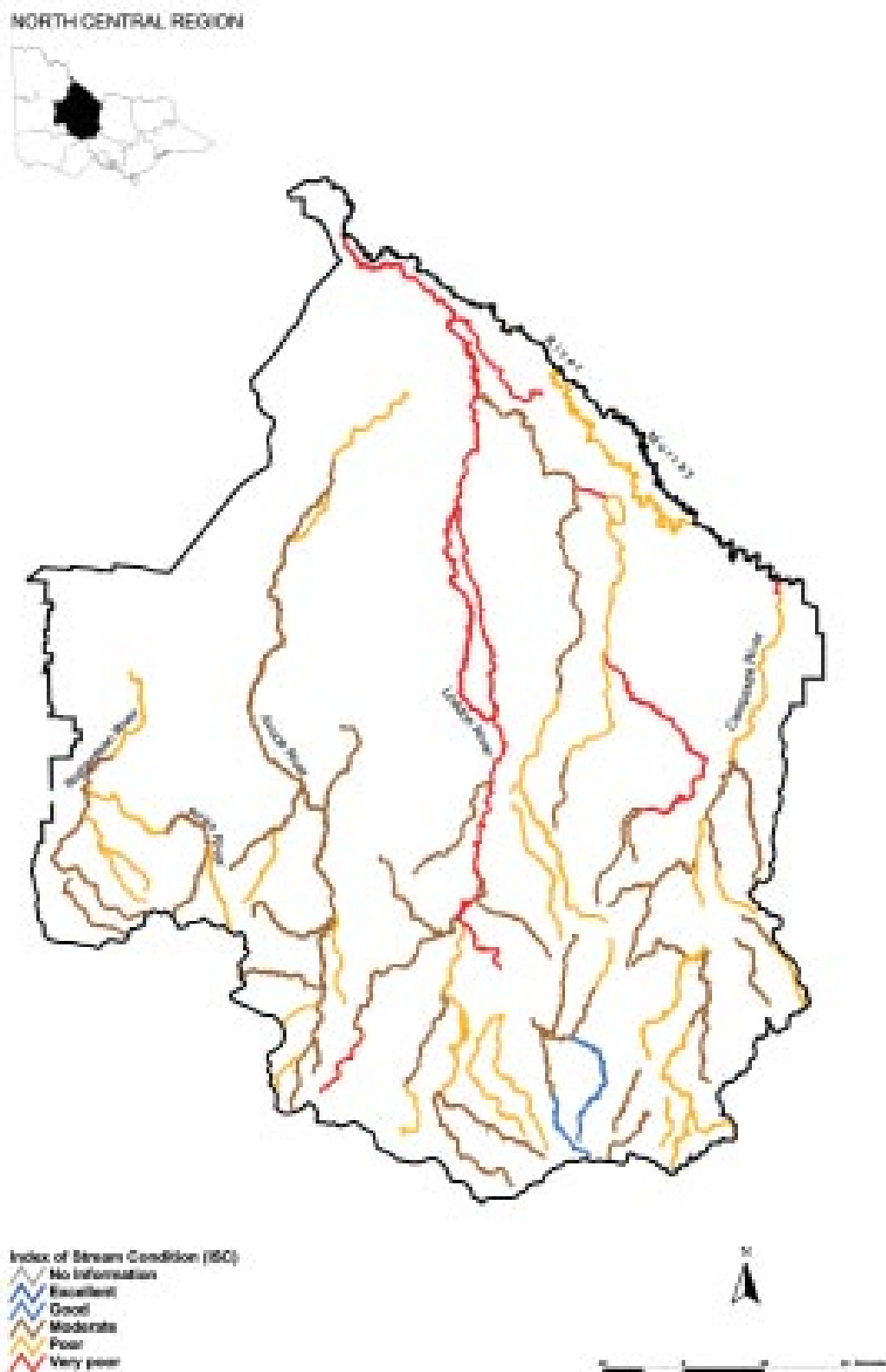


Figure 5: Index of stream condition, 1999.



PART C – Implementation



1 Priorities for program implementation

1.1 Introduction

The process for determining implementation priorities for the RCS was adapted from that used for the Wimmera RCS²². It uses a simple form of multi-criteria analysis to assess the benefits and risks of implementing programs. The methodology is transparent and accounts, within the same framework, for financial and non-financial benefits and risks across the 'triple bottom line' of social, economic and environmental accounts.

The prioritisation process developed for the RCS operates for 'packages' of management actions. This is considered to be appropriate, since the threats faced, the services they provide and the natural resource management outcomes sought by the RCS are all unlikely to be effectively addressed by single actions.

The assessment process to develop priorities for program implementation was initially undertaken by the RCS consulting team. It was subsequently reviewed by representatives of regional stakeholder organisations.

1.2 Implementation packages and programs

Implementation packages have been developed for each of the region's principal asset groups (Part B). A risk assessment process was used to identify the major threatening processes and the most threatened and valuable services provided by each asset class. This combination of threats and threatened services identified the priority issues for each asset (from over 240 issues across all assets). A suite of management actions (and associated targets) were then developed or taken from the existing NRM planning framework to address each priority issue. Management actions seek to mitigate the threat and protect or enhance service values. Combinations of management actions addressing the priority issues became the implementation packages.

Some management actions address the services provided and threats faced by several assets. For example, development and implementation of a management plan for mineral springs recharge areas is relevant to dryland, public land and water resource assets. However, to avoid duplication within the RCS document, actions have only been listed against a single, primary asset (water resources, in the case of the mineral springs management plan).

Implementation packages address threats or priority issues rather than services. In part, this reflects the issue based nature of the region's NRM planning framework, from which most management actions were drawn. However, the approach is conceptually sound. There is generally a clear connection between threat and response and that response typically provides benefits across a range of services that the asset provides.

The risk assessment process was not considered to be fully relevant to several assets, e.g. community, climate change and cultural heritage. Implementation packages for these assets were, at least in part, based on considerations other than threats to services.

Several additional management actions have been defined, but not included in this priority setting process. Some of these actions, such as the setting of targets for surface water quality, are critical components of the program. However, since they would not effect change in resource condition directly and do not easily link with other threat based packages, they would not be given high priority under the assessment procedure.

Many of the implementation packages are multi-faceted, including elements of natural resource planning, community engagement and capacity building, onground works and monitoring and evaluation. While primarily directed at improving service values for a particular asset, they will often seek to improve service values for other related assets. For example, the dryland salinity management and waterways and wetlands habitat packages both address the needs of biodiversity. They also have elements that lead to improved community capacity for natural resource management.

1.3 Assessing benefits

The relative benefits of undertaking implementation packages for each asset were assessed against the economic, social, environmental and general criteria listed in Table 25. A score of between 1 and 3 was given according to the level of agreement with the statement and/or the relative level of benefit likely to be achieved. A total score was given for each criterion and implementation packages ranked accordingly. The sum of rankings for economic, social, environmental and general criteria was used to rank implementation packages for the expected overall benefit. This assessment is not absolute, but provides a guide to how different packages compare against

1 Priorities for program implementation

each other in relation to environmental, social and economic criteria.

The assessment indicated that highest benefit would be achieved through implementation of the major water resources packages (water sharing, salinity, water quality and resource efficiency) and dryland and irrigation salinity and/or land management programs.

1.4 Assessing risk

Risk was assessed in terms of the likelihood of the program failing to realise anticipated benefits, (using the criteria in Table 25). The process followed was similar to that used for benefit. A score of between 1 – 3 was given according to the strength of

agreement with each statement and/or relative level of risk. Risk scores were summed and implementation packages ranked. The combined rank scores were then used to provide an overall risk ranking.

Most of the highest benefit packages were also assessed as having relatively low risk of not achieving the anticipated benefits. Lower risk activities also included pest plant and animal management in dryland areas.

Packages rated as having higher risk, were generally those delivering only a narrow range of outcomes (e.g. only social or only economic outcomes) or that were not able to comprehensively address the relevant threatening process.

Table 25: Benefit and risk assessment criteria

Theme	Benefit criteria	Risk criteria
Economy	<ul style="list-style-type: none"> ◆ Program will facilitate economic growth for regional industries and enterprises (e.g. agriculture, tourism). ◆ Program expenditure will result in long-term savings. ◆ Program will result in the development of new business opportunities. 	<ul style="list-style-type: none"> ◆ Program will not yield financial return within RCS period. ◆ Program will cost (works, incentives, enforcement, monitoring) more than the expected returns.
Society	<ul style="list-style-type: none"> ◆ Program will increase knowledge, skills and facilitate higher levels of NRM participation. ◆ Program meets community expectations. 	<ul style="list-style-type: none"> ◆ Program will not clarify stakeholder roles and responsibilities ◆ Program lacks support for change from NRM stakeholders ◆ Program may not manage community resistance to change
Environment	<ul style="list-style-type: none"> ◆ Program will maintain or enhance sustainable uses of land and water. ◆ Program will maintain, restore or enhance the health and function of natural ecosystems. 	<ul style="list-style-type: none"> ◆ Program implementation will not derive environmental change within human time scales. ◆ Program will not prevent further environmental degradation.
General	<ul style="list-style-type: none"> ◆ Program will break down institutional barriers and foster cooperation amongst stakeholders. ◆ Program will avoid the serious consequences of doing nothing. 	<ul style="list-style-type: none"> ◆ Program will not break down institutional barriers and foster cooperation amongst stakeholders. ◆ Program lacks technical and professional resources to precipitate change.

1 Priorities for program implementation

1.5 Setting priorities

Priority for investment in natural resource management should be based on expectations of benefits to be achieved, moderated by the level of confidence that those benefits will be realised (i.e. the associated risk). Therefore, implementation packages with relatively high benefit and low risk of failure should receive investment in preference to those which yield fewer benefits and/or present greater risk.

The combined benefit and risk assessment was used to set investment priorities under the RCS. Implementation packages were each given a score based on their respective overall benefit and risk rankings. This final score was then ranked and packages placed in priority order (see Table 26). Priority bands have been used to avoid attributing greater precision to the priority setting process than is warranted.

Highest priority implementation packages included:

- ◆ water resources packages addressing water quality, salinity and water allocation and trade
- ◆ irrigated land packages addressing salinity and land management practice
- ◆ dryland salinity management
- ◆ integration of the RCS with local government planning.

Several related packages were in the next grouping, including maintenance of flow regimes for waterways and wetlands, water resource efficiency and a response to rural residential development in dryland areas. Several biodiversity and habitat related packages were either in or just outside this second grouping.

Many of the highest priority packages include elements that address important community engagement and biodiversity issues.

It must be emphasised that this analysis gives a relative ranking between actions and responses that have already been identified through a risk assessment process as having priority. Lower ranking in this process does not imply that activities are unimportant – merely that compared with other actions, they provide fewer benefits or greater uncertainty.

1.6 Integration

The priority setting process described above provides an excellent basis for integration of programs under

the RCS. While the inputs to that process were based on individual assets and asset related issues, several common integrating themes have emerged. These themes, which are outlined below, provide the basis for the key program areas under the RCS. While they do not address all of the issues identified in the RCS, they provide a sound framework and a context for doing so.

Water resource management

The availability and quality of water for environmental, amenity and consumptive uses is fundamental to a sustainable future for the North Central region. The region's surface water resources, including inter-basin transfers from the Goulburn, Murray and Wimmera systems, are critical to primary industry, the viability and amenity of urban centres and to many of the region's most significant natural assets. While groundwaters that are suited to consumptive uses represent a much smaller resource, they are locally important for both agricultural and urban supplies. The region's mineral springs aquifers are nationally significant and help support a thriving tourist industry. The current prolonged dry climate sequence has highlighted the importance of water to both rural and urban populations.

The priority setting process highlighted the need for the regional natural resource management program to address the issues facing water. A water resource management program must address several issues, including:

- ◆ water quality, particularly in terms of salinity and nutrient and sediment load, for surface waters and contamination by nutrients and agricultural chemicals, for groundwater
- ◆ the allocation and sharing of water between the environment and various amenity and consumptive uses – a response is required to issues at both catchment and Murray-Darling Basin scales
- ◆ improving the efficiency of water distribution and use in agricultural and urban settings
- ◆ restoration and management of floodplains.

The program also needs to understand the implications of the region's own natural resource management activities on water resources. Achieving management action and resource condition targets for the region's native vegetation and dryland salinity management plans has the potential to substantially reduce inflows to upper and mid catchment water storages and in some cases might even worsen river

1 Priorities for program implementation

salinity. These and other land use changes may, without careful planning and management, place further pressure on already heavily committed water resources.

Management of irrigation and dryland salinity

It is a well noted irony that in a region where management of scarce water resources is such a pressing issue, the abundance and surface discharge of shallow groundwater should be one of the key natural resource management issues. For while the region is a substantial net importer of surface water, it contributes in a significant way to River Murray salt loads.

Shallow water tables and salinity pose a pervasive threat across dryland and irrigated regions of North Central Victoria. They already impact on the condition of many of the region's most significant natural assets and affect cultural heritage sites and infrastructure. The costs, in economic, environmental and social terms, are substantial.

The North Central region has strong and well established irrigation and dryland salinity programs. Maintenance of these programs is essential to protect threatened assets and lessen the regional impact on the River Murray. While these programs may be perceived as focussing on a single issue, i.e. salinity, they do in fact address a wide range of pressing natural resource issues, including:

- ◆ community engagement and capacity building
- ◆ improving land management practice
- ◆ protecting and restoring terrestrial, riparian and aquatic biodiversity
- ◆ improving river health and water quality.

There is clear linkage in irrigation areas between implementation packages that address land and water salinity, water quality, land management practice, water sharing and maintenance of flow regimes for wetland habitats. Each of these were identified as having high priority under the priority setting process. They are also key themes of the Loddon Murray Land and Water Management Strategy. There is a similar connection in dryland areas between priority implementation packages addressing dryland salinity, protection and restoration of terrestrial, riparian and wetland habitat and water quality.

In some areas, salinity also represents an economic opportunity. The region needs to fully explore commercial opportunities for use of its saline resources. In some areas, commercial use of saline resources may also help to protect important assets, including agricultural land or significant wetlands, from the effects of salinity. Where this is not the case and saline resource use enterprises can be established in an environmentally sustainable manner, they can at least boost local economies.

Protecting and enhancing indigenous biodiversity

The North Central region retains just 13% of its pre-1750 native vegetation coverage. Depletion of native vegetation coverage by clearing for mining, agriculture and urban development lies at the heart of the region's natural resource management issues. The feedback loop created by its initial depletion means that regional biodiversity – in terrestrial ecosystems, along waterways and floodplains and in lakes and wetlands – continues to face threats from those same natural resource management issues.

Protection and restoration of indigenous biodiversity is an important goal in its own right. Vegetation coverage in much of the region is already well below recognised sustainability thresholds. The depletion and fragmentation of native vegetation poses an ongoing threat to native fauna with specific habitat requirements.

Protecting and enhancing indigenous biodiversity is a core part of the region's natural resource management program. There are strong synergies between such activities and other priority actions addressing water quality, salinity and water resource management.

Protecting and enhancing biodiversity also provides a point of linkage for regional pest plant and animal management programs. While they threaten services to other assets (notably dryland agricultural production), justification for public investment in management programs is largely based on the threat to biodiversity assets.

Restoring native vegetation cover to the landscapes of the North Central region may reduce surface water yields and groundwater resource availability, as this will generally involve replacement of low water use agricultural species with deep-rooted perennials. Fortunately, the impacts will be less in the areas where native vegetation cover is most depleted – the

1 Priorities for program implementation

woodlands, grassy woodlands and grasslands of the Wimmera, Volcanic Plain, Riverina and Murray Mallee bioregions. In these areas rainfall and water yields are mostly relatively low and, in the case of grasslands, restoration of native vegetation cover would not greatly alter the landscape water balance. In other areas, particularly in higher rainfall, upper catchment locations, vegetation restoration must be carefully planned to minimise impacts on water yields.

Linking municipal planning with natural resource management

There is growing recognition of the need to improve the linkage between local government planning and the region's natural resource management agenda. Doing so provides another potentially effective point for the NCCMA and its partnership organisations to influence a range of activities that threaten the region's natural and cultural heritage assets.

The RCS has highlighted several drivers for this, including:

- ◆ population growth and pressure for urban and rural residential development (particularly in upper catchment areas in the south-east of the region and along the River Murray)
- ◆ intensification and diversification of agricultural land use and increasing demand for irrigation water to support those uses
- ◆ the potential impacts of inappropriate development on water resources, biodiversity, waterways and wetlands and agricultural land uses in dryland and irrigation areas.

Several related implementation packages have been developed in response to regional priority issues. They include a package dealing with integration of the RCS with land use planning and packages that respond to the challenge of rural residential land use in dryland and irrigation areas.

A regional program linking municipal planning with natural resource management must be based on a thorough process of engagement with local government. Ways must be found for linking the

regional NRM agenda with municipal planning that address the needs and resources of local government and the NCCMA and its other stakeholder organisation. It must also include processes to build capacity for natural resource management within local government and improve the understanding of local government processes within natural resource management organisations.

Community participation and education

Community participation and education is an essential theme that must operate throughout all of the regional natural resource management program areas. It must function at a number of levels, including:

- ◆ active engagement with key stakeholders and stakeholder groups at all stages from planning through implementation to monitoring and evaluation
- ◆ building capacity within the general community and specific stakeholder groups to effectively participate in natural resource management and help deliver on resource condition change
- ◆ educating the community about natural resource issues operating at local and regional levels through to a national scale and informing them about efforts to tackle these issues and progress towards objectives.

Given the diversity of the community, their differing interests and capacity to influence natural resource outcomes, a single, 'one size fits all' approach to community participation and education will not be effective. A range of approaches must be developed that are well targeted and strategic, i.e. linked to priority natural resource management issues.

Other priorities for community participation in the North Central region include:

- ◆ engagement of Indigenous communities
- ◆ building effective partnerships with stakeholders
- ◆ developing community and institutional leaders in natural resource management.

1 Priorities for program implementation

Table 26: Triple bottom line priorities table.

Asset	Implementation Package (Package No. in Asset Chapters)	Priority Band
Water resources	Water quality (1)	Priority band 1
Water resources	Water salinity (3)	
Irrigated land	Salinity management (1)	
Dryland	Managing the impacts of dryland salinity (1)	
Water resources	Water sharing (allocation) and trade (2)	
Community	Integration between RCS and land use planning (1)	
Irrigated land	Land management for sustainable agriculture (2)	
Waterways and wetlands	Maintaining or restoring appropriate flow regimes (2)	Priority band 2
Dryland	Responding to the challenge of rural residential development (3)	
Waterways and wetlands	Protecting and improving riparian, aquatic and wetland habitat (1)	
Dryland	Managing the impacts of pest plant and animal populations (2)	
Water resources	Water resource efficiency (4)	Priority band 3
Dryland	Improving natural habitat and ecosystem function in dryland areas (6)	
Irrigated land	Future land use – water allocation and trade (5)	
Public land	Sustainable management of public land (1)	
Biodiversity	Protecting and enhancing significant native vegetation communities (2)	
Community	Community participation and education (2)	
Irrigated land	Farm business for sustainable agriculture (3)	
Public land	Minimising impacts of pest plants and animals (3)	
Infrastructure	Managing impacts of salinity	Priority band 4
Dryland	Improved dryland land management practice (5)	
Public land	Safe and environmentally sustainable fire management (2)	
Irrigated land	Floodplain management (4)	
Climate	Climate change response (1)	
Irrigated land	Pest plant and animal control for sustainable land management (7)	
Community	Indigenous participation (3)	
Public land	Managing the impacts of dryland and irrigation salinity on public land (4)	
Irrigated land	Managing the expansion of rural residential land use (6)	
Public land	Improving habitat and biodiversity values on public land (5)	
Biodiversity	Reducing the impacts of pest and domestic animals on biodiversity (1)	Priority band 5
Cultural heritage	Protection of cultural heritage values	
Community	NRM Leadership development (4)	
Infrastructure	Managing the impacts of forest industry development	
Dryland	Safe and environmentally sustainable fire regimes (4)	
Biodiversity	Ecological burning for remnant native vegetation (3)	
Water resources	Pest plants and animal management for water resources (5)	

2 Monitoring and evaluation for adaptive management

2.1 Purpose

The purpose of the monitoring, evaluation and reporting framework is to:

- ◆ provide accountability to investors on their return on investment in natural resource management. Major investors such as the Commonwealth and State Government have specific monitoring and reporting standards that need to be met
- ◆ learn about the effectiveness of actions undertaken so that they can be continually improved through adaptive management
- ◆ ensure resourcing of programs achieves the RCS vision and objectives for each asset
- ◆ alert the NCCMA to changes in catchment conditions, new threats and new opportunities that were previously unknown.

2.2 Framework for monitoring, evaluation and reporting

Already many data exist in the North Central region. However, much have been collected at a wide range of spatial and temporal scales with datasets being managed for specific projects rather than for the purposes described above.

The framework for monitoring, evaluation and reporting should be driven by the objectives of the RCS.

These objectives need to be translated into a series of targets. Each target needs to be developed on the basis of an underlying assumption on cause and effect.

These assumptions need to be made explicit so that they can be tested and improved. For example, the time lag between action on the ground and improvement in resource condition (e.g. water quality) is one such assumption.

Stakeholders need to know the resource condition, the underlying trends and the return on investment within management plans.

To achieve this the framework overleaf has been developed.

A proforma will be developed as part of the implementation of the RCS that will apply the above framework to each management plan.

The completed proformas will form a report that will

list the specific measurable targets for each box described in Figure 6 as well as the underlying assumptions.

Each box will require two figures, one being the target figure with the management plan proposed and the other being the target figure if there is no management plan, i.e. the 'no intervention' scenario.

The proforma will also describe the monitoring required, the timescale and the evaluation process that will be used to test the key assumptions. Bearing in mind that the evaluation becomes more complex and the results less certain moving up the diagram.

The proforma will also list where responsibility lies for monitoring, evaluation, and reporting for each task of the management plan.

The proforma will include:

- ◆ to whom to report (e.g. NCCMA Board, Implementation Committees, funding bodies) for each measurable target
- ◆ the actual performance in the last 12 months
- ◆ the expected plan target performance
- ◆ the expected 'no intervention' performance
- ◆ National and State government monitoring requirements for RCS
- ◆ evaluation assumptions
- ◆ monitoring methods
- ◆ data custodian and storage protocols.

Some management plans work on more than one asset. In these cases, a completed proforma will be required for each asset.

The measurable targets used for each asset will be kept as consistent as possible across management plans, so that the effectiveness of each management plan can be compared.

Completed proformas will be aggregated at the resource condition and asset service level. This will ensure that benefits and achievements of management plans are consistent and realistic.

A report card on catchment health, trends and natural resource management will be produced. This will be incorporated into the NCCMA Annual Report and the next North Central Catchment Condition Report, a reporting tool to be used in the reflection phase of the next RCS review and renewal process.

2 Monitoring and evaluation for adaptive management

Key learnings will need to be acted upon as soon as they are identified, so that management plans can be improved.

A thorough review will be required in five years so that the next RCS review and renewal has a much improved knowledge base on what actions are effective in changing asset condition.

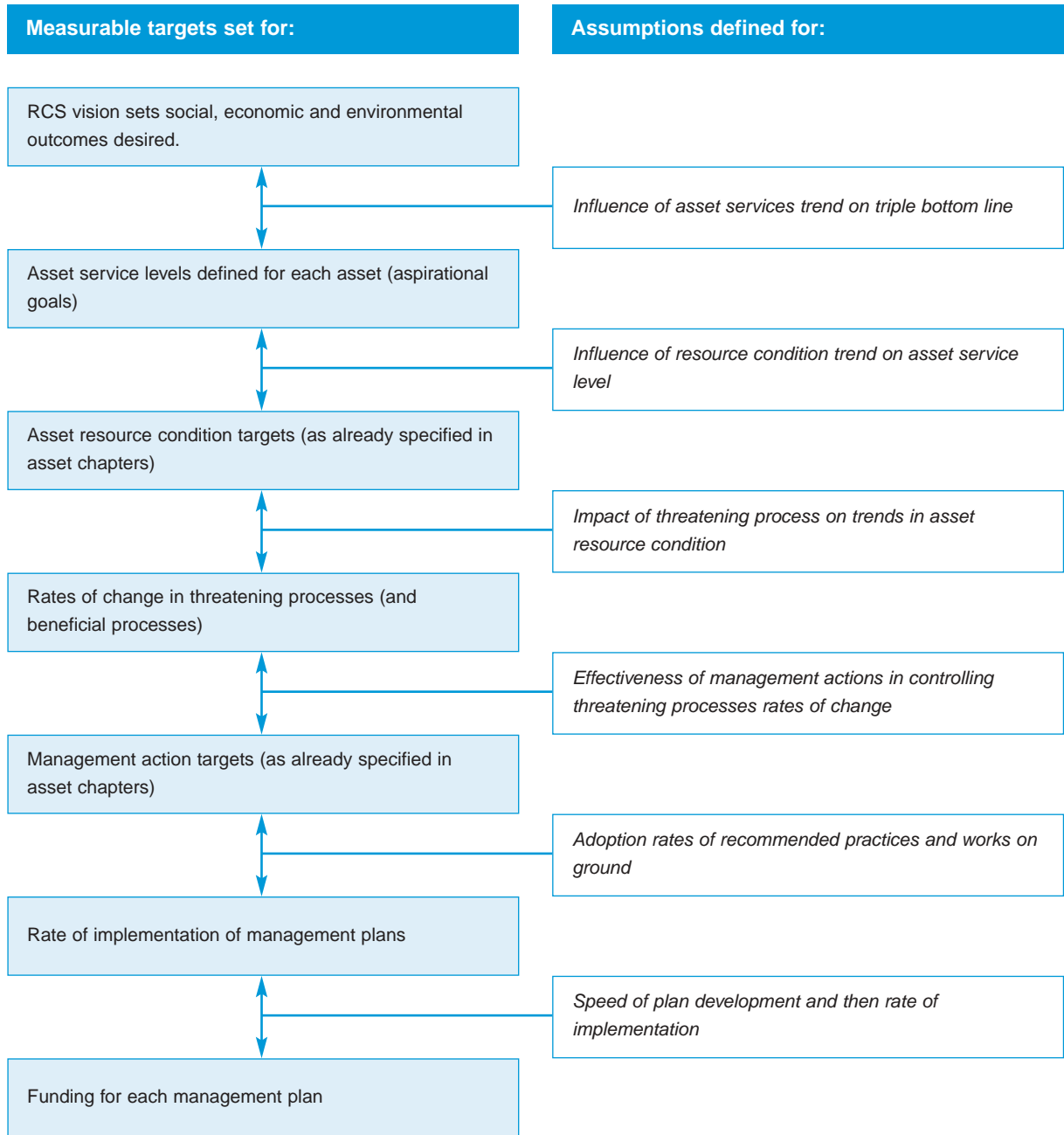


Figure 6: Framework for monitoring, evaluation and reporting.

3.1 Key stakeholders

The management and implementation of the range of natural resource projects and activities identified in the RCS will involve many individuals, groups and agencies. The roles and responsibilities of these stakeholders are briefly described below.

North Central Catchment Management Authority

- ◆ Coordinates natural resource management in the North Central region in partnership with the community, State government agencies, water authorities, local government and others.

Department of Sustainability and Environment

Catchment and Water Division

- ◆ Provides advice to government on statewide NRM issues
- ◆ Consults with CMAs, service deliverers and others to develop statewide NRM policies, programs and priorities
- ◆ Government agent for purchasing catchment management services from CMAs.

Parks, Flora and Fauna

- ◆ Oversees the management of land resources for environmental, conservation and recreational values
- ◆ Manages programs that conserve biological diversity of flora and fauna resources
- ◆ Supports conservation of historic places on public land
- ◆ Facilitates recreation and tourism opportunities on public land.

Forests Service

- ◆ Manages state forests for commercial uses, conservation, recreation and education and fire management in state forests, parks and reserves.

Fisheries

- ◆ Acts as the lead advocate for fish habitat management and works to secure sustainable use and production of Victoria's fish resources.

Energy and Minerals

- ◆ Promotes and regulates extractive industries, oil and gas and minerals and maintenance of the

State's historical geological database.

Greenhouse

- ◆ Develops statewide strategies, particularly for dealing with greenhouse gas emissions from all sources, opportunities for enhancement of greenhouse sink capacity and adaption to the impacts of climate change

Land Victoria

- ◆ Manages Crown land including reserves, unused roads, stream frontages, agricultural tenures and commercial / community use tenures

Department of Primary Industries

Regional Services

- ◆ Undertakes essential role in delivery of catchment related extension and advisory services, and provides technical services in catchment planning and investigations.

Agriculture Division

- ◆ Provides services to improve market access, market development and consumer confidence in food and agriculture
- ◆ Assists development of next generation technologies for sustainable agriculture
- ◆ Provides community, farm and industry development services.

Parks Victoria

- ◆ Manages Victoria's network of national, state, regional and metropolitan parks, other conservation reserves and significant cultural assets.

Local Government

- ◆ Incorporating catchment management objectives, priorities and actions within statutory planning processes
- ◆ Managing stormwater and regional drainage
- ◆ Facilitating local industry involvement in catchment management activities
- ◆ Providing support for local action groups, including Landcare. In the North Central region, local government is a key partner through its hosting arrangements for Landcare facilitators.

3 Roles and responsibilities of key stakeholders in natural resource management

EPA Victoria

- ◆ Facilitates the protection of environmental quality objectives in State Environmental Protection Policies
- ◆ Controls discharges to the environment and encourages improved environmental performance through application of statutory tools. These include licensing, enforcement, development and promotion of best practice environmental management guidelines, technical and scientific support, action partnerships, education and conflict resolution.

Rural water authorities

- ◆ Provide irrigation and rural drainage, salinity control, some urban water supply and other water-related services
- ◆ Contribute to management of specific water supply catchments.

Goulburn Murray Water (G-MW) is the major rural water authority operating in the region. It manages several of the major water storages in the region and almost the entire public irrigation infrastructure on behalf of water users and the State Government. G-MW is also a major natural resource management service provider in the region's irrigation districts. G-MW plays a major role in supporting the priority setting and strategic planning functions of the NCCMA, particularly as they relate to the region's irrigation areas.

Wimmera-Mallee Water is the other rural water authority that operates within the region.

Urban water authorities

- ◆ Provide water and sewerage services to towns and urban communities of the region. Contribute to the management of specific water supply catchments.

Coliban Water, Central Highlands Water and Grampians Water operate in the North Central region.

Individual landholders

- ◆ Vital to successful RCS implementation. Government alone cannot achieve sustainable catchment management
- ◆ All landholders have a major stake in maintaining land, water and biodiversity assets and passing them on to the next generation
- ◆ Most works must be undertaken by individual

landholders on privately owned land.

Landcare and other landholder groups

There are approximately 170 Landcare or community groups working in natural resource management in the North Central region. These groups have a diverse range of interests across the spectrum of natural resource issues and are strongly focussed on onground works. Commonwealth and State funding is provided through the NCCMA to support these activities, based on priorities in the RCS. These groups are a key means by which the NCCMA and its partners can deliver natural resource outcomes in the region. Their engagement and support in priority areas will remain important for natural resource management programs.

- ◆ Other types of community groups in the region that also contribute to natural resource management include service organisations, Friends groups, historical societies and youth groups.

Industry

- ◆ Industry holds a significant stake in ensuring that natural resources assets are managed in accordance with the principles of ecologically sustainable development.
- ◆ Responsible for ensuring that environmental impacts are minimised.

Indigenous communities

- ◆ Contribute to strategies and operational plans to ensure due recognition of Indigenous community values
- ◆ Facilitate training / education among Indigenous community members to increase knowledge and capacity in relation to the RCS and NRM issues
- ◆ Participate in implementing NRM projects on community controlled land
- ◆ Participate in programs to increase the knowledge and appreciation of Indigenous community issues in relation to NRM within the wider catchment community.

3 Roles and responsibilities of key stakeholders in natural resource management

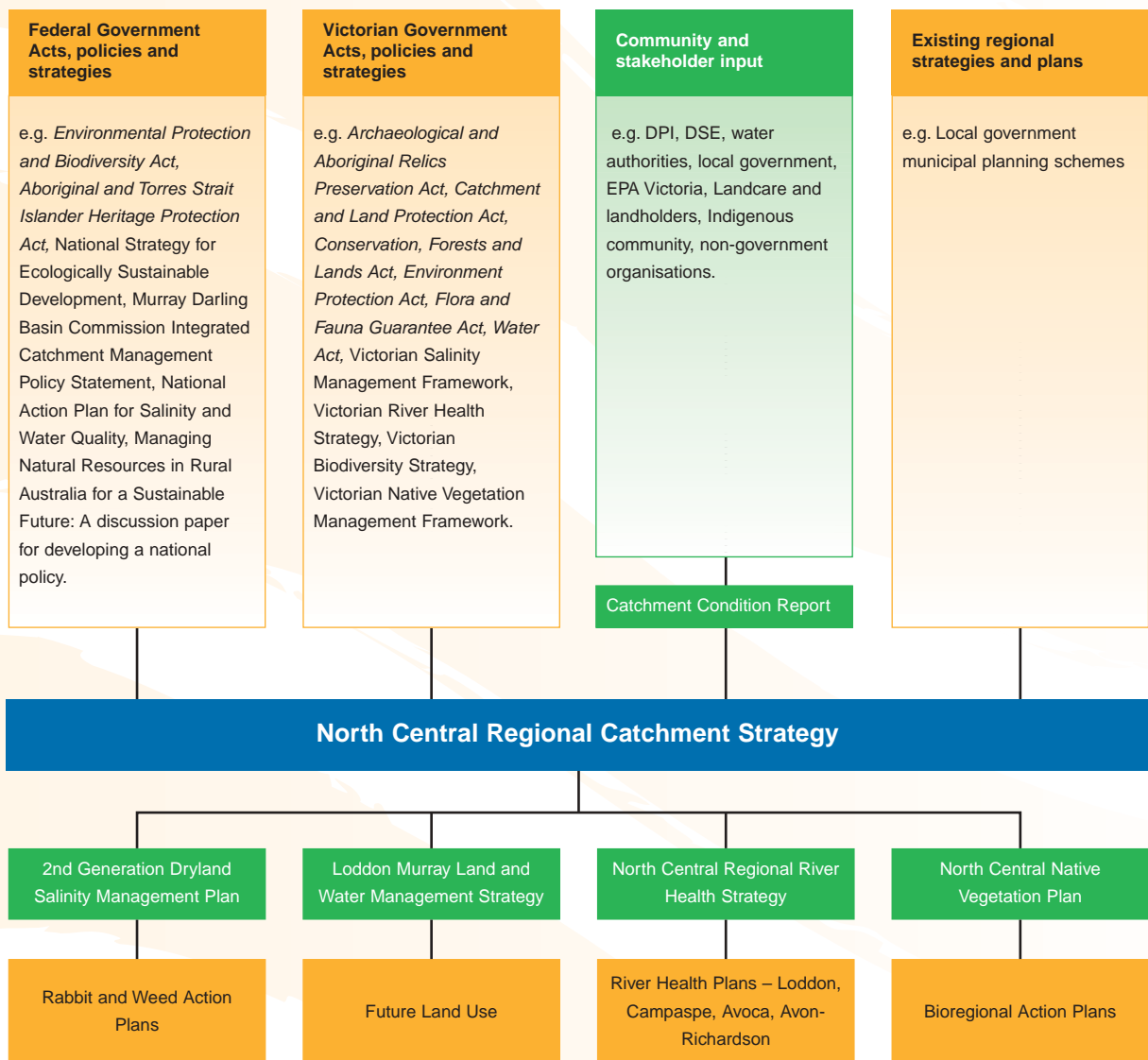
3.2 Other regional partners and service providers

The North Central region is well served by private sector service providers in natural resource management as well as institutions such as La Trobe University, Bendigo. Many providers have a local base within the region, particularly in Bendigo. Services are offered across the full range of natural resource management activities – primary production, land and water management, strategic planning, consultation and community processes – and mostly complement those available within public

sector service providers. The NCCMA, DPI/DSE and G-MW have ongoing relationships with several providers, who participate actively in the natural resource management partnership in the region.

3.3 RCS strategy relationships

The diagram below illustrates the relationship between the RCS and Commonwealth, State and local natural resource management planning.



(Note: the Acts, strategies, plans and groups included in the above diagram are examples selected from the many that exist)

Figure 7: RCS strategy relationships



Appendices



1 Stakeholder consultation

Review and Renewal of RCS

Review phase

The review of the 1997 RCS involved various sectors of the community. The purpose of the review was to:

- ◆ identify the progress that had been made against the 1997 RCS
- ◆ identify the extent of implementation
- ◆ assess the adequacy of the 1997 RCS in light of new information and arrangements
- ◆ identify gaps.

Advertisements were placed in 12 regional newspapers to inform the community, stakeholders and agencies of the start of the RCS renewal process. The NCCMA website provided regularly updated information on the process and recent developments throughout this phase.

In reviewing the original RCS, a total of nine one-day workshops were held in Donald, Bendigo, Quambatook, Echuca, Kyneton, Maryborough, St Arnaud, Kerang and Pyramid Hill. Representatives from a range of backgrounds participated in these workshops, including the Implementation Committees, NRE, Landcare, local government, water authorities, environmental organisations, VFF and other people representing key technical or community issues. On average 20 people attended each workshop.

The workshops were structured to obtain information of particular relevance to the program logic model used to assess the effectiveness of the 1997 RCS. In particular, information was sought relating to:

- ◆ vision, objectives, scope and priorities
- ◆ information and catchment condition
- ◆ stakeholder/community engagement
- ◆ achievements of resource management programs
- ◆ performance indicators

In addition, interviews were undertaken with NCCMA and DPI program managers.

Reflection phase

A workshop was held for representatives of Implementation Committees, DPI, Landcare, local government, water authorities, environmental organisations, VFF and other key people representing key technical or community issues. This workshop's objective was to:

- ◆ explain and communicate findings of the review phase and other studies
- ◆ indicate and discuss the new RCS vision, scope, objectives and targets
- ◆ discuss expected outcomes.

Indigenous community consultation

Consultation with Indigenous communities was a component of a larger community consultation process undertaken in the North Central region to review, reflect on and renew the RCS. Given the unique way Indigenous communities relate to natural resources and consultation processes, special emphasis was made to genuinely increase their participation in the review and renewal process of the RCS.

The consultation process with the Indigenous community involved face-to-face contact with relevant individuals, groups and organisations within each Indigenous community to schedule, plan and organise the needed consultation events (such as meetings and workshops). During stage two, these consultation events were facilitated.

The objective of this consulting with the Indigenous communities was to establish an ongoing dialogue on natural resources management, as well as to identify issues of importance to these communities for inclusion into the renewed RCS. A specific process and/or program for ongoing inclusion and participation of Indigenous communities was developed for inclusion into the ongoing broader community participation programs.

NCCMA board and key stakeholder workshop

A full-day workshop was held with the board and key regional agency representatives. The objective was to:

- ◆ to review information, interpretations, insights and implications relevant to the existing strategy and the new RCS resulting from the review and reflection workshops
- ◆ develop a revised set of strategy objectives, targets and vision.

Risks and target setting workshops

Three workshops were held with the key regional agency and NCCMA technical representatives. The objectives were to:

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- ◆ review information, interpretations, insights and implications of the work undertaken to date including the foundation programs
- ◆ identify the assets at risk
- ◆ integrate assets and identify priorities
- ◆ establish regional targets.

Research and development workshop

After the risks and targets workshops, a further workshop was conducted to define and develop strategies to fill knowledge gaps. The workshop was held with NRM researchers and other key stakeholders.

Monitoring program workshop

Following the research and development workshop, a workshop was held to define and develop a performance monitoring and evaluation plan. Key stakeholders from local governments, community groups and agencies participated. A review of regional natural resource monitoring networks and programs assessed their capacity to report against targets. The review considered the:

- ◆ nature of the monitoring networks
- ◆ existing monitoring arrangements.

The review also identified gaps in the monitoring network that prevented reporting on targets. Methods to address these issues were proposed.

New Regional Catchment Strategy

The NCCMA Board held a workshop to consider the information gathered to this stage of the process.

A drafting team then developed a preliminary draft RCS. The Department of Natural Resources and Environment's RCS Accreditation Coordinating Group provided feedback on this document.

Future Directions Paper

A Future Directions Paper was prepared and distributed. The paper formed the foundation of the draft RCS. It was distributed widely to allow interested parties to comment on the framework, the assets, the services and threats identified, and to reflect on how natural resource management programs could effectively be delivered within the region over the next five years.

A communications plan for the community feedback phase of the Paper was developed and implemented

to ensure the community and stakeholder groups had easy access to this document.

A series of presentations was made by the NCCMA to community forums and Implementation Committees.

Feedback was received over a five-week period. In that time, the NCCMA received over 80 written submissions from people from a range of backgrounds, including urban residents, landholders, Landcare groups and government agencies. The submissions were made on behalf of approximately 1,450 people.

Draft RCS

The draft RCS was prepared and made available to the community and stakeholders for a period of four weeks. Over 70 written submissions were received in addition to the formal feedback received from the Accreditation Coordinating Group and Key Contacts and Expert Panels.

Key messages from regional consultation process

The consultation process identified a range of new and existing issues that have helped shape the renewed RCS. The major issues raised were:

- ◆ improving the river health and water quality within the region
- ◆ improving land and water management practices, including soil health, pest plant and animal management
- ◆ protecting and enhancing biodiversity
- ◆ landscape change incorporating land stewardship, climate change and sustainable farming systems
- ◆ considering the effects of increasing residential and hobby farm development on natural resource management, particularly in the upper catchment.

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- ◆ improving community communication and knowledge transfer to enhance the community's capacity to apply integrated management to the land
 - ◆ needing to understand that private landholders will contribute to the restoration of the land, water and biodiversity assets of the region, but cannot be expected to do it all
 - ◆ continue to support Landcare groups
 - ◆ including the Indigenous communities in management of the region's natural resources
 - ◆ enhancing coordination among the NCCMA, agencies and other partners to build ownership and understanding of the RCS
- ◆ ensuring NCCMA community engagement structures are effective and supported by the community
 - ◆ enhancing integration of sub-strategies and action plans
 - ◆ ensuring, where possible, that solutions to natural resource management issues are integrated and achieve multiple outcomes
 - ◆ adopting a 20 – 50 year horizon that embraces the community's aspirations for natural resource management and landscape change
 - ◆ including the community as an asset, along with land, water, biodiversity and climate.

2 Risk assessment process

An assessment has been undertaken of all of the threats that challenge regional natural asset services. This involved identifying the full range of threats and services listed on the following pages.

The risk assessment involved scoring the consequence of a threat to the service and the likelihood of the threat. This was done using the risk scoring matrix shown below.

A summary table of the most significant threats and at-risk services (scores 7–9) was then compiled for each asset and is presented in the North Central Catchment Condition Report. The summary table also indicates the location within the region where the threat is most prominent.

		Likelihood score		
		Low	Moderate	High
Consequence score	Low	1	2	4
	Moderate	3	5	7
	High	6	8	9

Figure 8: Risk scoring matrix

2 Risk assessment process

Table 27: Asset service definitions

Asset service	Definition
Cultural heritage	Indigenous and non-Indigenous sites and places of cultural heritage.
Direct economic activity	Service generates direct economic activity, e.g. agricultural production, forestry production.
Domestic and stock	Water used for domestic purposes and stock watering.
Energy	Provision of corridors for distribution of energy (electricity, gas).
Environmental flow	Provision of water to stream or wetland for specific environmental objectives.
Fire fighting	Provision of water for fire fighting purposes.
Flood protection	Protection of built infrastructure from damage by flooding.
Flora and fauna habitat	Provision of habitat for indigenous flora and fauna, including aquatic, terrestrial and soil ecosystems. Includes ecosystem function.
Generate water run-off	Water run-off from a catchment area. Includes amount and quality of water.
Groundwater recharge	Groundwater recharge to a beneficially used aquifer. In parts of the region, this will include mineral or spring water.
Human shelter	House or other structure of human habitation.
Infrastructure corridors	Locations of transport, communications, water or energy supply/distribution infrastructure.
Irrigation and rural drainage	Provision of corridors for irrigation and rural drainage pipes and channels.
Landscape - visual amenity	Visual amenity or aesthetic value of landscape views.
Mineral water	Water with high carbonate and/or mineral content that is extracted for bottling or used in tourist facilities.
Recreation and tourism	Passive and active recreational activity, including that undertaken by tourists.
Rural living	The amenity associated with living in areas beyond major provincial centres.
Salt disposal	Provision of sites for evaporation basin or other sites of 'salt disposal'. In most cases water is evaporated and salt retained.
Town water	Potable water used for drinking and other domestic purposes.
Transport	Provision of corridors for road and rail transport.
Waste disposal and reuse	Provision of sites for disposal and recycling of wastes, including domestic rubbish and urban and industrial waste water.
Water supply infrastructure	Provision of corridors or locations for water supply infrastructure, such as reservoirs, dams, weirs, pipes and channels.

2 Risk assessment process

Table 28: Threatening process definitions

Threatening process	Definition
Changed fire regime	Direct impact on asset services by fire (esp. wildfire). Longer term, largely ecological impact associated with fire regime or the lack of fire for a fire adapted ecosystem.
Changed flow regime	Change in surface water flow regime (e.g. timing, extent, frequency of flooding; timing and duration of wetting and/or drying cycle in ephemeral wetlands). May be due to change in rainfall-run-off relationships with clearing and agricultural development, upper catchment storages, climate change or use of waterway or wetland in distribution of irrigation or stock and domestic water supplies.
Climate change	Long term shift in rainfall and/or temperature regime associated with greenhouse effect. Change beyond 'normal' climatic variability.
Farm business viability	Change in capacity of landholders to operate a commercial scale farm business. Viability affected by commodity and land prices, scale and efficiency of operation, quality/productivity of land base and livestock etc.
Flooding	Stream flow that extends beyond the stream channel.
Fragmentation of habitat	Loss of continuity, connectivity, size and ecological function in native vegetation.
Inappropriate land management practice	Land management practices that have unintended adverse consequences on other asset services.
Inappropriate recreation	Recreational activities that result in damage to the locations at which recreation occurs.
Infrastructure development	Maintenance or expansion of infrastructure within a corridor. Includes, road widening, construction of new infrastructure (e.g. pipeline or power line) within existing or new corridor.
Land use change: forestry plantations	Land use change from broadacre agriculture or other use to plantation forestry. Land use change primarily taking place in higher rainfall areas in the south. Impacts potentially associated with any removal of retained native vegetation and alterations to hydrological regime.
Land use change: horticulture	Land use change from broadacre agriculture or other use to (generally irrigated) horticulture. In dryland areas change often accompanied by construction of irrigation water supply dams. Proliferation of such dams may impact on surface water regimes in some sub-catchments.
Land use change: rural residential expansion	Land use change from broadacre agriculture or other use to rural residential/lifestyle use. Agriculture may still be practised, but is not commercial in intent, scale or intensity. Land use change generally occurring on the periphery of provincial centres and along Calder and Murray corridors. This is also linked to water trade and loss of water in some irrigation areas.
Mining	Extraction of minerals, stone, gravel, sand, soil, gypsum and/or salt. Damage resulting directly from contemporary mining activity or from residual impact of historical mining (e.g. sand/gravel slugs in streams).
Pest animals	Non indigenous species that cause economic or environmental damage. Main pests are rabbits, foxes and domestic animals (cats, dogs).
Pest plants	Non indigenous species that cause economic or environmental damage.
Salinity	Presence of shallow water tables and soil salinisation as the result of human activity.
Soil acidity	Acidification of soil profiles as the result of human activity. pH also affects availability of potentially toxic (to plants) minerals within the soil (e.g. aluminium) and of phosphorus.
Soil erosion	Loss of top or sub soil due to action of wind or water.
Soil structure decline	Compaction of soils as the result of excessive animal or vehicular traffic and/or cultivation. Accentuated by traffic/cultivation when soils are wet and by loss of organic matter from soil.
Water allocation and trade (water shares)	Water can be traded from one location to another. Water is allocated to a range of commercial and environmental uses. Snowy River and Living Murray environmental flow initiatives may result in less water being available to commercial users. The loss of water from the region through water trade is also allocated by landuse change, i.e. rural residential expansion.
Water quality decline	Loss of quality of surface water or groundwater by contamination with sediment, nutrients, agricultural chemicals and other contaminants.

3 Landcare and other environmental groups of the North Central region

Appin Leaghur Landcare and Waterwatch Group
Appin West of Loddon Landcare Group
Ashbourne Landcare Group
Avon Plains Landcare Group
Axe Creek Catchment Landcare Group
Bald Hills/Creswick Landcare Group
Bamawm Drainage Diverters Group
Banyena Landcare Group
Baringhup Landcare Group
Baringhup Young Landcare
Barkers Creek Landcare and Wildlife Group
Barr Creek Tree Group
Baynton Sidonia Landcare Group
Bendigo Creek Floodplain Group
Bendigo Deborah Reef Action Group
Benjeroop Landcare Group
Blampied/Kooroocheang Landcare Group
Brenanah Creek Tree Group
Bridgewater Landcare Group
Calivil Landcare Group
Callawadda Landcare Group
Campaspe Lamb Group
Campaspe River and Land Management Group
Campaspe Runnymede Landcare Group
Campaspe Valley Landcare Group
Canary Island Landcare Group
Carapooee Landcare Group
Castlemaine Urban Landcare Group
Charlton Landcare Group
Chewton Landcare Group
Clunes Landcare Group
Combined Upper Campaspe Landcare Group
Daylesford Landcare Group
Donald Landcare Cropping Group
Donald Landcare Tree Group
Dunolly Landcare Group
Eaglehawk Environment Group
Echuca Urban Landcare Group
Echuca West Salinity Group
Elmore/Rochester Farm Group
Emu Landcare Group
Fairley Bael Bael Landcare Group
Fentons Creek Conservation Group
Friends of the Campaspe
Glenloth Landcare Group
Glenlyon Upper Loddon Landcare Group
Golden Point Landcare Group
Guildford and Upper Loddon Landcare Group
Gunbower Landcare Group
Harcourt Valley Landcare Group
Hunter Landcare Group
Jarklin Landcare Group
Jeffcott North Landcare Group
Junortoun Landcare Group
Kamarooka Landcare Group
Kangderaar Catchment Landcare Group
Kerang Landcare Group
Kinypanial Landcare Group
Kooreh Group
Korop/Gannawarra Landcare Group
Koyuga/Kanyapella Landcare Group
Laanecoorie Farm Group
Lake Boga Landcare Group
Lake Charm Landcare Group
Lalbert Landcare Group
Langley Landcare Group
Lexton Landcare Group
Lockington Landcare Group
Loddon Vale Landcare Group
Longlea and District Landcare Group
Macorna Landcare Group
Maldon Landcare Group
Maldon Urban Landcare Group
Malmsbury Landcare Group
Marnoo Land and Water Management Group
McCallums Creek Landcare Group

3 Landcare and other environmental groups of the North Central region

Mclvor Landcare Group
Mologa District Landcare
Moolort Landcare Group
Mt Bolton/Beckworth Landcare Group
Mount Pleasant Landcare Group
Mt Korong Landcare
Muckleford Catchment Landcare Group
Mullers Creek Drainage
Murphy's Creek Landcare Group
Murrabit Landcare Group
Myall Landcare Group
Nanneella Landcare Group
Natte Yallock Landcare Group
Newstead Landcare Group
North Central Landcare Group
North Harcourt-Sedgwick Landcare Group
Northern United Forestry Group
Nuggetty Land Protection Group
Pental Island Landcare Group
Pine Grove Farm Advancement Group
Pipers Creek Landcare Group
Pyramid Hill FM500
Quambatook Landcare Group
Ravenswood Valley Landcare Group
Rocky Lead Landcare Group
Salisbury West Landcare Group
Sandon-Werona Landcare Group
Sandy Creek Landcare Group
Sheepwash Creek Landcare Group
Shepherds Flat Landcare Group
Silverleaf Nightshade Control Group
Stuart Mill Landcare Group
Sutton Grange Landcare Group
Swanwater Landcare Group
Taradale Walking and Landcare Group
Teddywaddy Rabbit Action Group
Terricks Ridge Landcare Group
Timor West Landcare Group
Tragowel Landcare Group
Trentham District Landcare Group
Tylden Landcare Group
Tyntynder Landcare Group
Ullina Landcare Group
Upper Spring Creek Landcare Group
Wandella Landcare Group
Watchem West Landcare Group
Wattle Flat-Pootilla Landcare Group
Welshmans Reef Landcare Group
West Boort Landcare Group
West Marong Landcare Group
Wharparilla Landcare Group
Winjallock Landcare Group
Woodend and Five Mile Landcare Group
Woosang Farm Advance Group
Wycheproof Landcare Group
Yando Landcare Group
Yarrowalla Tree Group
Yawong Conservation Group
Yawong Rabbit Action Group

Acronyms

ABS	Australian Bureau of Statistics
BWE	Bulk Water Entitlement
CaLP Act	<i>Catchment and Land Protection Act 1994</i>
CAMBA	China-Australia Migratory Birds Agreement
CMA	Catchment Management Authority
CVGA	Central Victorian Greenhouse Alliance
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
Dryland SMP	Dryland Salinity Management Plan
EC	Electrical conductivity
EMS	Environmental Management System
EPA	Environment Protection Authority
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPO	Environment Protection Overlay
EVC	Ecological vegetation class
GFS	Groundwater flow system
GL	Gigalitre
G-MW	Goulburn-Murray Water
ha	Hectare
HVP	Hancocks Victorian Plantations
ISC	Index of Stream Condition
JAMBA	Japan-Australia Migratory Birds Agreement
LMLWMS	Loddon Murray Land and Water Management Strategy
MDBC	Murray Darling Basin Commission
ML	Megalitre
NAP	National Action Plan for Salinity and Water Quality
NCCMA	North Central Catchment Management Authority
NHT	Natural Heritage Trust
NGO	Non-government organisation
NRE	Department of Natural Resources and Environment (now DPI / DSE)
NRM	Natural resource management
PV	Parks Victoria
RAP	Rabbit Action Plan
RCIP	Regional Catchment Investment Plan
RCS	Regional Catchment Strategy
RCT	Resource Condition Target
RFA	Regional Forest Agreement
SDL	Sustainable Diversion Limit
SEPP	State Environment Protection Policy
SMFP	Stream Flow Management Plan
SMP	Salinity Management Plan
VPO	Vegetation Protection Overlay
VRSTS	Victorian Rare or Threatened Species
VFF	Victorian Farmers' Federation
WAP	Weed Action Plan
WMW	Wimmera Mallee Water

Terms

Aquifer	An underground layer of soil, rock or gravel able to hold and transmit water.
Bulk Water Entitlements	Issued to rural and urban water authorities, and in some cases for the environment. A bulk water entitlement defines the volume of water that an authority may take from a river or storage, the rate at which it may be taken and the reliability of the entitlement.
Bush Tender	A program which enables landholders to receive payment in return for providing management services that improve the quality and extent of their native vegetation. The tender process allows landholders to establish their own price for the native vegetation management services they offer.
Carbon sequestration	Removing carbon dioxide from the atmosphere via the uptake and storage of carbon. Planting vegetation is one way of biologically removing carbon dioxide. Alternatively, carbon dioxide released from industry could be collected and pumped into geological formations including oil and gas reservoirs, unmineable coal seams, and into and below the sea.
Community engagement	To consult the community, increase awareness and promote the involvement of community members in a particular event, activity or project.
Discharge area	An area where groundwater reaches the soil surface.
EC Units	Electrical conductivity is the most widely used method of measuring the salinity of water. EC is not a direct measure of salinity, but a measure of the ability of water to carry an electrical current. The EC increases as the presence of salt increases.
Ecological Vegetation Class	The vegetation classification system of choice in Victoria. An EVC comprises one or several vegetation communities based on landscape, structural, floristic and ecological features.
Effluent stream	A creek that leaves a watercourse and does not return to it (the opposite of a tributary). This term has nothing to do with pollution.
End of Valley Target	A target for the quality and quantity of water at the point where a river leaves a catchment.
Groundwater	Water beneath the surface held in or moving through saturated layers of soil, sediment or rock.
Palaeozoic	A geological era that extended from approximately 570 million years ago to 225 million years ago. The Palaeozoic era contained the Cambrian, Ordovician, Silurian, Devonian, Carboniferous and Permian periods.
Peri-urban	Districts on the outside edge or perimeter of urban areas.
Recharge Areas	Areas of the landscape where, due to free draining soils and rocks that are highly fractured, rainfall can infiltrate into the deeper zones and ultimately enter the groundwater system.
Social capacity	An individual or group's ability to learn, understand and act in relation to maintaining or enhancing social, environmental and economic well being.
Sodosols	Sodosols have a sodic subsoil and strong texture contrast between A and B horizons. Widespread throughout the North Central region they frequently occur on the older alluvial plains in the north and on sedimentary hills and rises.
Sodic soils	Soils containing so much exchangeable sodium that plant growth and soil stability are adversely affected.
Tenosols	Tenosols are shallow, weakly developed soils with little profile development other than accumulation of surface humus. They generally have low water holding capacity and fertility. In the North Central region they are most commonly associated with steep hills on sedimentary rock.
Triple bottom line	A term used for measuring and reporting business performance against economic, social and environmental parameters.

Endnotes

Note No.	Endnote
1	MacKay & Eastburn 1992, <i>The Murray</i> , Murray Darling Basin Commission, Canberra.
2	North Central Catchment Management Authority 2003, <i>North Central Catchment Condition Report</i> , North Central Catchment Management Authority, Huntly.
3	CSIRO 2001, <i>Natural assets: An inventory of ecosystem Goods and Services in the Goulburn Broken Catchment</i> , CSIRO, Canberra.
4	North Central Catchment Management Authority 2003, <i>Regional Response to Climate Change – Revegetation Action Plan</i> , North Central Catchment Management Authority, Huntly.
5	Maunsell Australia Ltd. 2002, <i>Catchment Management Issues</i> , Municipal Association of Victoria, Melbourne.
6	Victorian Catchment Management Council 2003, <i>Protocols, Principles and Strategies Agreement for Indigenous Involvement in Land and Water Management</i> , State of Victoria, Melbourne.
7	Australian Bureau of Statistics 1997 and 2001, <i>Australian Bureau of Statistics Census</i> (adapted by Neil Clark & Associates) Canberra, as reported in the North Central Catchment Condition Report 2003.
8	TBA Planners and Neil Clark & Associates 1998, <i>North Central Catchment Profile</i> , North Central Catchment Management Authority, Huntly.
9	National Land and Water Resources Audit 2001, <i>Australian dryland salinity assessment 2000</i> , National Land and Water Resources Audit, Canberra.
10	Smith, N 1992, <i>Recent hydrological changes in the Avoca River catchment</i> , Department of Conservation and Natural Resources, Water Division.
11	Victorian Catchment Management Council 2002, <i>The health of our catchments. A Victorian report card 2002 – The Victorian Catchment Management Council 5 year report</i> , Victorian Catchment Management Council, Melbourne.
12	Slattery, B & Hollier, C 2002, <i>The impact of acid soils in Victoria</i> , The State of Victoria, Department of Natural Resources and Environment, Rutherglen Research Institute.
13	Department of Natural Resources and Environment 2001, <i>North Central Region Weed Action Plan 2001 – 2005</i> , The State of Victoria, Department of Natural Resources and Environment.
14	Wilson, S M 2001, <i>Dryland salinity – What are the impacts and costs to non-agricultural stakeholders (North Central region)</i> , Report to the Murray-Darling Basin Commission and the National Dryland Salinity Program, Canberra.
15	Goulburn-Murray Water 1997, <i>Irrigated Farm Census</i> , Goulburn-Murray Water, Tatura.
16	Lewis, D 2002, <i>The Value of Water</i> , The State of Victoria, Department of Natural Resources and Environment.
17	Department of Natural Resources and Environment 1998, <i>Cereal, cattle and sheep property values</i> , The State of Victoria, Department of Natural Resources and Environment.
18	Department of Sustainability and Environment 2003, <i>Victoria's 2001 – 2002 Report to the Murray Darling Basin Salinity Management Strategy</i> , State of Victoria, Department of Sustainability and Environment.
19	Department of Natural Resources and Environment 1997, <i>Victoria's Biodiversity: Directions in Management</i> , The State of Victoria, Department of Natural Resources and Environment.
20	Department of Natural Resources and Environment 2002, <i>Healthy Rivers, healthy communities & regional growth – Victorian River Health Strategy</i> , The State of Victoria, Department of Natural Resources and Environment.
21	Murray Darling Basin Ministerial Council 2002, <i>The Living Murray – A discussion paper on restoring the health the River Murray</i> , Murray Darling Basin Commission, Canberra.
22	Fleming N, Young D & Abernethy B 2002, <i>Integrating our management of natural resources. Combining benefits and risks in planning and prioritising investments</i> , Sinclair Knight Merz.

Values and Principles

The North Central Partnership will manage its business in a highly professional and ethical manner. The values and principles of the North Central Partnership require a particular behaviour that will cement relationships between partners and the wider community, and will underlie all decisions, actions and relationships entered into. These values will be promoted so that all people and organisations that the North Central Partnership has dealings with know what to expect.

Our Values

We agree to work together, and ensure that our behaviour reflects the following values:

Courage

We will take a visionary approach, provide leadership and be prepared to make difficult decisions.

Inclusiveness

We will build relationships based on trust and sharing, considering the needs of future generations, and working together in a true partnership.

We will engage all partners, including Indigenous communities.

Commitment

We will act with passion and decisiveness, taking the long-term view and aiming for stability in decision-making.

We will take a regional perspective and a non-partisan approach to regional management.

Respect and Honesty

We will respect different views, respect each other and acknowledge the reality of each other's situation.

We will act with integrity, openness and honesty, be fair and credible, and share knowledge and information.

We will use resources equitably and respect the environment.

Flexibility

We will accept reform where it is needed, be willing to change, and continuously improve our actions through a learning approach.

Practicability

We will choose practicable, long-term outcomes and select viable solutions to achieve these outcomes.

Mutual obligation

We will share responsibility and accountability, and act responsibly, with fairness and justice.

We will support each other through necessary change.

Our Principles

We agree, in a spirit of partnership, to use the following principles to guide our actions:

Integration

We will manage catchments holistically; that is, decisions on the use of land, water and other environmental resources are made by considering the effect of that use on all those resources and on all people within the catchment.

Accountability

We will assign clear responsibilities and accountabilities.

We will manage resources wisely, being accountable and reporting to our partners.

Communication

We will keep communities informed of our programs, activities and outcomes.

We will engage communities to encourage understanding of, support for and ownership of our strategies and plans.

We will communicate to the community a clear process for their involvement in decision-making.

We will establish a respectful and flexible process for genuine involvement of Indigenous people in decision-making, support and understand the value of this involvement.

Transparency

We will clarify the outcomes sought.

We will be transparent about how to achieve outcomes and what is expected from each partner.

Effectiveness

We will act to achieve agreed outcomes.

We will learn from our successes and failures and continuously improve our actions.

Efficiency

We will work in partnership to ensure the most efficient use of resources, both internal (i.e. financial and human resources) and external (environmental, social and economic).

Full accounting

We will take account of the full range of costs and benefits, including economics, environmental, social and off-site costs and benefits.

Informed decision-making

We will make decisions at the most appropriate scale.

We will make decisions on the best available information, and continuously improve knowledge.

Learning approach

We will learn from our failures and successes.

We will learn from each other.



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