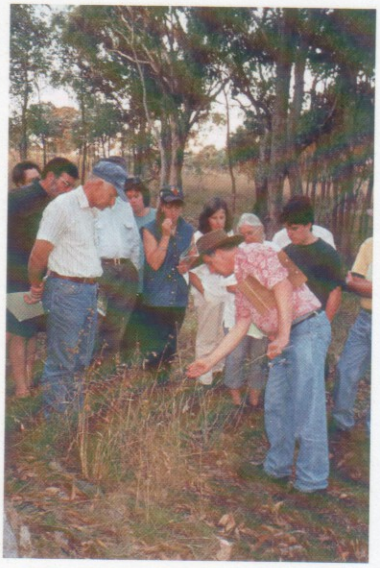
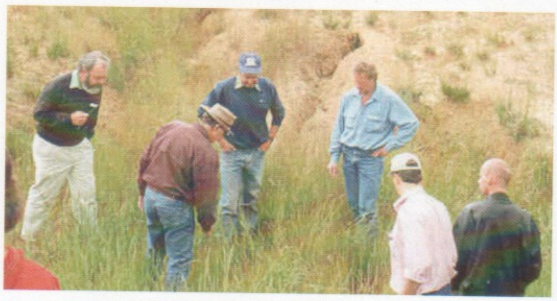
Yass Area Network of Landcare Groups

CATCHMENT ACTION PLAN



Yass Area Network of Landcare Groups

Working together



YASS AREA NETWORK OF LANDCARE GROUPS

YASS AREA CATCHMENT ACTION PLAN

October 2002

Natural Resource Planning Advisor Steering Committee:
Sylvia Gleeson, Ray Malam, John Franklin, Trent Brassil, Richard Webb.

Yass Area Network of Landcare Groups Management Committee:
John Betts, Peter Dawes, Graham Robertson, John Franklin, Sylvia Gleeson, Trent Brassil, Geoff McFarlane, Bruce Bray, Ray Malam, John Sutton, Robert Gorman, David Young.

***Author**: Jacquie White*
Natural Resource Planning Advisor

***Edited and finalised**: Nicole Cosgrove*

Yass Valley Way
PO Box 23
Yass NSW 2582

Ph. (02) 6226 1433
Fax. (02) 6226 2642

This project has been supported by the Natural Heritage Trust.

Natural Heritage Trust

1. FOREWORD

We have been told that within the next 50 years, remnant vegetation affected by dryland salinity could increase twelve-fold (NLWRA 2001). This scenario would be disastrous for a catchment such as ours, already suffering the impact of salinity. However, it highlights the need for this, our first locally developed and owned catchment plan, to focus our actions on local needs.

The Yass Area Network of Landcare Groups provide a forum for landcare groups, state and local governments, and community organisations to work together to address natural resource issues in the Yass area. In 1997 funding from the National Landcare Program allowed work to begin on our catchment plan. As chairman of the Yass Area Network of Landcare Groups, I am now pleased to present this plan.

The plan will assist all land managers with an interest in natural resource management to identify, quantify and prioritise the issues in this part of the Murrumbidgee catchment. It will also provide a sound basis to justify and plan future investment in specific on-ground actions. While we recognise that work needs to continue to refine our data and to collect additional information, we are proud to lay the foundations.

Most of the actions in this plan are locally focussed, but will contribute to regional and national outcomes. We are proud that our local actions will support national change, and I would like to acknowledge individual and group efforts to this end.

I would like to emphasise that this is not a regulatory document, and is not intended to set out compulsory obligations. On the contrary, its strength lies in its voluntary nature and its development through extensive consultations with landholders.

I would like to thank Jacquie White and Annabel Kater who have each held the position of the Natural Resource Planning Advisor during the life of this project. This plan is the result of their many hours of data collection, surveys, community consultation and research. Through their hard work, persistence and initiative they have made a significant contribution to the future sustainability of this catchment.

I would also like to acknowledge the efforts of the Steering Committee in ensuring the plan was completed to a high standard in the absence of a dedicated catchment planner for the last several months, and to Nicole Cosgrove who finalised the plan after Jacquie's departure.

This catchment plan is the product of a cooperative effort from all partners and illustrates our strong tradition of stewardship in this region. It demonstrates the commitment of those living and working in the Yass area to identifying and addressing the most pressing natural resource issues. We thank our funding partners; the Commonwealth Government's Natural Heritage Trust, and the New South Wales Government. We look forward to continuing our work with them in the Yass area catchment.

John Betts
Chairman
Yass Area Network of Landcare Groups

2. ACKNOWLEDGEMENTS

The Yass Area Network of Landcare Groups would like to thank the following for their assistance in the development of the Yass Area Catchment Action Plan.

Yass Area Network of Landcare Groups:
Bookham/Burrinjuck, Geary's Gap/Wamboin, Goodhope/Boambolo, Gundaroo, Manton, Murrumbateman, Narrangullen, Sutton, Taylor's Creek, Yass Urban, Binalong, Jerrawa Creek, Collector, Hall, Bungendore

Department of Land & Water Conservation, Yass:
John Franklin, Brad Parker, John Scown, David Cosgrove, Lyn Polsen

Landcare Coordinator:
Katie Hollingsworth

Department of Agriculture, Yass:
Fiona Leech

Yass Shire Council:
Mark Grayson, Ben Ponton, Steve Finch

Upper Murrumbidgee Catchment Coordinating Committee:
Val Wiseman

National Parks & Wildlife, Queanbeyan:
Rainer Rehwinkel, Paul Packard

Greening Australia:
Sue Streatfield

Salt Action, Cowra:
Andrew Wooldridge, Nik Henry

Also: Annabel Kater, Alex Sticpewich, Libby Elliot, Sarah Shelley, Emma Williams, Peter Regan, Stewart Jeffress.

Members of the Yass catchment community: In particular, thanks to those who participated in catchment surveys, workshops and planning meetings – Gundaroo Primary School, Sutton Primary School and Green Corps.

Consultant and adviser:
Nicole Cosgrove

Funding from the following organisations is gratefully acknowledged in contributing to the development of the Yass Area Catchment Plan:

- *Natural Heritage Trust*
- *Yass Area Network of Landcare Groups*
- *Department of Land & Water Conservation*

CONTENTS

List of Figures, Tables and Maps

3. EXECUTIVE SUMMARY

Since the success of the first landcare projects, governments across Australia have continued to demonstrate their commitment to programs to address natural resource management issues in partnership with local communities. Emphasis has been placed on community action, on-ground works and developing practical solutions at a local level. While governments have provided national and regional frameworks, a large responsibility has rested with communities to implement these policies.

This plan is the initiative of the Yass Area Network of Landcare Groups in recognition of the community's role in developing **a strategic approach to addressing the land degradation and environmental issues in the Yass area**. It is a guide to provide direction for individual and community action. We have deliberately chosen not to allocate specific responsibilities to agencies or groups in this plan, as we want this document to encourage stakeholders to work together in a flexible and cooperative manner.

Work on this plan began in 1997. In the meantime the broader scale Murrumbidgee Catchment Action Plan (1998) and Blueprint (2001) have also been developed with input from community consultations in the Yass catchment. The actions proposed in this plan are consistent with the targets and activities identified in the Murrumbidgee Catchment Blueprint and will contribute to meeting overall Murrumbidgee Catchment targets. However, it also stands alone as **a community-owned plan that identifies local issues and proposes local actions.**

It reflects a significant change in attitude towards natural resource management in the local area over the last ten years, and the popularity of landcare in this region.

In preparing this plan we have aimed to create a document that contains relevant information in a way that is easy to find and read. The plan consists of two parts. The first describes and quantifies the most serious natural resource issues as defined by the community and suggests actions to address them. Maps of the priority catchment issues are included. The second part, the Appendix, contains the supporting information and more technical data.

Much of the data that forms the basis of this plan was collected by individual land holders, DLWC and the Natural Resource Planning Advisor.

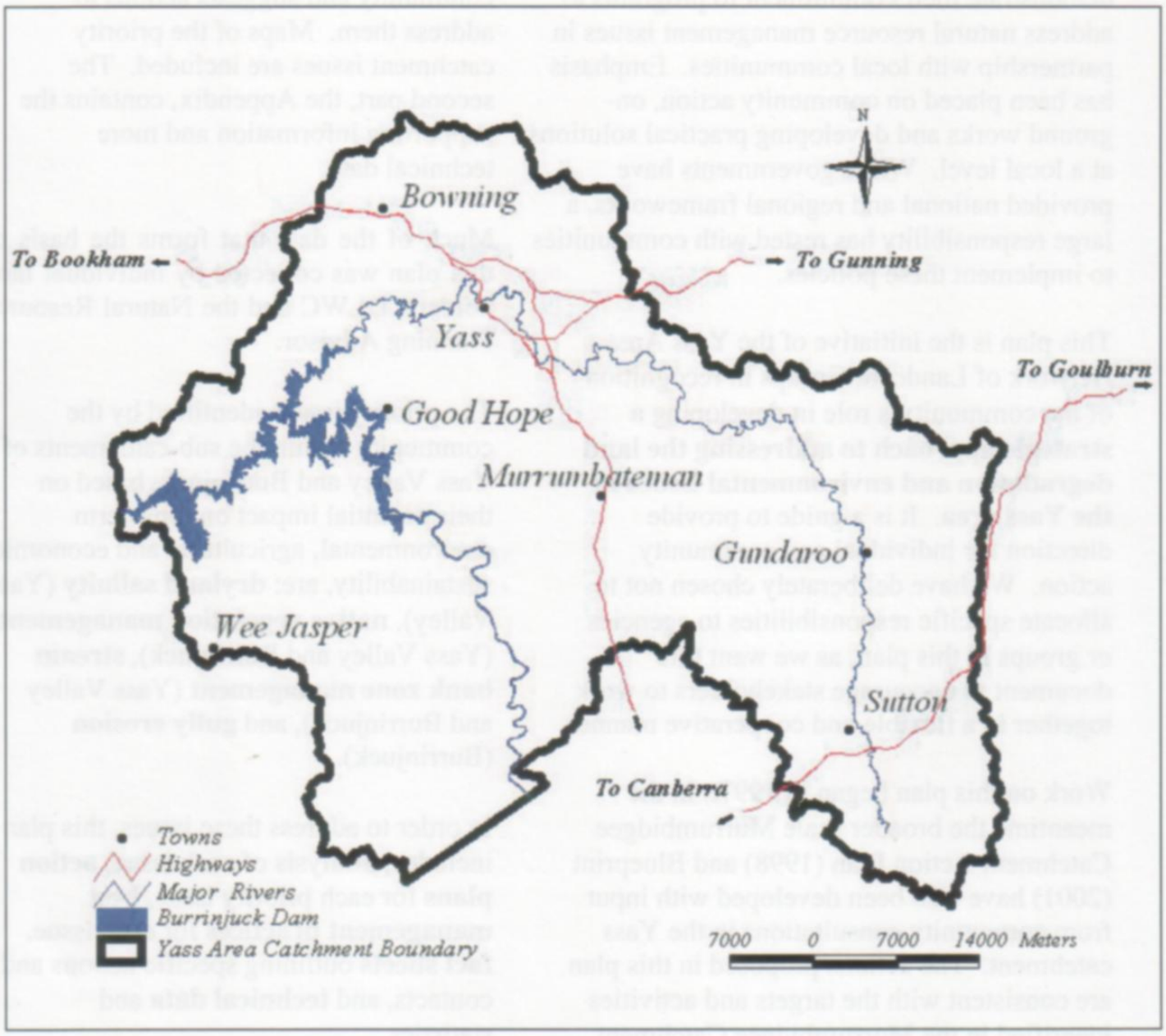
The priority issues identified by the community within the sub-catchments of Yass Valley and Burrinjuck, based on their potential impact on long-term environmental, agricultural and economic sustainability, are: **dryland salinity** (Yass Valley), **native vegetation management** (Yass Valley and Burrinjuck), **stream bank zone management** (Yass Valley and Burrinjuck), and **gully erosion** (Burrinjuck).

In order to address these issues, this plan includes; **analysis** of each issue, **action plans** for each priority issue, **best management practices** for each issue, **fact sheets** outlining specific actions and contacts, and **technical data** and statistics.

The Appendix contains technical data collated from landcare groups and government agencies. It is a comprehensive collection of base line data describing the natural resources in the catchment.

The plan will assist local groups to design projects that address the Yass catchment priorities as well as ensure they also contribute to overall Murrumbidgee Catchment objectives.

Map 1: THE YASS AREA CATCHMENT



4. THE YASS AREA NETWORK OF LANDCARE GROUPS

Our Landcare Network

The Yass Area Network of Landcare Groups was formed in 1996, in response to the need for an integrated approach to address land management and natural resource issues across the Yass area. The network incorporates 15 Landcare groups with an estimated membership of 450 landholders. Since 1996-97, 69 new and continuing projects have been undertaken by the groups drawing on over $1.8 million of government contributions and over $2 million in community contributions. (*See Appendix, section 1*).

Why we need a Catchment Plan

The term 'catchment' usually refers to a hydrological drainage area with physical boundaries such as mountains or hills, containing a specific set of natural resources. The boundaries of the Yass Area Catchment Action Plan have been determined by not only physical considerations, but also social and economic (see Map 1). In this way, the boundaries make sense to those living, working and managing natural resources in this area.

Catchment plans are a way of ensuring that the natural resources within the catchment are managed sustainably, consistent with the principles of ecologically sustainable development.

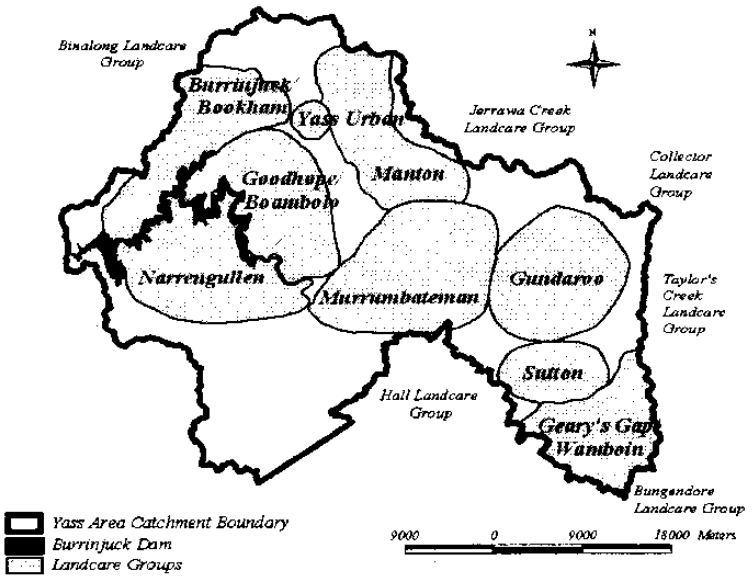
This plan identifies our catchment's high priority natural resource issues and suggests actions to address them. And while it takes account of other relevant plans and strategies on a larger scale, this document is largely community-owned and developed.(*Appendix sections 2,3, 4*).

Our Aims

The Yass Area Catchment Action Plan incorporates the actions and best management guidelines for natural resource management as developed by the Yass Area Network of Landcare Groups, individual landholders and community groups. The purpose of this plan is to:

- provide **current information** on the natural resources in the Yass catchment
- identify **priority issues** and areas
- suggest **actions** to address these problems, and
- promote **coordinated action** across government agencies, land managers and the community.

Figure 1: The Yass Area Network of Landcare Groups



Our Partners

This plan stands alone as a community-owned document that fits under the larger scale Murrumbidgee Catchment Blueprint, the Murrumbidgee Catchment Action Plan, and state and federal policies relating to natural resource management.

The Yass area catchment represents 20% of the 1,406,000ha Upper Murrumbidgee Catchment. We share the Murrumbidgee Catchment Management Board's vision of *a healthy productive Murrumbidgee Catchment and its communities working together.*

Table 1: Context of Action Plan in National, State and Regional Policies

COMMONWEALTH
Natural Resource Management Strategies and Policy
(eg National Action Plan for Salinity and Water Quality, Natural Heritage Trust)

↓

MURRAY-DARLING BASIN
Natural Resource Management Strategy
(eg Integrated Catchment Management in the Murray-Darling Basin 2001-2010)

↓

NEW SOUTH WALES
Natural Resource Management Strategies and Policy
(eg NSW Salinity Strategy)

↓

MURRUMBIDGEE CATCHMENT
(Murrumbidgee Catchment Blueprint)

↓

YASS CATCHMENT

YASS CATCHMENT ACTION PLAN

LOCAL GOVERNMENT
(Yass Shire Council, Gunning Shire Council, Yarrowlumla Shire Council)

SUB-CATCHMENT
Yass Valley & Burrinjuck Sub-Catchment Action Plans

↓

Individual Property Plans

5. A SNAPSHOT OF OUR CATCHMENT

Our Catchment

Yass is located 283 km south-west of Sydney on the Hume Highway at the westernmost tip of the Southern Highlands of New South Wales. The Yass Area Network of Landcare Groups covers an area of 283,255 ha extending from Burrinjuck Dam in the west, to Lake George Range in the east, from the Mundoonen Range and Hume Highway north-east of Yass township extending south to the Brindabella Range at Wee Jasper and along the ACT border. The catchment includes the towns and villages of Yass, Bowning, Good Hope, Gundaroo, Sutton, Murrumbateman and Wee Jasper.

The word 'Yass' is believed to have originated from the Aboriginal term 'yhar', meaning 'running water'. The Ngunnawal people inhabited the area prior to European settlement in the 1820s.

Climate

The Yass region is described as 'temperate' with warm summers, cold winters and a relatively uniform rainfall throughout the year. Average annual rainfall is 650 mm, and average maximum daily temperatures are 12.5 degrees Celsius in winter and 28.7 degrees Celsius in summer. (*see also Appendix section 6.1*)

Landform

The Yass catchment is generally representative of a typical tablelands landscape with plateau areas of flat to undulating terrain such as Boorowa-Binalong and Yass Valley. There are areas of upland and hilly landscapes (Lake George Range) and an area of steep, rugged terrain to the south-west of the catchment at the Brindabella Range.

Vegetation

The native vegetation within the catchment has largely been cleared, with remnants existing mainly on steeper, rocky soil and along roads and railway lines. Within the Yass Shire, which makes up most of the catchment, the original native Yellow Box/Red Gum woodland is poorly conserved, and few remnants remain.

Natural temperate grasslands were also a characteristic of the Yass Plains, dominated by native species of perennial grasses. Pasture species included *Themeda australis, Stipa aristiglumis* and *Poa* species. The degree of disturbance of these grasslands, particularly through activities such as grazing, indicates it is unlikely that these natural temperate grasslands persist in any significant amount (NECS 2001).

The speargrass *Stipa* grassland community occurs as a frost pocket to the south of Yass, locally known as the treeless plains (NECS 1999).

The native vegetation in protected reserves, approximately 2% of current native vegetation, does not adequately represent the Yellow Box/Red Gum woodland and natural temperate grasslands which once covered extensive portions of the area (NECS 1999).

The Vegetation Management Plan coordinated by the Yass Shire Council on behalf of the YANLG has carried out an inventory and assessment of native vegetation in the Shire. The plan also identifies priority areas for revegetation and retention to maximise linkages to focus on these two main vegetation communities that have declined within the Shire. (*see also Appendix section 6.4*)

Land Use and Structural Change

Historically, the Yass area has been dominated by large agricultural and pastoral holdings, renowned for merino wool, sheep and cattle studs. However, over the last 15 to 20 years, the character of the district has undergone significant change. While large agricultural enterprises remain important economic contributors to the region, there has been a growing number of small and hobby farm enterprises, as well as rural residential sub-division, that has changed the economic and social make-up of the catchment and which has important implications for natural resource management.

There is now a significant number of people living in the Yass area, but working in the larger centre of Canberra. In addition, new industries such as olive growing and viticulture have flourished, generating direct income from wine and grape sales, as well as attracting tourism.

Rural sub-divisions vary in concentration, in sizes of two, sixteen, forty and eighty hectares. Older subdivisions were carried out on existing portion boundaries resulting in fragmentation of agricultural areas, soil erosion, access difficulties, poor water management, bush fire hazard, detrimental visual impacts, fragmented management of vegetation and restricted ability for sustainable grazing management (MCAP 1998). It is estimated that if current trends continue, there could be 17,800 people living in rural areas of the ACT and Subregion by 2021, with 13,500 of these rural residential dwellers occupying around 40,000 hectares (MCAP 1998). (*see also Appendix section 6.7*)

Table 2 : YASS VALLEY CATCHMENT STATISTICS

Land Use		Area (ha)	Number Mapped	Percentage of Catchment
Cultivation area (continuous or rotational)		5126.89		3.22
Grassland 1 (includes native, volunteer, exotic, etc.)		115321.02		72.35
Grassland 2 (low to nil grazing)		6416.04		4.03
Horticulture: vineyards		147.56		0.09
other		49.87		0.03
Irrigated land (lucerne, pasture, crops, etc.)		445.54		0.28
Urban area (industrial, residential, etc.)		774.94		0.49
Modified land (not covered by other units)		630.73		0.40
Native tree cover	+ understorey	13294.54		8.33
	+ understorey + grazing	1206.66		0.76
	no understorey	3113.88		1.95
	no understorey + grazing	6576.15		4.13
	+ tree regrowth	1929.15		1.21
	+ tree regrowth + grazing	613.64		0.38
Softwood planting (e.g., pines and commercial)		740.82		0.46
Water storages / dams (dams < 5 ML)		771.00	6425	0.48
Water storages / dams (dams 5-10 ML)		82.90	300	0.05
Water storages / dams (dams > 10 ML)		364.13	425	0.23
Riparian zones native trees		42.20		0.03
	native trees + grazing	235.58		0.15
	exotic vegetation	17.06		0.01
	exotic vegetation + grazing	464.23		0.29
	grasses (native + exotic)	15.19		0.01
	grasses + grazing	262.53		0.16
	other, e.g., roads, urban	0.35		0.00
Stream channel (along main stream only)		445.44		0.28
Wetlands		311.08		0.20
Total		**159,399.12**		**100.00**

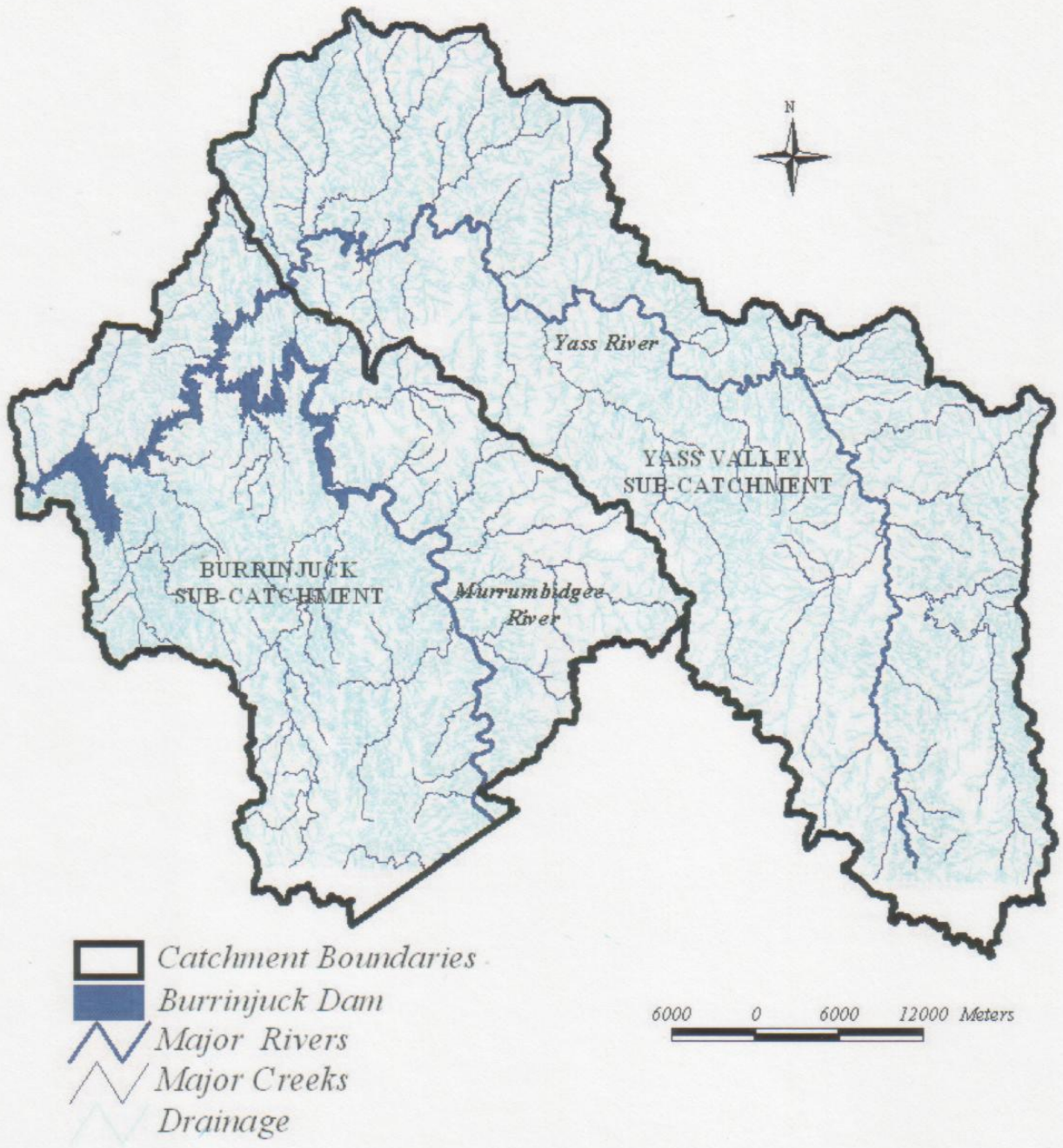
Yass Valley Land Use and Catchment Condition, DLWC, 2000

Drainage and Hydrology

The **Yass Area** Catchment incorporates the two major sub-catchments of:

- **Yass Valley** - flowing into the Yass River, and
- **Burrinjuck** - flowing into Burrinjuck storage and the Murrumbidgee River.

Map 2: Yass Valley & Burrinjuck Sub-catchments (Drainage)



6. ACTION PLANS

The Yass area catchment consists of two major sub-catchments; the **Yass Valley Sub-catchment** and the **Burrinjuck Sub-catchment**. Priority natural resource management issues have been identified for both sub-catchments and action plans for each priority issue have been developed through a process of community consultation. In addition, fact sheets outlining best management practices to address the priority issues are included as companion documents to the action plans. These will help groups to identify specific actions to address their local issues.

Many of the natural resource priorities identified by the landcare groups are inter-related. It is important to recognise these links in addressing them on a catchment scale and in applying best management practices.

NB: It is important to note that some actions may require advice and/or consent from local government or state agencies. YANLG advises individuals or groups to seek advice and approval as required.

Yass Valley Sub-catchment

The Yass Valley sub-catchment extends over 159,399 hectares encompassing six Landcare Groups: *Geary's Gap/Wamboin, Gundaroo, Manton, Murrumbateman, Sutton and Yass Urban.*

In the Yass Valley, grasslands (native and exotic) used for grazing represent over 72% of the sub-catchment (116,091 hectares). Just over three percent (5,127 hectares) is cropped. Vineyards occupy 148 hectares, and there are 446 hectares of irrigated land. The remainder is made up of urban and modified areas.

The priority natural resource management issues identified in the Yass Valley Sub-catchment are:

1. ***Dryland Salinity***
2. ***Native Vegetation Management***
   (remnant management and vegetation enhancement)
3. ***Stream Bank Zone Management***
   (riparian vegetation management)

Additional issues identified include; stream bank condition, weed management, soil erosion, pest animal management, surface water flow, soil acidity (grazing management) and rural residential development.

Burrinjuck Sub-catchment

The Burrinjuck sub-catchment extends over 123,836 hectares encompassing three landcare groups; *Bookham/Burrinjuck, Goodhope/Boambolo and Narrangullen.*

The priority land degradation issues identified by the landcare groups were:

1. ***Native Vegetation Management***
   (remnant management and vegetation enhancement)
2. ***Stream Bank Zone Management***
   (riparian vegetation management)
3. ***Gully erosion***
   (soil, gully and stream bank)

YASS VALLEY

SUB-CATCHMENT

Action Plans

1. DRYLAND SALINITY ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage the landscape to control and ameliorate dryland salinity.	To maintain sustainable productive farmland and to minimise the community impacts of salinity locally and downstream.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Soil Health √	Salinity √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

DS1. Seek expert advice on local causes.

DS2. Use tools such as the Salt Identification Kit to identify problems and severity.

DS3. Target priority areas (see Dryland Salinity BMP).

Implement management practices

DS4. Retain existing native vegetation. (PrMA3)

DS5. Manage grazing to promote groundcover & maintain grasses at their highest water using growth stage (BMA2, SMA5)

On-ground works

DS6. Fence off and protect remnant vegetation in identified high recharge country. (PrMA3, SMA5, BMA2, BMA7)

DS7. Replace annual pastures with perennial species (incl natives). (PrMA1, SMA8)

DS8. Revegetate identified high recharge country (eg Bidgee Hilltops project, Upper-Mid Lachlan & Upper Murrumbidgee Targeted Revegetation project). (PrMA4, BMA7)

DS9. Revegetate in interceptor areas. (PrMA6)

DS10. Rehabilitate high priority saline discharge areas by fencing to control stock, revegetate with salt-tolerant pasture and tree species, promote groundcover using fertiliser and gypsum application, mulching and earthworks where necessary. Graze to encourage water use where appropriate. (PrMA16, PrMA17)

Promote and educate

DS11. Promote practices that minimise recharge to groundwater, and reduces salt in streams, in both urban and rural situations by developing educational and awareness raising material/activities. (CBMA11)

DS12. Provide education and information to promote improved grazing management practices (eg PROGRAZE). (SMA5)

Monitor

DS13. Monitor salinity periodically to show extent of salinity, long term trends and results of management. Monitor local discharge and downstream river salt levels and promote successes to encourage further action (CBMA11)

2. NATIVE VEGETATION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Retain and enhance remnant vegetation and increase area of native vegetation.	To maintain and improve ecological health to ensure sustainable production and conservation.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Salinity √	Soil Health √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

NV1. Use assessment kits to assess the quality of native vegetation.

NV2. Seek expert advice to establish local reasons for decline (eg dieback).

Implement management practices

NV3. Create an extensive network of vegetation to link revegetation and remnant protection activities (eg Wamboin Greenways). (BMA1, PrMA3)

NV4. Protect and manage remnant native vegetation on private land. (PrMA3, PrMA4)

NV5. Promote revegetation of native ecological communities listed as threatened or endangered, through fencing, reducing competition etc. (BMA6, BMA7)

NV6. Develop and encourage the use of local vegetation communities seedstock where possible. (PrMA4)

On-ground works

NV7. Enhance the health of remnants by encouraging natural regeneration and re-introducing a large range of local native understorey plants. (PrMA3, PRMA4)

NV8. Manage weeds and feral animals.

NV9. Retain dead standing and fallen timber for habitat. (BMA6)

NV10. Fence areas of important native vegetation & manage grazing appropriately.

NV11. Support more research on germination of native vegetation especially native grasses.

Promote and educate

NV12. Raise awareness of the importance of remnant vegetation. (BMA1, CBMA11)

NV13. Encourage local government to identify and protect high quality vegetation, particularly where it will be affected by development. (BMA1, BMA7)

NV14. Encourage financial rebates or incentive schemes for revegetation works (BMA7)

NV15. Develop identification information sheets for native perennial pasture management - grazing techniques, fencing, fires, allowing for seed set. (SMA8, PrMA1)

NV16. Promote native farm forestry through trial farm forestry sites.

Monitor

NV17. Monitor revegetation and remnant management activities to improve techniques, species selection and strategies. (BMA5)

3. STREAM BANK ZONE ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage creek and river corridors.	To prevent loss of productive farmland, minimise sediment & chemical content, and to maintain water quality.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

SZ1. Use the Riparian Catchment Assessment Sheets to identify and target high priority areas.

SZ2. Seek expert advice on the severity of the problem and possible local causes.

Implement management practices

SZ3. Manage stock access to protect areas of identified stream bank erosion, eg large mobs grazing for short periods to maximise ground cover. (WMA4, BMA2)

SZ4. Change practices to include buffer zones near stream banks.

SZ5. Encourage zoning of appropriate stream bank areas for public use, access and environmental benefit. (BMA2)

SZ6. Use 'environmentally-friendly' chemicals near waterways, and ensure other chemicals do not enter the stream bank zone.

On-ground works

SZ7. Where appropriate to individual farm plans, fence areas as necessary with the cooperation of land holders.

SZ8. Remove weeds such as Crack willows or Black willows. (WMA5)

SZ9. Improve stream bank vegetation cover and biodiversity. (BMA10)

SZ10. Undertake structural earthworks on severely eroding banks. (WMA6)

SZ11. Control carp populations through participation in regional actions. (WMA15)

Promote and educate

SZ12. Develop information kit/guidelines for landholders. (CBMA11)

SZ13. Develop demonstration and sponsor projects. (CBMA11)

SZ14. Encourage voluntary agreements such as land retirement, management agreements and covenants for stream bank areas.

Monitor

SZ15. Establish regular assessment and mapping of stream bank conditions (building on existing GIS data).

SZ16. Monitor change and the impacts of management practices (CBMA11)

SZ17. Monitor downstream sediment loads to test impact of actions taken.

BURRINJUCK

SUB-CATCHMENT

Action Plans

1. NATIVE VEGETATION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Retain and enhance remnant vegetation and increase area of native vegetation.	To maintain and improve ecological health to ensure sustainable production and conservation.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Salinity √	Soil Health √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

NV1. Use assessment kits to assess the quality of native vegetation.

NV2. Seek expert advice to establish local reasons for decline (eg dieback).

Implement management practices

NV3. Create an extensive network of vegetation to link revegetation and remnant protection activities (eg Webs of Green). (BMA1, PrMA3)

NV4. Protect and manage remnant native vegetation on private land. (PrMA3, PrMA4)

NV5. Promote revegetation of native ecological communities listed as threatened or endangered, through fencing, reducing competition etc. (BMA6, BMA7)

NV6. Develop and encourage the use of local vegetation communities seedstock where possible. (PrMA4)

On-ground works

NV7. Enhance the health of remnants by encouraging natural regeneration and re-introducing a large range of local native understorey plants. (PrMA3, PRMA4)

NV8. Manage weeds and feral animals.

NV9. Retain dead standing and fallen timber for habitat. (BMA6)

NV10. Fence areas of important native vegetation & manage grazing appropriately.

NV11. Support more research on germination of native vegetation especially native grasses.

Promote and educate

NV12. Raise awareness of the importance of remnant vegetation. (BMA1, CBMA11)

NV13. Encourage local government to identify and protect high quality vegetation, particularly where it will be affected by development. (BMA1, BMA7)

NV14. Encourage financial rebates or incentive schemes for revegetation works (BMA7)

NV15. Develop identification information sheets for native perennial pasture management - grazing techniques, fencing, fires, allowing for seed set. (SMA8, PrMA1)

NV16. Promote native farm forestry through trial farm forestry sites.

Monitor

NV17. Monitor revegetation and remnant management activities to improve techniques, species selection and strategies. (BMA5)

2. STREAM BANK ZONE ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage creek and river corridors.	To prevent loss of productive farmland, minimise sediment & chemical content and to maintain water quality.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

SZ1. Use the Riparian Catchment Assessment Sheets to identify and target high priority areas.

SZ2. Seek expert advice on the severity of the problem and possible local causes.

Implement management practices

SZ3. Manage stock access to protect areas of identified stream bank erosion, eg large mobs grazing for short periods to maximise ground cover. (WMA4, BMA2)

SZ4. Change practices to include buffer zones near stream banks.

SZ5. Encourage zoning of appropriate stream bank areas for public use, access and environmental benefit. (BMA2)

SZ6. Use 'environmentally-friendly' chemicals near waterways, and ensure other chemicals do not enter the stream bank zone.

On-ground works

SZ7. Where appropriate to individual farm plans, fence areas as necessary with the cooperation of land holders.

SZ8. Remove weeds such as Crack willows or Black willows. (WMA5)

SZ9. Improve stream bank vegetation cover and biodiversity. (BMA10)

SZ10. Undertake structural earthworks on severely eroding banks. (WMA6)

SZ11. Control Carp populations through participation in regional actions. (WMA15)

Promote and educate

SZ12. Develop information kit/guidelines for landholders. (CBMA11)

SZ13. Develop demonstration and sponsor projects. (CBMA11)

SZ14. Encourage voluntary agreements such as land retirement, management agreements and covenants for stream bank areas.

Monitor

SZ15. Establish regular assessment and mapping of stream bank conditions (building on existing GIS data).

SZ16. Monitor change and the impacts of management practices. (CBMA11)

SZ17. Monitor downstream sediment loads to test impact of actions taken.

3. GULLY EROSION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Prevent, treat and manage active gully erosion.	To minimise on-farm management problems associated with gully erosion and reduce water quality impacts.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

GE1. Continue detailed surveys using Gully Erosion Assessment Kit.
GE2. Evaluate gullies in regard to degree of activity and connection.
GE3. Evaluate gullies as to potential for sediment entrapment and storage.
GE4. Update vegetation and soils mapping.

Implement management practices

GE5. Control stock access and maintain groundcover. (WMA1, WMA4)
GE6. Retain and enhance existing riparian vegetation in discharge areas. (WMA1, WMA2)
GE7. Retain native vegetation on land with high susceptibility to erosion. (WMA1, BMA1)
GE8. Implement remedial measures in high priority areas.

Carry-out on-ground works

GE9. Remediate most severe gullies, which have been mapped and assessed using revegetation and soil works. (WMA3, WMA6, WMA7)
GE10. Undertake gully control earthworks where necessary. (WMA6)
GE11. Fence and revegetate gullies to assist in reducing erosion and sediment movement. (WMA3)
GE12. Fence and revegetate all moderate to minor erosion problems. (WMA3, WMA7)
GE13. Divert surface water flows away from gully 'head'.

Promote and educate

GE14. Use successful projects as encouragement for others embarking on work.

Monitor

GE15. Evaluate techniques for sediment entrapment.
GE16. Evaluate results of structural gully treatment.

YASS VALLEY

SUB-CATCHMENT

YASS VALLEY SUB-CATCHMENT

Map 3: Roads & Rivers

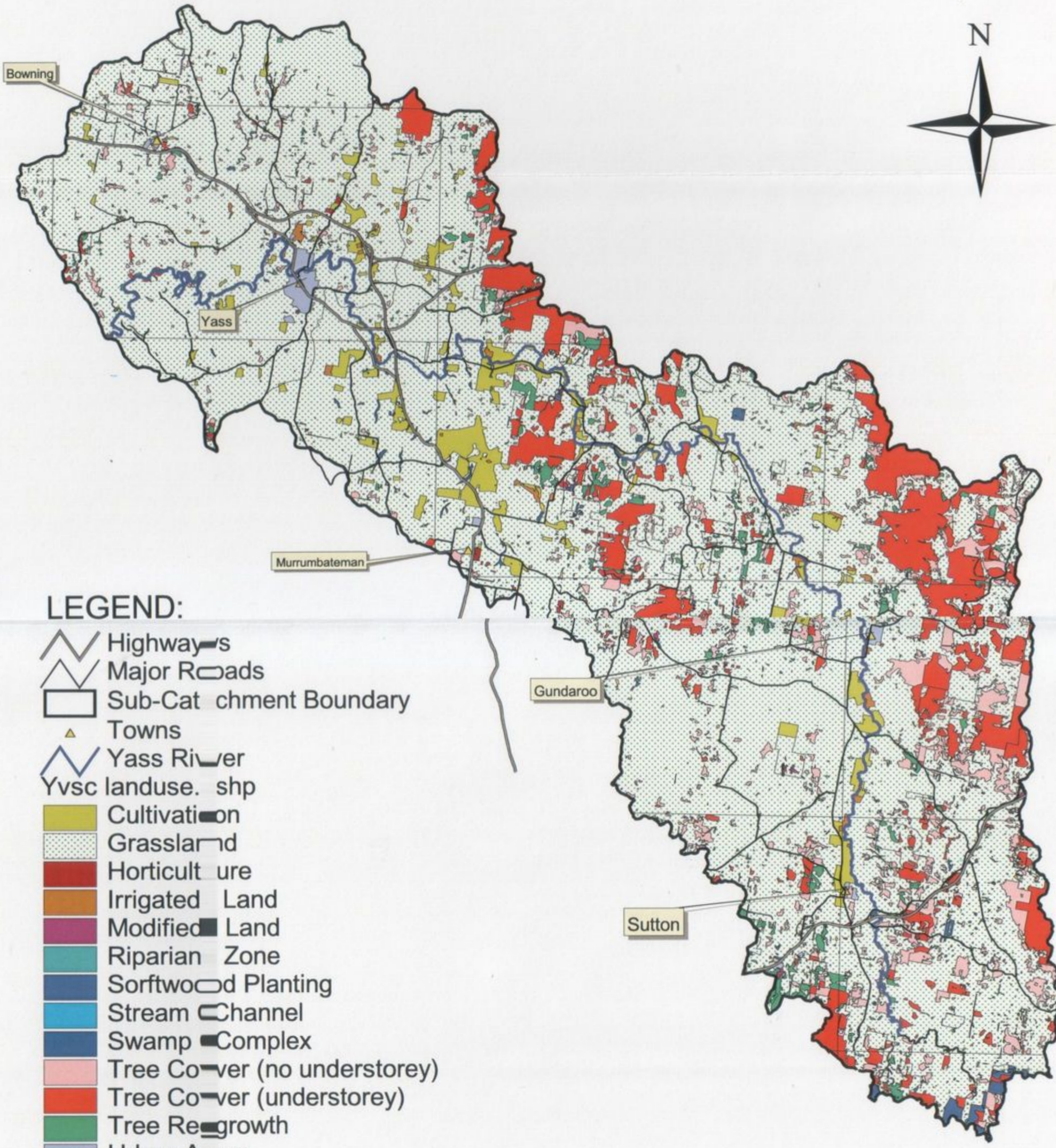
Yass Area Network of Landcare Groups
Working together

YASS VALLEY SUB-CATCHMENT

Map 4: Land Use

Yass Area Network of Landcare Groups
Working together

N



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- Towns
- Yass River

Yvsc landuse. shp

- Cultivation
- Grassland
- Horticulture
- Irrigated Land
- Modified Land
- Riparian Zone
- Sorftwood Planting
- Stream Channel
- Swamp Complex
- Tree Cover (no understorey)
- Tree Cover (understorey)
- Tree Regrowth
- Urban Area
- Water Storages/Dams

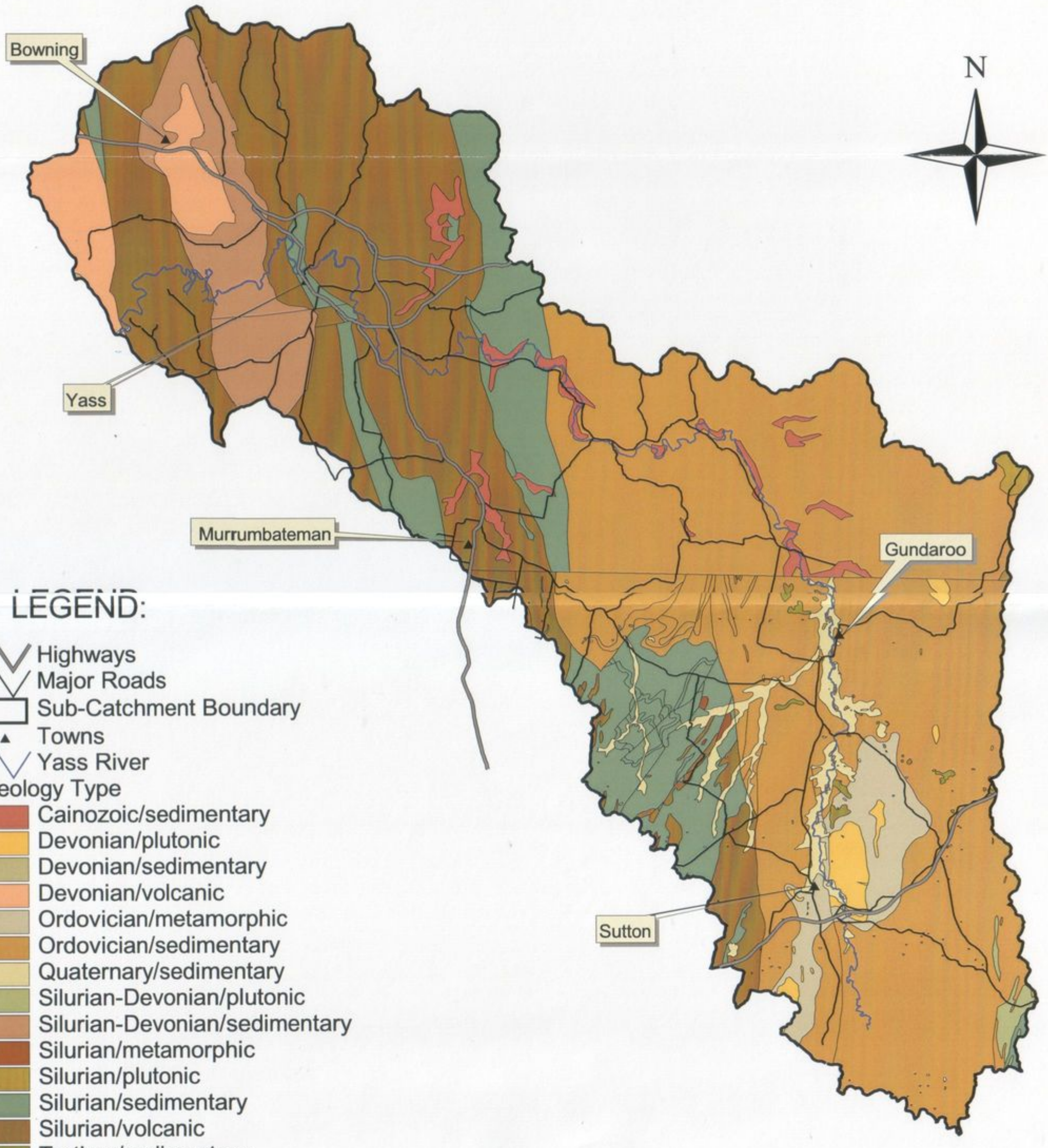
SCALE 1:250000

10 0 10 20 Kilometres

YASS VALLEY SUB-CATCHMENT

Map 5: **Geology**

Yass Area Network of Landcare Groups
Working together



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- Towns
- Yass River

Geology Type

- Cainozoic/sedimentary
- Devonian/plutonic
- Devonian/sedimentary
- Devonian/volcanic
- Ordovician/metamorphic
- Ordovician/sedimentary
- Quaternary/sedimentary
- Silurian-Devonian/plutonic
- Silurian-Devonian/sedimentary
- Silurian/metamorphic
- Silurian/plutonic
- Silurian/sedimentary
- Silurian/volcanic
- Tertiary/sedimentary

SCALE 1:250000

10000 0 10000 20000 Metres

SOURCE: RACD, 1999

7. YASS VALLEY SUB-CATCHMENT

7.1 DRYLAND SALINITY

What is dryland salinity ?

Dryland salinity occurs when there is a build up of salt in the surface soil, usually as a result of rising groundwater tables.

What is its impact ?

In NSW, dryland salinity has reduced land values by $40 million and resulted in lost agricultural production of more than $22 million each year (DLWC 1998). Nationally, over $130 million is lost each year due to dryland salinity (PMSEIC 1999).

Between 120,000 and 174,000ha of land is affected by dryland salinity in New South Wales (DLWC, 2000a). Without land management changes, salinity affected land (including irrigation salinity) in the NSW part of the Murray-Darling Basin could increase to 2-4 million hectares by 2050 (DLWC 2000a). Nationally, 5.7 million hectares are considered at risk or affected by dryland salinity (NLWRA 2001).

Salinity reduces farm productivity and land value, causes erosion, damages infrastructure such as roads, and affects urban gardens, buildings and businesses. It also has a major impact downstream such as affecting water quality, habitat, irrigation supplies and causes erosion. In south-western NSW, it is estimated that 34% of state roads and 21% of national highways are affected by high water tables costing the community about $9 million every year (Blackmore 1999).

The signs and symptoms of rising watertables and surface salts are:

- *Reduced yields and productivity*
- *Decline in plant growth*
- *Decline in water quality*
- *Waterlogging*
- *Change in species, favouring salt tolerant varieties*
- *Increased erosion hazard*
- *Dead and dying native vegetation.*

In urban areas the signs and symptoms of salinity include:

- *Road surfaces breaking up*
- *Bare patches in lawns and sporting fields*
- *Dead & dying trees*
- *Deterioration of house foundations, reduced life of concrete slabs*
- *Corrosion of underground services – pipelines and cables*
- *"Rising damp" in buildings – public and private*
- *Salt crusting on bricks, concrete and pavers*

(Extract from "Reading and Designing the Landscape, 2000)

What causes dryland salinity ?

The reduction of vegetation, through clearing or grazing, has reduced the amount of rainfall being utilised by vegetation on the surface. The rainfall then leaks below the root zone (recharge), and adds to the water tables. As water tables rise, salt is bought to the surface (discharge) killing vegetation and leading to soil erosion and degradation.

Ordovician sedimentary geology has historically contributed to the development of much of the Yass Valley's dryland salinity problems. This is related to the high re-charge nature of landforms associated with this geology type. However, saline areas of large spread and more recent growth have tended to occur on silurian acid volcanic geology.

What is the impact on the Yass catchment ?

The Yass River has recorded a salinity level rise of 7% per year which is approximately double the State's average (Franklin 1999).

In 1993, 1.2% (1,451 ha) of land was recorded as severely salt affected (Nicholl & Scown 1993). Mapping conducted by Yass Valley landcare groups has identified a further 67 sites showing signs and symptoms of dryland salinity. In addition, mapping conducted by DLWC identified a further 79km of dryland salinity along eroding gullies and 1,584 ha in areas of identified soil erosion.

The Yass Valley sub-catchment is ranked as the third highest area contributing to overall salinity levels in the Murrumbidgee catchment. At the local level, DLWC, Yass have carried out monitoring of water quality in 24 sites in the Yass Valley, and have prioritised these areas. The areas have been assessed in terms of; the area of salt affected land, and areas of cleared high recharge country (see table below).

This prioritisation is important in ensuring that works are targeted to achieve the most effective results. The high priority areas include; Williams Creek, Nowlands Creek, Back Creek and Sawpit Creek. YANLG and DLWC are currently developing a project to produce small scale local maps with accompanying land management recommendations and actions to reduce the salt load in the sub-catchment.

Table 3:YASS VALLEY DRYLAND SALINITY SUB-CATCHMENT PRIORITIES

	Sampling Site	Rating Based on Salt tonnes / ha Catchment	Rating based on % Catchment area high recharge	Rating based on % Catchment area discharge	Final Priority
1	Brooks Ck (Fed Hwy)	20			
2	Yass River Upper	21	7		
3	Yass River (Brooks)	10	7		
4	Brooks Ck (to Yass R)	18			
5	Gundaroo Creek	22			
6	Back Creek	1	8	6	3
7	Sawpit Creek	4	7	2	4
8	Nelanglo Creek	12			6
9	Nowlands Creek	3	3	2	2
10	Williams Creek	2	2	1	1
11	Dicks Creek	8	1	2	5
12	Corregans Creek	9			
13	Manton Creek	15	4	5	6
14	Bango Creek	6	6	8	6
15	Derringullen Creek	11	5	9	
16	Bowning Creek	17			
17	Washpen Creek				
18	Reedy Creek	18			
19	Rainbow Creek				
20	O'Briens Creek	5		7	8
21	Kitty's Creek	7		4	8
22	M'bateman Creek - Upper	16	9	3	7
23	M'bateman Ck - Mid	14	9	3	6
24	M'bateman Ck - Lower	13	9	3	7

Priority

The impact of dryland salinity, particularly in the Yass Valley sub-catchment, is becoming increasingly evident and is therefore recognised by the landcare groups as a high priority for management. The main focus being to manage the cause of the problem rather than treating the symptoms.

Local Actions to Date

2000-2001

- Implementing the Yass Valley Sub-catchment Plan - Salinity on-ground works
- Stop our salt and soil entering Yass River project
- Manton (Yass) gully stabilisation, salt mitigation and bio-diversity project
- Targeted revegetation for salinity recharge in upper-mid Lachlan & upper Murrumbidgee catchments

1999-2000

- Implementing the Yass Valley Sub-catchment Plan - Salinity on-ground works

1998-1999

- Jerrawa Creek Salinity project

1997-1998

- Jerrawa Creek Dryland Salinity reparation project
- Jerrawa Creek Salt Action project

1995-1996

- Jerrawa Creek Salt Action project

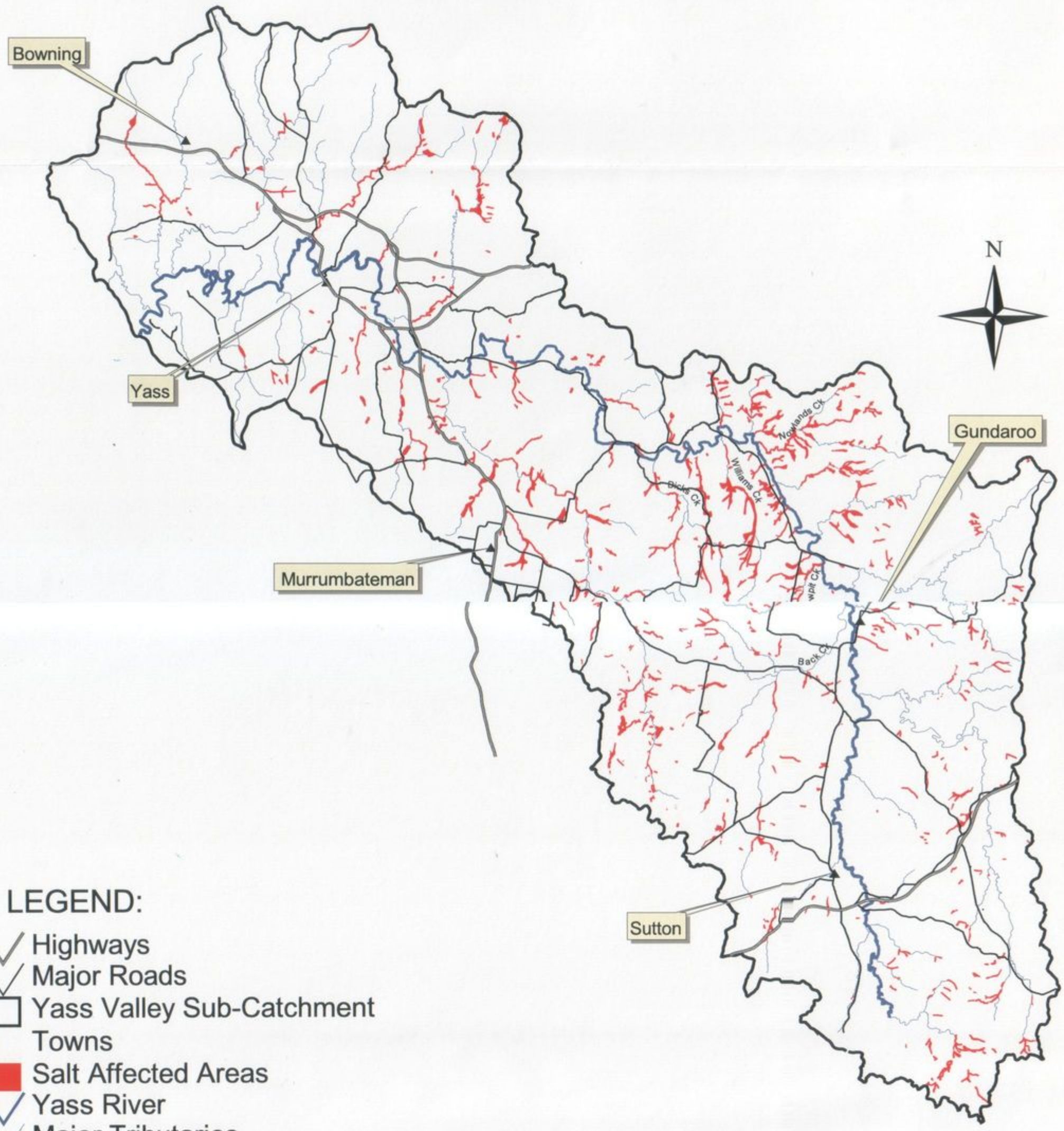
1993-1994

- Jerrawa Creek Salt Action project

See also in the Appendix:
Section 7.1 *Dryland Salinity*

YASS VALLEY SUB-CATCHMENT

Map 6: Dryland Salinity



LEGEND:

- Highways
- Major Roads
- Yass Valley Sub-Catchment
- Towns
- Salt Affected Areas
- Yass River
- Major Tributaries

SCALE: 1:250000

SOURCE: Department of Land & Water Conservation, 1999 & NRPA 2000

1. DRYLAND SALINITY ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage the landscape to control and ameliorate dryland salinity.	To maintain sustainable productive farmland and to minimise the community impacts of salinity locally and downstream.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Soil Health √	Salinity √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

DS1. Seek expert advice on local causes.

DS2. Use tools such as the Salt Identification Kit to identify problems and severity.

DS3. Target priority areas (see Dryland Salinity BMP).

Implement management practices

DS4. Retain existing native vegetation. (PrMA3)

DS5. Manage grazing to promote groundcover & maintain grasses at their highest water using growth stage. (BMA2, SMA5)

On-ground works

DS6. Fence off and protect remnant vegetation in identified high recharge country. (PrMA3, SMA5, BMA2, BMA7)

DS7. Replace annual pastures with perennial species (incl natives). (PrMA1, SMA8)

DS8. Revegetate identified high recharge country (eg Bidgee Hilltops project, Upper-Mid Lachlan & Upper Murrumbidgee Targeted Revegetation project). (PrMA4, BMA7)

DS9. Revegetate in interceptor areas. (PrMA6)

DS10. Rehabilitate high priority saline discharge areas by fencing to control stock, revegetate with salt-tolerant pasture and tree species, promote groundcover using fertiliser and gypsum application, mulching and earthworks where necessary. Graze to encourage water use where appropriate. (PrMA16, PrMA17)

Promote and educate

DS11. Promote practices that minimise recharge to groundwater, and reduces salt in streams, in both urban and rural situations by developing educational and awareness raising material/activities. (CBMA11)

DS12. Provide education and information to promote improved grazing management practices (eg PROGRAZE). (SMA5)

Monitor

DS13. Monitor salinity periodically to show extent of salinity, long term trends and results of management. Monitor local discharge and downstream river salt levels, and promote successes to encourage further actions. (CBMA11)

BEST MANAGEMENT PRACTICES

DRYLAND SALINITY

What is dryland salinity ?

The introduction of European farming practices in the Australian landscape included the removal and modification of the natural deep-rooted perennial vegetation. As a consequence, less rainfall was used up by plants and more could soak through the soil into the water table (this is called *recharge*). This causes water tables to rise to the surface bringing with it the natural salts stored in the geology, subsoils and soils (*discharge*). The salts are left on the surface after the water evaporates. This concentrates salt levels in the root zone to the point where only salt tolerant plant species can survive. In more severe cases even salt tolerant species die and erosion from surface water often occurs.

Why do we need to manage it ?

Elevated saline water tables discharge more salt into the rivers and creeks which has a large downstream impact on other farms and towns. Across Australia, costs associated with dryland salinity are estimated at $130 million every year (PMSEIC 1999). In parts of the Yass catchment, dryland salinity is a major problem. Salinity is reducing productivity in our agricultural land, costing all Yass ratepayers in treating drinking water, causing damage to roads as well as costing downstream users due to reduced water quality.

What can I do ?

Three main types of landscapes have been identified in the Yass Valley Sub-catchment, (1) high recharge areas, (2) good grazing areas, and (3) discharge sites. Different management practices are required in each to address the salinity problem.

These have been called:

1 "Plug the Leaks" (high recharge areas)
2 "Feed the Sheeps" (good grazing areas)
3 "Cover the Seeps" (discharge sites).

1. "Plug the Leaks" (high recharge country) see Map 7

These are typically the areas of rocky outcrop, and shallow stony soils associated with the top of hills and ridgelines in the landscape. Best management practices in this area are to:

- Retain native trees and shrubs
- Improve degraded remnant vegetation through revegetation and regeneration
- Revegetate cleared areas with native trees, shrubs and grasses
- Manage native grasses and pastures to maximise water use
- Fence these areas to separate from the more productive parts of the landscape and protect from stock

2. "Feed the Sheeps" (good grazing country) see Map 8

These are the more productive parts of the landscape and range from the mid-slopes to creek and river flats. Best management practices in this area are:

- Retain native trees and shrubs
- Maintain and manage good remnant native pasture country in less fertile parts of the grazing landscape
- Improve productivity of native pastures where appropriate by application of super phosphate and sub-clover seed
- Utilise introduced deep-rooted perennial pastures in more productive parts of the grazing landscape.
- Manage introduced pastures for high water use and production

- Adopt management fencing that separates native pastures from introduced pastures and allows more intensive grazing for shorter periods consistent with production and water use goals

3. "Cover the Seeps" (discharge areas) See Map 9

These are areas where saline groundwater is discharging on the surface. These sites vary from wet boggy areas covered in vegetation to bare and eroding sites. Best management practices for these areas are:

- Fence area from the remainder of the property
- Where erosion is a problem, divert surface water flows away from the discharge sites to a safe disposal area
- Maintain groundcover where present
- Reinstate groundcover where discharge area is bare, utilise salt tolerant species
- Manage grazing regime to maintain vigour of vegetation and > 80% groundcover
- Plant interceptor tree plantings above these sites where consistent with farm management goals

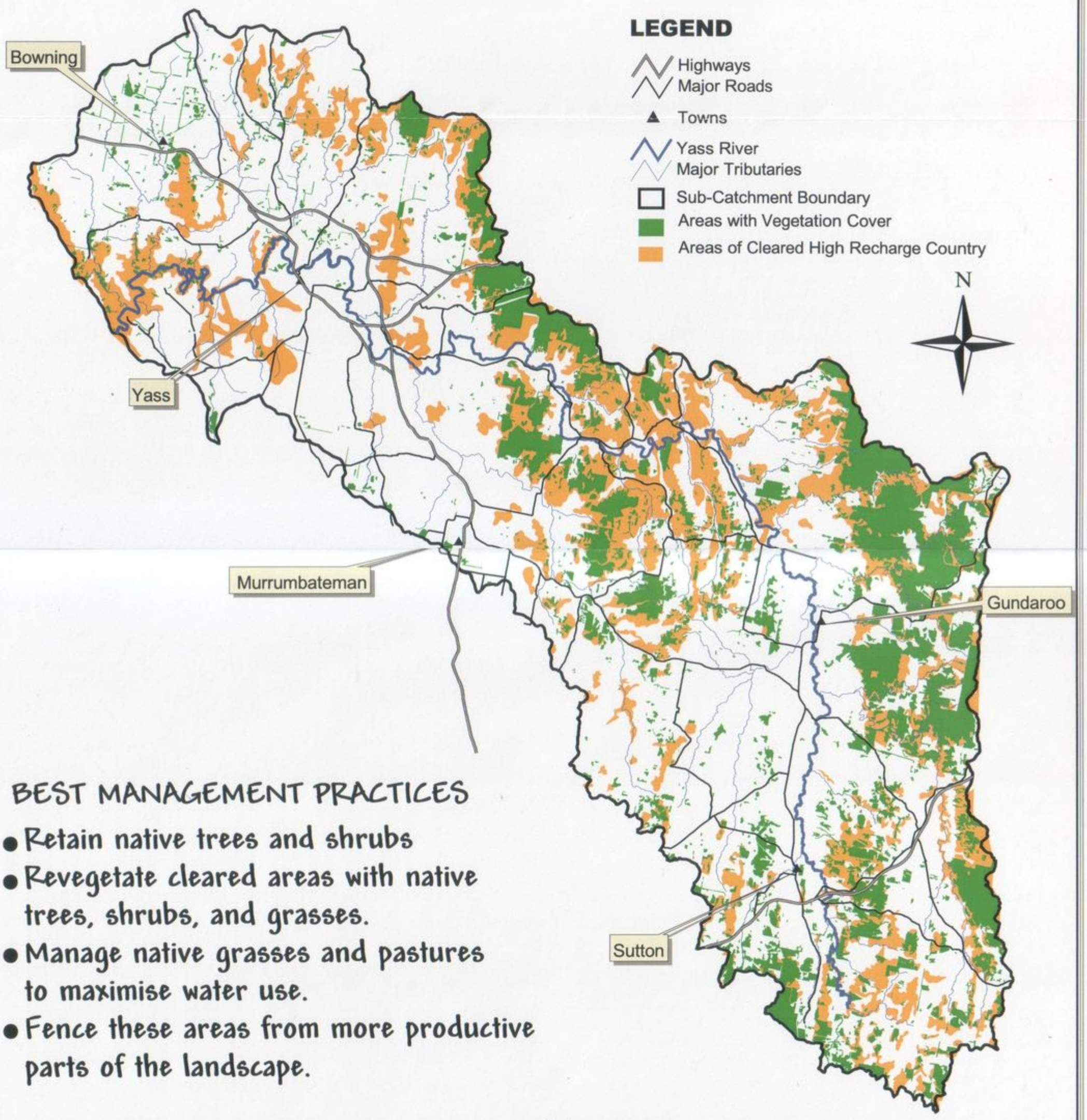
Who can help ?

Department of Land and Water Conservation, Yass Office, phone 6226 1433
NSW Agriculture, Yass Office, phone 6226 2199

YASS VALLEY SUB-CATCHMENT

Map 7: Plug the Leaks

Yass Area Network Landcare Groups
Working together



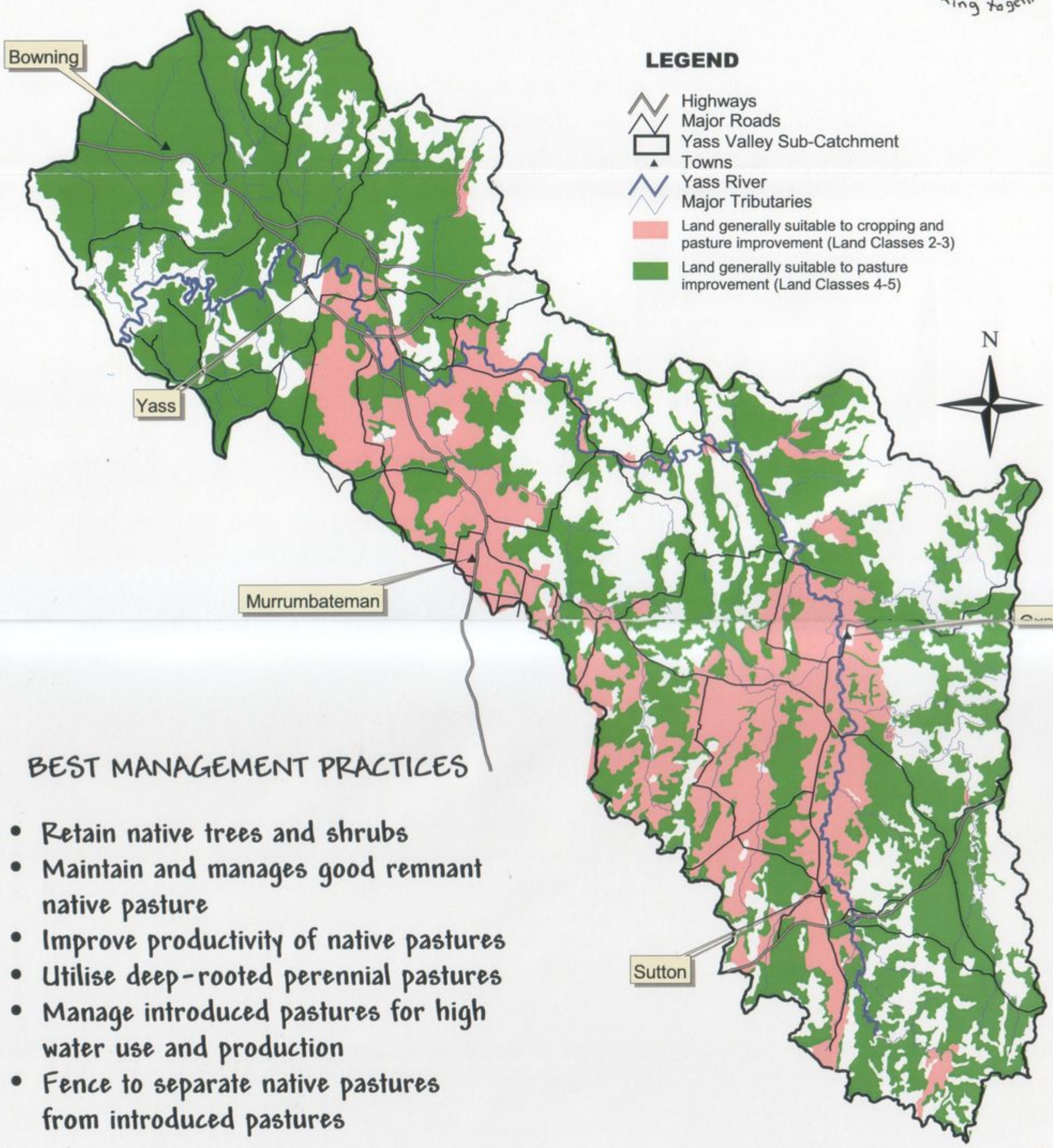
BEST MANAGEMENT PRACTICES

- Retain native trees and shrubs
- Revegetate cleared areas with native trees, shrubs, and grasses.
- Manage native grasses and pastures to maximise water use.
- Fence these areas from more productive parts of the landscape.

YASS VALLEY SUB-CATCHMENT

Map 8: Feed The Sheeps

Yass Area Network Landcare Groups
Working Together



LEGEND

- Highways
- Major Roads
- Yass Valley Sub-Catchment
- Towns
- Yass River
- Major Tributaries
- Land generally suitable to cropping and pasture improvement (Land Classes 2-3)
- Land generally suitable to pasture improvement (Land Classes 4-5)

BEST MANAGEMENT PRACTICES

- Retain native trees and shrubs
- Maintain and manages good remnant native pasture
- Improve productivity of native pastures
- Utilise deep-rooted perennial pastures
- Manage introduced pastures for high water use and production
- Fence to separate native pastures from introduced pastures

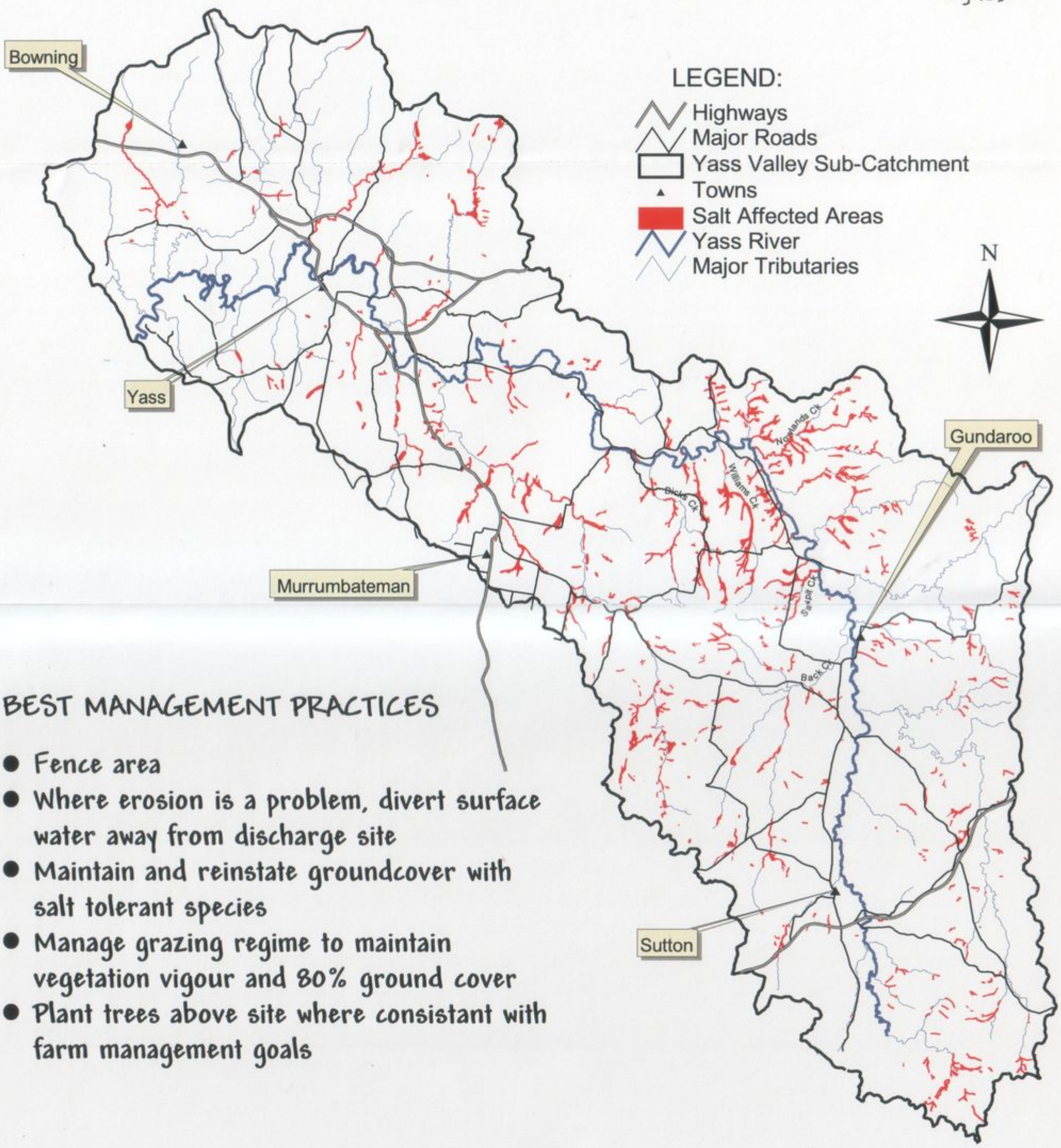
Scale 1:250000

10000 0 10000 20000 Metres

YASS VALLEY SUB-CATCHMENT

Map 9: Cover the Seeps

Yass Area Network Landcare Groups
Working together

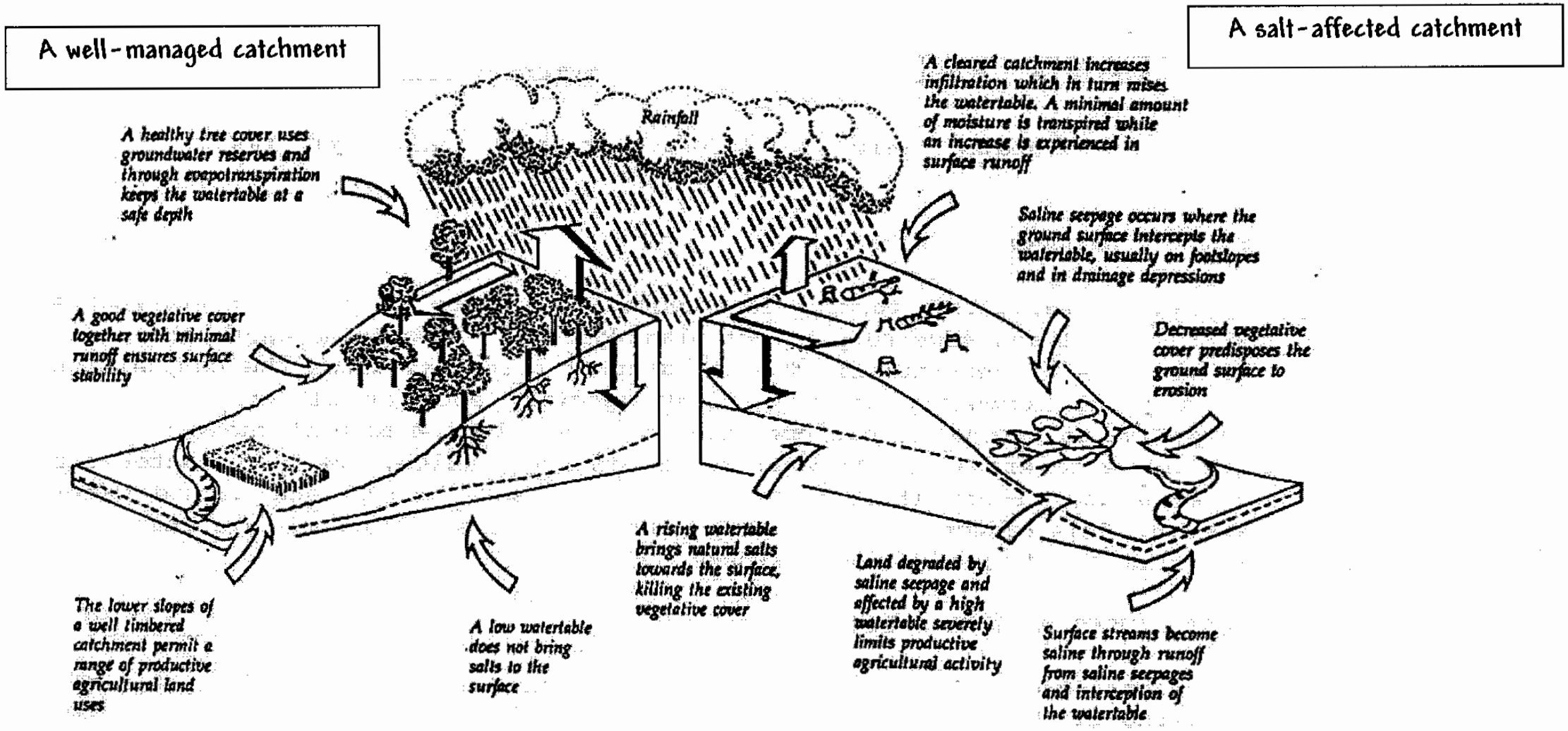


SCALE: 1:250000

BEST MANAGEMENT PRACTICES

- Fence area
- Where erosion is a problem, divert surface water away from discharge site
- Maintain and reinstate groundcover with salt tolerant species
- Manage grazing regime to maintain vegetation vigour and 80% ground cover
- Plant trees above site where consistant with farm management goals

THE DRYLAND SALINITY WATER CYCLE



FACT SHEET

WHAT ARE THE SIGNS OF DRYLAND SALINITY?

Even though dryland salinity is a well-known problem in rural Australia, it is sometimes hard to recognise the early signs of salinity until the impact becomes severe. Here are some events that may indicate salinity. If you recognise one or more of these on your property and believe you have a salinity problem, you should seek advice on early action you can take to prevent the problem becoming more severe. (see contacts below). These signs are likely to occur at the bottom of slopes and in drainage depressions and be known as 'discharge' sites.

1. **Waterlogged soil and areas of new wet patches.**
   Waterlogging does not indicate salinity in every case, but is an early warning sign.

2. **Trees dying**
   As the saline groundwater table rises, trees begin to die for no apparent reason, usually before any impact on pastures is evident.

3. **Loss of productive annual and perennial vegetation species**
   As the ground becomes more saline, annual and perennial species die. Often, in their place grow more salt tolerant plants, such as sea barley grass, couch, annual beard grass, spike rush or strawberry clover.

4. **Bare patches of soil**
   Bare areas of soil appear and become larger. The soil may also set hard as it dries out. Often referred to as a 'salt scald'.

5. **The area attracts stock**
   Stock love to lick the salt from the ground, and usually gather together in a large group around the saline area.

6. **Visible salt crystals**
   When the surface is dry, salt crystals appear on the surface of the soil. It may look like white dust or powder.

7. **Puffy soil**
   When dry, the surface of the soil is "puffy" and shatters when walked on.

8. **Excess water runoff**
   The area is eroding from large quantities of water runoff.

9. **Clear dam water**
   Water in dams close to the site tends to be quite clear as the salt settles the sediment.

10. **A salty smell**
    Salt can be smelt in the area.

Who can help?
Department of Land and Water Conservation, Yass Office. Phone (02) 6226 1433

FACT SHEET

HOW TO MANAGE SALINE DISCHARGE SITES

What is a saline discharge site?

A saline discharge site is an area where the water table has risen and salt has affected vegetation and soil on the surface. Its impact varies, but usually results in

- a reduction in pasture and crop performance,
- bare scalded areas,
- dead trees,
- salt crystallisation and
- excessive erosion.

How do I manage it?

The appropriate way to manage a discharge site will vary depending on the severity of the problem. The main options are below, but also ask the local extension officer from agencies such as the Department of Land and Water Conservation office for advice (contact details below).

1. Fence the site

Stock should be kept off the site (they like to lick the salty ground). The fence should be at least 20 metres from the edge of the salt affected area. Vegetation changes will indicate the boundaries of the salt affected site. If the land is flat around the site, the fence should be placed further away as salt is likely to spread.

2. Carry out earthworks

Earthworks are usually needed for more severely affected areas. The type of earthwork will depend on the site, but some options include creating diversion banks to divert the flow of water away from the site, gully control structures, and deep ripping to assist in revegetation.

3. Plant salt tolerant grass species

Grasses, rather than trees, are usually more successful in revegetating saline areas. However, trees are useful in planting above and around the site to contain it. Good grass species include Tall Wheat Grass, Puccinella and Strawberry Clover (see the *Salt Tolerant Species Fact Sheet*).

4. Apply straw mulch, gypsum and fertiliser

Straw mulch protects the bare soil and reduces evaporation. It also protects seed for revegetation and provides organic material. Gypsum improves the soil structure, drainage, adds calcium and breaks the surface crust on bare soil. Fertiliser should also be applied on all saline sites to improve nutrient levels.

5. Manage and monitor the site!

Stock access to the site should be limited to when they will do least damage and when the area can stand some grazing ('crash' grazing method can be used ie high stock numbers for short periods). The site should be monitored for any spreading and any increase in salinity level. Piezometers may be useful to assess and measure the depth of the ground water. Once productive species are established, keep them well grazed so they use as much water as possible.

Who can help?

Department of Land and Water Conservation, Yass Office. Phone (02) 6226 1433

Other reading

Salt Tolerant Species Fact Sheet (in this Plan)

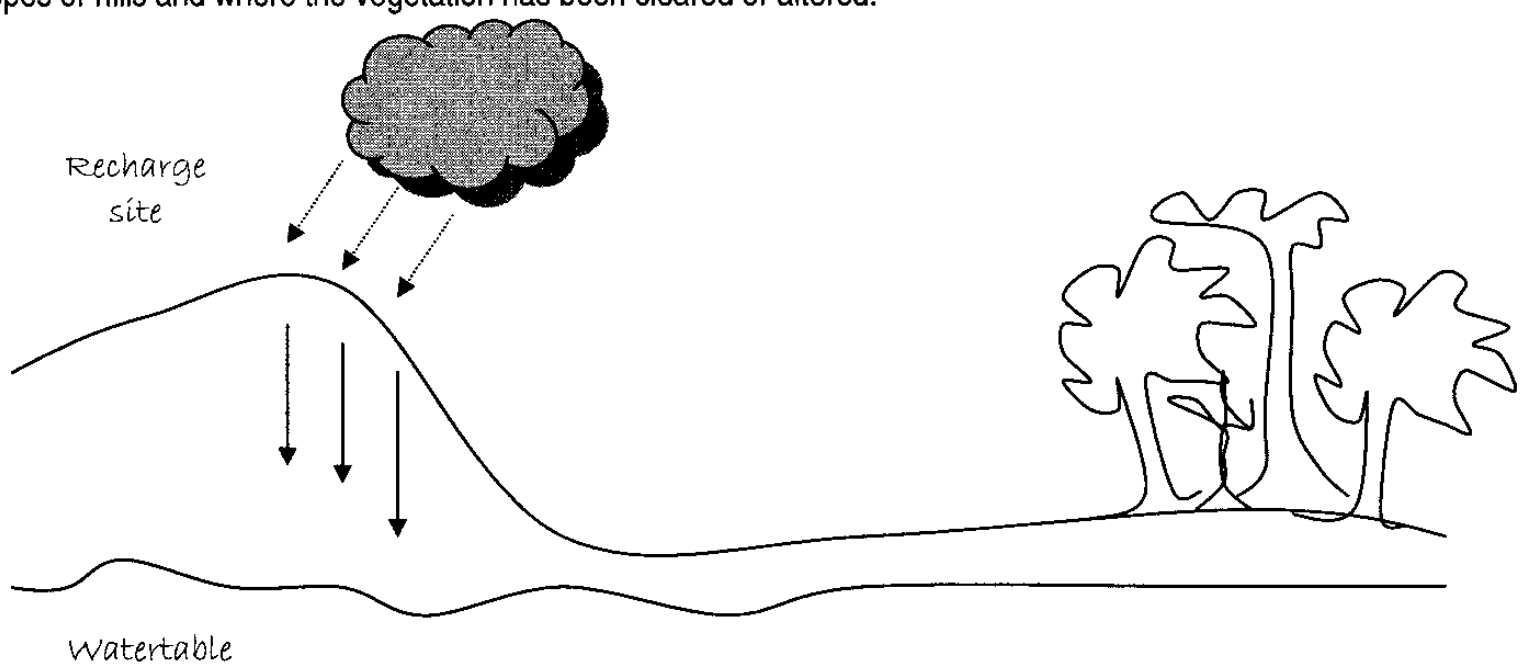
Dryland Salinity, Booklet 4. Productive Use of Salt Affected Land, DLWC.1993

FACT SHEET

HOW TO MANAGE SALINE RECHARGE SITES

What is a saline recharge site?

Recharge areas are the points at which water (rainfall) enters the groundwater table. Recharge occurs in all parts of the landscape except for discharge sites. Highest rates of recharge are usually in the higher parts of slopes or hills and where the vegetation has been cleared or altered.



How do I manage it?

There are many options for managing recharge sites. Your choices will depend on the severity of the problem, how it fits your whole farm plan, your resources (time, money), and the physical characteristics of the site such as access. Some options are to;

1. Revegetate
   Revegetate the area with deep-rooted trees, shrubs and grasses.

2. Establish perennial pastures
   Increase water use on the rest of your property by ensuring growth of deep-rooted perennial grasses and pasture. Ensure you carry out appropriate weed, pest and disease control, as well as fertiliser treatment to maintain good growth. Graze well to maximise water use.

3. Native grasses
   In areas where pasture improvement is not suitable, ensure good growth of native grasses.

4. Engage in appropriate management practices
   Avoid inefficient irrigation, long fallow periods and poor cropping practices in recharge areas.

Further Reading

Dryland Salinity 8. Options for Control DLWC 1994

Who can help?

NSW Department of Agriculture, Yass Office (02) 6226 2199
NSW Department of Land and Water Conservation, Yass Office (02) 6226 1433

FACT SHEET

PASTURE MANAGEMENT

Pastures are a dynamic system. They include native and introduced species and are subject to grazing, pest and disease attacks, as well as varying inputs, such as rainfall.

The management of pastures to address and prevent dryland salinity means using pastures to increase water use. The choice of pasture must fit the site on-farm taking into account soil type, pH, depth, drainage, degradation or erosion, and enterprise (wool, beef etc).

Seek advice about which option will best suit the different areas on your property.

What can you do?

- Sow pasture species that are suited to the land capability. eg. salt tolerant, acid tolerant.
- Plant pasture species that use more water than annual pasture species, such as lucerne, phalaris, cocksfoot.
- Don't fallow. Recharge is increased if left to long fallow periods.
- Take advantage of extra moisture for opportunity cropping when conditions are appropriate, but make sure the land is able to sustain such activities.
- Use a phase cropping system. Rotate annual crops with perennial pastures for example, after 5-7 years of continuous cropping plant 5-7 years of lucerne.
- Use the alley cropping method. Plant annual crops in alleys among rows of perennial plants that will provide shelter, increase water use and provide other benefits such as fodder and habitat.
- Ensure existing native and introduced pastures are productive and self-sustaining. It is important to have a significant component of perennial pasture.
- Plant and maintain trees, particularly near grazing pastures.
- Fertilise pastures to maximise growth and therefore water use.

Who can help?
NSW Department of Agriculture, Yass Office (02) 6226 2199

FACT SHEET

SALT TOLERANT TREE & GRASS SPECIES FOR THE YASS AREA

Revegetation is an important component in the treatment of dryland salinity. The tree and shrub species listed below have varying levels of tolerance to salinity. Trees and shrubs generally should not be planted directly into scalded discharge areas (ie. bare salty patches), but rather on the boundary of the affected area (see also the Fact Sheet; *How to Manage Saline Discharge Areas*). Bare saline sites are best managed by sowing salt tolerant pasture species (listed below).

SALT TOLERANT TREES AND SHRUBS

BOTANICAL NAME	COMMON NAME	SALT TOLERANCE	GENERAL COMMENTS
Acacia longifolia	Sydney golden wattle	slight-moderate	tolerates wet sites, frost tolerant
Acacia mearnsii	Black wattle	slight (varies with provenance)	fast growing
Acacia melanoxylon	Blackwood	slight-moderate *(varies with provenance)*	tolerant of periodic waterlogging, slow growing
Acacia retinoides	Swamp wattle	moderate-high	tolerant of wet sites with saline sub-soils, frosts
Casuarina glauca	Swamp she-oak	moderate-high (varies with provenance)	tolerates waterlogging, mild-moderate frost tolerance
Eucalyptus aggregata	Black gum	slight	good in wet areas
Eucalyptus camaldulensis	River red gum	moderate (large variation in provenance)	tolerates waterlogging
Eucalyptus camphora	Swamp gum	slight-moderate	good in wet areas
Eucalyptus melliodora	Yellow box	slight-moderate	slow growing
Eucalyptus ovata	Swamp gum	slight	tolerates waterlogging, frost tolerant, slow growing
Melaleuca ericifolia	Swamp tea-tree	moderate	highly frost tolerant

OTHER REVEGETATION SPECIES USEFUL FOR SALINE AREAS

BOTANICAL NAME	COMMON NAME	SALT TOLERANCE
Callistemon citrinus	Crimson bottlebrush	medium salt tolerance
Casuarina obesa	Swamp she-oak	highly salt tolerant tolerates waterlogging tolerates mild frosts
Eucalyptus astringens	Brown mallet	slightly salt tolerant
Eucalyptus botryoides	Bangalay	low-moderate salt tolerance tolerant of waterlogged soils
Eucalyptus leucoxylon	Yellow gum	slight/moderate salt tolerance sub-species variation in tolerance
Eucalyptus robusta	Swamp mahogany	moderately salt tolerant highly tolerant waterlogging
Eucalyptus sideroxylon	Mugga ironbark	slightly salt tolerant
Melaleuca bracteata	River tea-tree	moderately salt tolerant moderately frost tolerant
Melaleuca decussata	Cross-leaf honey myrtle	highly salt tolerant highly frost tolerant

SALT TOLERANT PASTURE MIX

For slightly saline sites - 2-4 dS/M*

COMMON NAME	RATE OF MIX
Australian phalaris	2 kg/ha
Tall wheat grass	4-6 kg/ha
Demeter fescue	4 kg/ha
Trikkala or gosse sub clover	2 kg/ha
Perennial ryegrass	2 kg/ha
Palestine Strawberry clover	1 kg/ha
Paradana Balansa clover	1 kg/ha
Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15	125 kg/ha

* *deci-Siemens per metre*

For moderately saline sites - 4-8 dS/M*

COMMON NAME	RATE OF MIX
Australian phalaris	2 kg/ha
Tall wheat grass	4-6 kg/ha
Demeter fescue	4 kg/ha
Puccinellia	2-4 kg/ha
Perennial ryegrass	1-2 kg/ha
Palestine Strawberry clover	2 kg/ha
Paradana Balansa clover	2 kg/ha
Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15	125 kg/ha

* *deci-Siemens per metre*

For severely saline sites - 8+ dS/M*

COMMON NAME	RATE OF MIX
Tall wheat grass	6-10 kh/ha
Puccinellia	2 kg/ha
Palestine Strawberry clover	2-3 kg/ha
Fertiliser - nitrogen and phosphorus mix with sulphur present, eg Starter 15	125 kg/ha

* *deci-Siemens per metre*

FURTHER SALINITY READING

Assessing the Texture of Your Soil. Save Our Soils. NSW Agriculture and NSW Department of Land and Water Conservation.

Detecting Dryland Salinity on the Southern Tablelands of New South Wales, DLWC and Salt Action

Dryland Salinity, Salt Action Series, DLWC , 1993, 1994

1. The Causes
2. How Severe is Your Discharge Area
3. Piezometers - How and Why
4. Productive Use of Salt Affected Land
5. Crop Management for Central and Southern NSW
6. The Role of Vegetation Management
7. The Economic Picture
8. Options for Control

Dryland Salinity - a land management issue, not a disaster, in Rising Water Tables and Salinity in the Yass River Valley, J.Franklin, DLWC 1999 (pp 31-55)

NSW Salinity Strategy, NSW Department of Land and Water Conservation, 2000

Dryland Salinity and its Impact on Rural Industries and the Landscape. Prime Minister's Science, Engineeringand Innovation Council, Occasional Paper No 1, Department of Industry, Science and Resources, Canberra 1999

Productive Solutions to Dryland Salinity GRDC Canberra, July 2001.

Trees, Water and Salt: An Australian guide to using trees for healthy catchment and productive farms. Joint Venture Agroforestry Program, Rural Industries Research and Development Corporation 2000.

7.2 NATIVE VEGETATION MANAGEMENT

What is native vegetation management ?

Native vegetation management is the management of native trees, shrubs and grasses to increase the viability of rural communities, maintain biodiversity and to prevent land and water degradation. (DLWC 1998)

For the purpose of this Plan, "remnant vegetation" does not necessarily refer to 'untouched' vegetation, as much of the catchment has been ringbarked, cleared, grazed or burnt since settlement. Much of the vegetation that remains today represents regrowth from this era, with many of the stands showing evidence of these past activities. It is important that these areas are preserved, as they may represent important samples of Yass area vegetation communities.

Why is native vegetation important ?

Protecting and managing areas of native remnant vegetation can have multiple benefits in promoting sustainable catchment health. These include:

- *providing windbreaks, shade and shelter for stock*
- *enhancing economic value (agroforestry, firewood, property value)*
- *providing a source of seed for regeneration*
- *reducing groundwater levels and recharge*
- *filtering nutrients and pollution in the stream bank zone*
- *controlling erosion*
- *increasing and maintaining biodiversity*
- *providing wildlife habitat and corridors.*
- *preserving aesthetic values*

Shade and shelter provided by native vegetation can increase production. Sheep on sheltered plots produced 35% more wool and 6kg more liveweight than those without shelter, during a five year study at Armidale. Shelter also reduced lambing losses by up to 50% (Dengate).

Native vegetation also provides an important aesthetic function in attracting tourism to farming areas, and plays an important role in local and regional cultural history.

What causes native vegetation decline ?

Native vegetation decline has occurred through *direct loss* of vegetation, *fragmentation* of vegetation and *degradation* of those areas (DLWC 1998).

Clearing, continuous grazing and dieback are the primary causes of native vegetation decline in the Yass area. Clearing in the catchment dates back to 1898 with much of the remaining vegetation consisting of small remnants or individual paddock trees. These small, segmented remnants are generally not protected from grazing pressure and as a result, are more susceptible to the pressures influencing dieback and tree decline. This can affect reproduction, species diversity and exposure of remnants to weather and the impacts from adjoining landuse (fertiliser/herbicide drift, weeds and stock) known as the 'edge effect'. Many isolated paddock trees in the catchment are also old and in

their later stages of life, reducing their ability to recover from dieback.

How is it affecting the Yass catchment ?

Urban expansion and poor grazing management are the major pressures on native vegetation in the catchment, leading to fragmentation and increased vulnerability of vegetation to pests and disease. Clearing of native tree cover in the Yass Valley has also been significant and has contributed to rising groundwater levels and increased saline discharges in the catchment (DLWC 2000b). This has also contributed to pollution of watercourses and erosion, adversely affecting water quality in the Yass River.

In the Yass area, a combination of the above factors has contributed to extensive dieback and tree decline. In particular, impacting on Blakely's Red Gum (*Eucalyptus blakelyi)* causing severe defoliation of both young and old stands primarily as a result of psyllid (insect) attack. Dieback has also been noted in stands of Red Stringybark (*Eucalyptus macrorhyncha*) and to a lesser degree in Yellow Box (*Eucalyptus melliodora*).

Native vegetation in the catchment

Native vegetation cover in the Yass Valley sub-catchment is 22,671 hectares representing over 14% of the sub-catchment. This has been assessed as a 'high resource stress' affecting biodiversity and water quality (DLWC 2000b).

Priority actions

The overall objectives of the suggested action plans are to:

1. protect existing remnants
2. revegetate degraded areas
3. establish vegetation corridor links, and,
4. improve biodiversity, habitat and aesthetics.

Local Actions to Date

2000/2001

- Dieback Revegetation Project
- Picaree Hill Conservation Project

1999/2000

- Burrinjuck Webs of Green Vegetation Enhancement and Protection Project
- Burrinjuck Revegetation for Biodiversity Project
- Yass Area Dieback Revegetation Project
- Jerrawa Creek Catchment Green Corridors Project
- Yass Shire Vegetation Management Plan
- Tyrone Tree Corridor Project
- Jerrawa Creek Wildlife Corridor Project

1998/1999

- Jerrawa Creek Wildlife Corridor
- Jerrawa Creek Catchment Green Corridors
- Tyrone Creek Corridor
- Burrinjuck Remnant Bush Preservation and Revegetation
- Yass Shire Vegetation Management Plan
- Burrinjuck Webs of Green
- Murrumbateman Missing Links
- Yass Area Dieback Revegetation

1997/1998

- Jerrawa Creek Catchment Green Corridors
- Burrinjuck Remnant Bush Preservation and Revegetation
- Yass Shire Vegetation Management Plan
- Gundaroo Common Native vegetation survey
- Re-greening the Greenways
- Wee Jasper Nature Conservation Group.

1996/1997

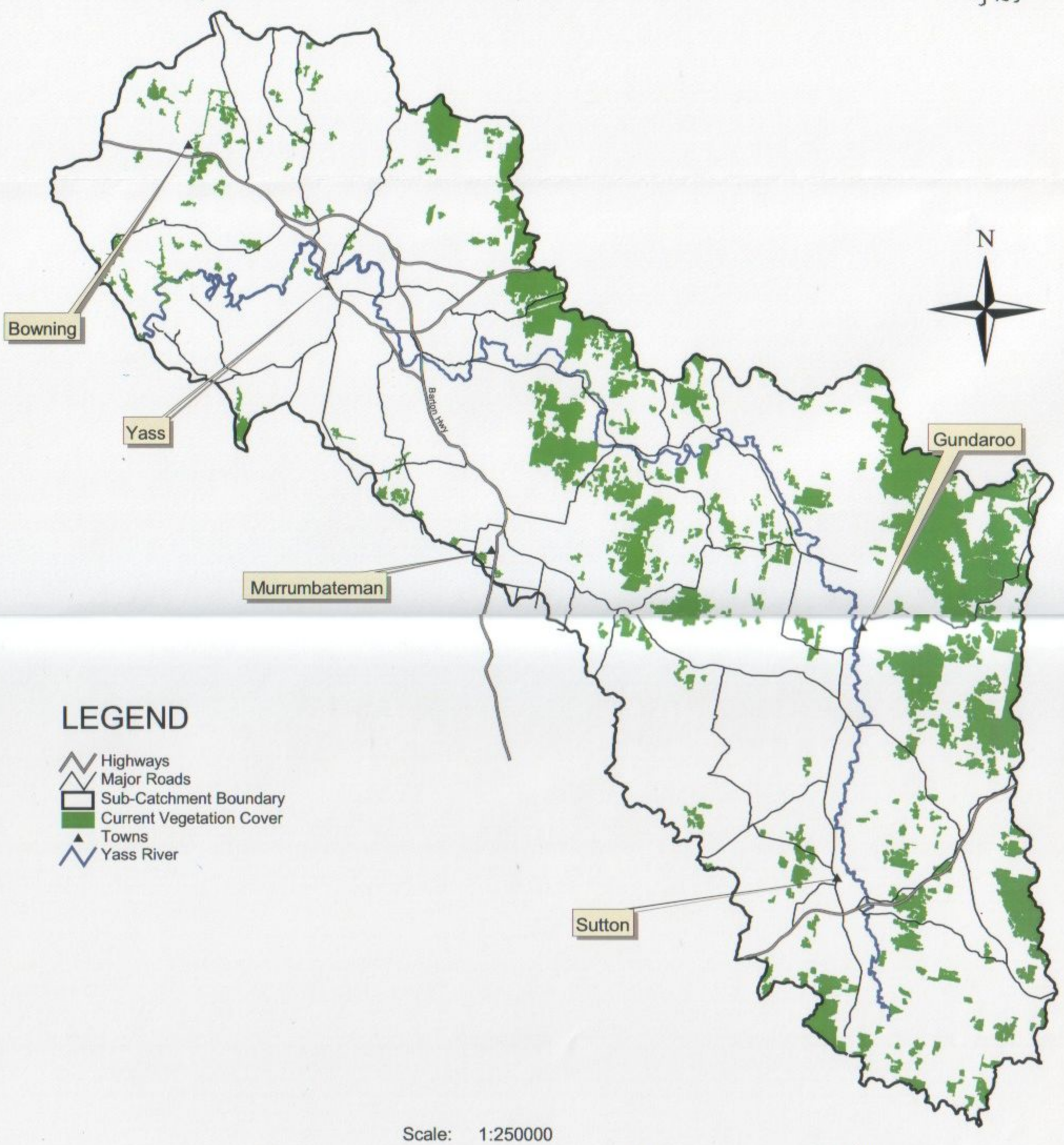
- Burrinjuck remnant bush preservation and revegetation
- Yass Shire Vegetation Management Plan
- Landcare guide for the hobby farm and bush block
- Murrumbateman - gully fencing, revegetation and erosion control

See also in the Appendix:
Section 6.4 Vegetation
Section 7.2 Native Vegetation
Table 3: Threatened Flora in the Yass Area
Table 4: Noxious Weeds in the Yass Area
Table 5: Threatened Fauna in the Yass Area

YASS VALLEY SUB-CATCHMENT

Map 10: Vegetation Cover

Yass Area Network of Landcare Groups
Working together



LEGEND

- Highways
- Major Roads
- Sub-Catchment Boundary
- Current Vegetation Cover
- Towns
- Yass River

Scale: 1:250000

10 0 10 20 Kilometres

DISCLAIMER

The Yass Area Network of Landcare Groups and/or contributors accepts no responsibility for the result of action taken or decisions made on the basis of the information contained herein or for errors, omissions or inaccuracies presented here. Whilst all care is taken to ensure a high degree of accuracy, users are invited to notify of any map discrepancies.

SOURCE: NSW National Parks & Wildlife Service, 2001

2. NATIVE VEGETATION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Retain and enhance remnant vegetation and increase area of native vegetation.	To maintain and improve ecological health to ensure sustainable production and conservation.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Salinity √	Soil Health √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

NV1. Use assessment kits to assess the quality of native vegetation.

NV2. Seek expert advice to establish local reasons for decline (eg dieback).

Implement management practices

NV3. Create an extensive network of vegetation to link revegetation and remnant protection activities (eg Wamboin Greenways). (BMA1, PrMA3)

NV4. Protect and manage remnant native vegetation on private land. (PrMA3, PrMA4)

NV5. Promote revegetation of native ecological communities listed as threatened or endangered, through fencing, reducing competition etc. (BMA6, BMA7)

NV6. Develop and encourage the use of local vegetation communities seedstock where possible. (PrMA4)

On-ground works

NV7. Enhance the health of remnants by encouraging natural regeneration and re-introducing a large range of local native understorey plants. (PrMA3, PRMA4)

NV8. Manage weeds and feral animals.

NV9. Retain dead standing and fallen timber for habitat. (BMA6)

NV10. Fence areas of important native vegetation & manage grazing appropriately.

NV11. Support more research on germination of native vegetation especially native grasses.

Promote and educate

NV12. Raise awareness of the importance of remnant vegetation. (BMA1, CBMA11)

NV13. Encourage local government to identify and protect high quality vegetation, particularly where it will be affected by development. (BMA1, BMA7)

NV14. Encourage financial rebates or incentive schemes for revegetation works (BMA7)

NV15. Develop identification information sheets for native perennial pasture management - grazing techniques, fencing, fires, allowing for seed set. (SMA8, PrMA1)

NV16. Promote native farm forestry through trial farm forestry sites.

Monitor

NV17. Monitor revegetation and remnant management activities to improve techniques, species selection and strategies. (BMA5)

BEST MANAGEMENT PRACTICE

NATIVE VEGETATION

What is native vegetation management?

Native vegetation is made up of trees, shrubs, grasses and all other plants native to Australia. Native vegetation management includes working with the community to increase and improve native vegetation cover and to better manage existing vegetation.

Why do we need to manage it ?

Native vegetation provides ecological, social and economic benefits. It contributes to biodiversity, protects from land degradation, maintains water quality, acts as a carbon sink, and provides for recreation, natural heritage, and research.

It provides fodder, products such as timber and honey, and habitat for beneficial pest predators. It also has important social, economic and cultural values for Aboriginal people.

What can I do ?

Manage remnant native vegetation to improve its condition. Ensure your revegetation or new plantings are consistent with your whole farm plan. Think about where they will provide the most benefit to your farming system. They might be to provide livestock shade and shelter, protect buildings, prevent groundwater recharge, stabilise stream banks or provide wood production.

How do I do it?

Retain

- Retain patches of native vegetation and try to link with other patches.
- Retain large trees, leaf litter, sticks and logs under remnant vegetation.

Protect

- Fence native vegetation areas to protect from stock
- Avoid fragmenting existing areas of vegetation by roads or fences.
- Keep a buffer between native vegetation remnants and other intensive land uses

Manage

- Manage grazing to allow regrowth of vegetation (ie don't graze in seed setting/flowering, or germination periods)
- Look after existing patches of remnant vegetation to allow natural regeneration
- Use appropriate native species when planting vegetation, particularly in existing vegetation areas
- Retain tree stumps, fallen trees, dead trees and understorey vegetation for habitat for pest predators
- Control weeds
- Minimise disturbance to soil and vegetation to maintain ground cover, keep weeds out and allow the understorey plants to establish.
- Reduce chemical and fertiliser drift from adjacent farm activities.

Who can help ?

Department of Land and Water Conservation, Yass phone (02) 6226 1433
Greening Australia, ACT phone (02) 6253 3035

FACT SHEET

VEGETATION ESTABLISHMENT TECHNIQUES

Fencing and weed control are vital for successful vegetation establishment !

TUBESTOCK

Tubestock are seedlings grown in narrow tubes of between 10-30 cm high and approximately 6-9 months old. They will establish and grow quickly under the right conditions.

When do I plant ?

Plant seedlings in early spring when soil moisture is high. If the soil tends to dry out in late spring, planting in early autumn is suitable. The site should be already ripped (usually best done in summer), along contour lines if planting on a hill, and should be sprayed at least twice in the preceding autumn and spring.

Where and what do I plant ?

Greening Australia has site specific species lists outlining species suitable for different areas, for example wet or dry areas, stony hills, deep soils, acid and saline soils. See contact details below.

What to remember when planting tubestock

- Water seedlings well before planting.
- Make sure the planting hole is as close as possible in size to the tubestock.
- Break-off any roots sticking out the bottom of the tube before planting.
- Remove the seedling from the tube (holding it upside down) with one knock, trying to minimise damage.
- Ensure the stem of the seedlings is no deeper in the soil than in the tube.
- Leave a small depression around the seedling to allow water to collect.
- Water immediately after planting.
- If mulching, keep mulch away from direct contact with the stem.
- Fence the area to protect seedlings from stock and pest animals.
- Remember to keep free of weeds.
- Blocks of plantings or lanes of at least 20m wide are much more beneficial to the landscape than narrow tree lanes.

It is best to plant close to existing patches of vegetation than in an open location.

DIRECT SEEDING

Direct seeding is where seed is directly drilled into the ground. It is significantly cheaper than planting tubestock, and takes a lot less time. Historically, it is slightly less successful than planting tubestock. Greening Australia will do direct seeding on a contract basis or a direct seeding machine can be hired from the Yass Area Network of Landcare Groups.

When do I plant?

It is recommended that herbicide applications up to 12 months before planting are necessary to reduce competition from weeds and grasses, and to build up soil moisture. Spring is the best time to carry out direct seeding. Fence the area before planting.

Where and what do I plant?

See Greening Australia for site specific species recommendations (contacts below). A seed mix of 30-40 species is recommended with seeding rates of 0.5 to 1kg per hectare or 200 to 400 grams per kilometre of tree line. Seed can be bought or collected from nearby remnant vegetation.

For further information

Greenotes, Greening Australia ACT & SE NSW PO Box 538, Jamison Centre, ACT 2614 ph (02) 6253 3035 fax (02) 6253 3145 email gaact@netinfo.com.au

- Greenotes #5 Collecting Australian Native Tree Seed
- Greenotes #6 Propagating Australian Native Trees

Who can help ?
Greening Australia ACT & SE phone (02) 6253 3035
Department of Land and Water Conservation, Yass phone (02) 6226 1433
The Farm Foresty Network, see Greening Australia.

FACT SHEET

REVEGETATION ESTABLISHMENT

Why should I establish native vegetation ?

Native vegetation provides many environmental benefits to flora and fauna through providing habitat and food sources. However, it also contributes to farm productivity through providing shelter, alternative grazing areas and providing habitat for beneficial pest predators.

What can I do ?

- Use local native species including trees, shrubs and grasses.
- Concentrate on expanding and enhancing existing vegetation remnants.
- Retain existing clumps of remnant vegetation. Where trees already exist it is easier and cheaper to fence them off and encourage regeneration.
- Link shelterbelts together and with existing vegetation to provide additional food, shelter and corridors for wildlife.
- Revegetate along creeks and gullies.
- Include local native understorey plants (shrubs) that flower at different times throughout the year to attract a variety of wildlife.
- Revegetated areas can become a shelter and habitat for pest species. Develop pest animal management plans for these areas and consult local agencies regarding appropriate control measures.

Who can help ?

- Contact your local Landcare group, Greening Australia or the list of local nurseries for local plant selection.
- Refer to Greening Australia "Green Notes" for plant establishment guidelines.

FACT SHEET

NATIVE SEED COLLECTION

Why should you collect native seed?

The cost of seed is a major part of the cost of revegetation projects. Collecting your own seed keeps costs down, and also ensures the best source of seed from local species suited to local conditions.

How do you collect seed?

- ❖ Seeds of native plants are usually found in a pod, woody capsule or cone. The seed is ready to be collected as the seed matures (usually December-January).

  For eg wattles and the pea flower family in our region produce pods that open as they mature and can be picked when they are brown and just starting to open.

- ❖ Collect the seeds in calico bags, pillowslips or cardboard boxes.

- ❖ Dry them in a warm dry place on a sheet or newspaper until seed has been shed. This may take anywhere between a few days to several weeks.

  Banksia cones and Hakea fruits may need to be put in a very slow over for an hour or more to encourage them to open up and release their seed.

- ❖ Store the dried seed in jars in a cool place away from sunlight.

REMEMBER!

- ! Only collect seed from healthy trees and shrubs that have minimal insect damage and healthy leaves and foliage.

- ! Choose seed from a site that has several healthy specimens of the desired species.

- ! Never collect seed from a single remnant tree.

- ! Collect seed from different parent trees of the same species within a distance of 100 metres apart. This will ensure a good genetic diversity.

Who can help?
Yass Landcare Office C/- DLWC Yass, (02) 6226 1433

FACT SHEET

NATIVE PLANT PROPAGATION

Here are some useful tips for propagating native plants.

How do I treat the seed before sowing?

- Boil 6 times the volume of water relative to the volume of seed. Add seed to boiling water after turning off heat (but while still boiling).
- Allow to stand for at least 3-4 hours, or overnight.
- Use the seed immediately or after drying (dry seed is easier to handle than wet seed).

  If drying, lay out seed on hessian, shadecloth etc until dry.

What type of soil mix should I use?

The basic soil mix includes coarse river sand, loam and peat, used in equal proportions. A small amount of slow release pelleted fertiliser with a low phosphorus content can be mixed in with the soil.

How should I sow the seedlings?

- Ensure the soil mix is moist (not wet).
- Make a small depression in soil and drop in seeds (4-6 seeds each for small seeds such as eucalyptus, 2-4 seeds for acacias and other large seeds).
- Large seeds should be covered with 3-5 mm layer of the soils mix and watered gently.
- Smaller seeds should be covered with a thin layer of coarse, washed river sand and gently sprayed with water. Try not to move the seeds and sand when watering.

How do I take care of the seedlings?

- Keep the seedlings moist, but not wet.
- Keep them in open sun or part shade with good air circulation to prevent fungal disease.
- Leave all seedlings to grow until they develop their second set of leaves. Then select the healthiest - one per tube - and cut the rest off at soil level.
- To 'harden off' seedlings, place them in full sun and water less frequently 3-4 weeks before planting. These seedlings can be planted when 10 cm tall. Otherwise, wait until they are about 25-30 cm tall, and then plant.

Who can help?
Yass Landcare Office C/- DLWC Yass, (02) 6226 1433

FACT SHEET

GRAZING MANAGEMENT IN NATIVE VEGETATION

Why should I manage grazing in areas of native vegetation?

Unmanaged grazing in areas of native vegetation does not allow regeneration of native plants. It can also result in high levels of damage to plants, introduction of weeds, and soil compaction. However, grazing does not have to be completely stopped.

How do I manage grazing?

These strategies will depend on the condition of the native vegetation.

FENCES
To control grazing access, native vegetation needs to be fenced.

TIMING
Avoid grazing during flowering and seeding of native plants, usually between September and January. Avoid stocking during significant regeneration events, such as rainfall during seeding.

DURATION
Control the length of time stock are left to graze. For highly degraded areas, crash-grazing (high stock rate over a short period) is effective in reducing weed cover to allow natural seed regeneration.

STOCKING RATE
The best method is varying stocking rates.

Who can help?
NSW Department of Agriculture, Yass Office (02) 6226 2199

FACT SHEET

REVEGETATING AREAS AFFECTED BY DIEBACK IN BLAKELY'S REDGUM

What is dieback?

Dieback refers to the thinning of a tree's crown or canopy. In Red Gum, this is due to the removal of foliage by intense insect attack. It ultimately results in the death of the tree due to a lack of enough leaf area to photosynthesize.

Extensive dieback can affect;

- soil structure
- watertable levels
- salinity
- loss of shelter
- flora & fauna biodiversity
- landscape

Dieback in Red Gum is primarily caused by psyllid (lerp) attack. Research suggests the main causes of lerp infestations are loss of predators, a reduction in the number of trees in the landscape through clearing, and a weakening of the vigour of the tree due to stress.

Lerps !

Psyllids (lerps) are 1-2mm long, feed on sap and can fly long distances. They shelter beneath a white, fan shaped covering or cocoon called a "lerp" attached to leaves. They feed by injecting toxin into the leaf causing the leaf to die. They breed three to four times a year with eggs hatching after one to two weeks. The newly-hatched psyllids immediately commence feeding.

Reducing the impact of dieback

Revegetation is the most effective way to reduce the impact of dieback caused by insect attack. Revegetation will reduce stress on the tress and attract natural predators of the insects.

Things you can do

- ❖ fence trees (mature trees in clumps of 5 - 10) from stock to encourage revegetation
- ❖ encourage a diverse understorey including indigenous grasses, wildflowers, shrubs and trees which provide shelter for predatory fauna.
- ❖ choose plants with a range of flowering times
- ❖ choose a range of plant shapes & sizes to attract diversity of birds & insects
- ❖ monitor the revegetation areas for evidence of a range of birds & insects, their preferred plants and changes in the conditions of trees.

Who can help?
NSW Department of Land and Water Conservation, Yass Office (02) 6226 1433

FACT SHEET

RECOMMENDED SPECIES FOR UNDERSTOREY REVEGETATION (RED GUM / YELLOW BOX WOODLANDS)

The following species are readily available and are reliable for direct seeding

Scientific Name	Common Name	Preferred Habitat	Description*	Flowering
Acacia buxifolia	Box-leaf Wattle	acid, skeletal, rocky outcrops	**S**, shrub 1-2m	Aug-Oct
Acacia brownii	Juniper Wattle	poorly drained sandy soils	prickly shrub 0.5-2m	Mar-Sept
Acacia cultriformis				
Acacia dealbata	Silver Wattle	dry, acid skeletal soils	**S**, tree 2-7m	July-Oct
Acacia decora	Western Silver Wattle	dry rocky outcrops, red loams	rounded, spreading shrub 1-4m	Aug-Sept
Acacia genistifolia	Spreading Wattle	dry, shallow soils	**S**, shrub 1-2m	May-Oct
Acacia implexa	Lightwood	sandy, shallow, dry	**S**, small tree 5-15m	Dec-Mar
Acacia lanigera	Woolly Wattle	shallow, rocky/quartz slopes	shrub 1-2m	Winter to Spring
Acacia melanoxylon	Blackwood	prefers deeper soils	**S**, small-large tree 6-30m	Aug-Oct
Acacia paradoxa	Hedge Wattle	dry, shallow soils	**S**, small, spreading shrub 2-4m	Aug-Nov
Acacia rubida	Red Stem Wattle	dry soils	**S**, shrub-small tree 2-10m	Aug-Oct
Acacia verniciflua	Varnish Watltle	sandy, shallow, rocky soils	**S**, shrub 1-4m	July-Nov
Acacia vestita	Hairy Wattle	dry hillsides	spreading shrub 1-4m	Aug-Oct
Bursaria lasiophylla	Bursaria	dry	**S**, shrub to small tree1-8m	Nov-Feb
Bothriochloa macra			**S**,	
Bursaria spinosa	Bursaria	dry sites, gullies	**S**, shrub	Nov-Feb
Cassinia aculeata	Common Cassinia (Dogwood)	sandy, clay	**SC**, shrub 2-3m	Nov-Feb
Chionocloa pallida	Redanther Wallaby Grass		**DS**,	
Dodonaea viscosa subsp. viscosa	Giant Hop-bush	clay, sandy	**S**, tall shrub 1-6m	Sept-Mar
Eucalyptus blakelyi	Blakely's Red Gum	dry, well drained	**S**, tree 10-24m	Aug-Sept
Eucalyptus bridgesiana	Apple Box	clay	**S**, tree 8-25m	Jan-Mar

Scientific Name	Common Name	Preferred Habitat	Description*	Flowering
Eucalyptus melliodora	Yellow Box	wet/poorly drained	**S**, tree 12-30m	Sept-Feb
Gompholobium hueglii	Giant Wedge Pea	poor sandstone soils	**S**, shrub 1-3m	Aug-Nov
Hakea sericea	Bushy Needlewood	hill country, within scrub	shrub 2-5m	May-Sept
Hardenbergia violacea			**S**,	
Hovea heterophylla			**S**,	
Hovea lineraris			**S**,	
Indigofera australis	Austral Indigo	poor shallow soils	**S**, shrub 0.5-2m	Aug-Sept
Juncus species	Rush		**SD**,	
Kunzea ericoides	Burgan	clay, sandy, wet/poor drained	**S**,	Nov-Feb
Kunzea parvifolia	Violet Kunzea	rocky slopes	**S**, shrub 0.5-2.5m	Oct-Dec
Leptospermum juniperum	Prickly Tea-Tree	poorly drained soil	prickly shrub 1-4m	Oct-Mar
Leptospermum lanigerum	Woolly Tea-Tree	along streams, swampy flats	shrub to small tree 2-6m	Sept-Dec
Leptospermum multicaule	Silver Tea-tree	dry hills	**SC**, shrub 0.5-2m	Spring
Melaleuca ericifolia	Melaleuca	poorly drained, swamps stream flats	shrub-small tree 2-9m	Oct-Nov
Melichrus urceolatus				
Microlaena stipoides	Weeping Grass	tolerant of low soil pH	S, small-med. perennial	Nov-Feb
Vittadinia spp.			**S**,	

Developed with the assistance of Rainer Rehwinkel (NPWS) and John Weatherstone

* *Method of Propagation: **S** - seed, **C** - cutting, **D** - Division*

SUPPLEMENTARY LIST for UNDERSTOREY REVEGETATION

The following species are suitable for understorey revegetation, but may be more difficult to obtain

Scientific Name	Common Name	Preferred Habitat	Description*	Flowering
Acacia gunii	Ploughshare Wattle		**S**, small shrub	Late Winter
Aristrida ramosa	Purple Wiregrass	sandy	**S**,med.-large tussock grass	Dec-Feb
Brachyloma daphnoides	Daphne Heath	poor, dry, rocky or sandy hills	small, heathy shrub, to 1m	Aug-Sept.
Bracteantha viscosa	Sticky Everlasting		**S**, perennial forb 80cm	
Bulbine bulbosa	Bulbine Lily	rocky sites	**S**, perinnial 40cm	Oct-Dec
Calytrix tetragona	Common Fringe-myrtle	rocky, sandy or gravelly sites	**S**, heathy shrub 1-2m+	Sept-Dec

Scientific Name	Common Name	Preferred Habitat	Description*	Flowering
Carex appressa	Tall Sedge	wet sites, above creeks	**D**, perinnial, 40-120cm	
Cassinia longifolia	Shiny Cassinia (Cauliflower Bush)	dry, shallow	**SC**, shrub 1-3.5m	Dec-Mar
Cassinia quinquefaria	Cassinia		**SC**, shrub 1-3m	Jan-Mar
Cheiranthera linearis	Finger Flower		shrub to 30cm	
Chrysoccephalum apiculatem	Common Everlasting (Yellow Buttons)		**SDC**, upright/creeping perinnial 7-60cm	Late Winter-Spring
Cryptandra amara	Bitter Cryptandra		heathy shrub -35cm	
Cymbopogon refractus	Barbed Wire Grass		**S**,	
Danthonia spp.			**S**,	
Daviesia species	Pea	dry rocky or sandy sites	**S**, shrubs 0.5-2m	Aug-Dec
Dianella spp.	Flax Lily		**SD**, tufted perinnial - 80cm	Nov -Feb
Dichantheum sericeum	QLD Bluegrass		**S**,	
Dillwynia sericea			**S**,	
Epacris spp.	Heaths	near swamps, streams	small heath 0.5-2m	various
Exocarpus cupressiformis	Cherry Ballart	shallow soils	small tree 3-8m	Dec-May
Exocarpus strictus	Pale-fruit Ballart		shrub 1-2.5m	Aug-Nov
Glycine clandestina	Twining Glycine		**S**, creeping pereinnial	
Gonocarpus tetragynus	Common Raspwort		**S**, perennial -35cm	Sept - Feb
Grevillea alpina	Cat's Claw	stoney, sandy ground	shrub to 2.5m	July-Sept
Grevillea juniperina	Prickly Grevillea	sand or rock near rivers	**SC**, prickly shrub 1-2.5m	Oct-Jan
Grevillea lanigera	Woolly Grevillea	sandy, rocky sites	**SC**, shrub 1-2m	Aug-Dec
Haloragis heteophylla	Swamp Raspwort	wet, drainage lines	**C**, sparse perennial 20cm	Summer
Helichrysum thyrsoideum	Sticky Everlasting	rocky highland sites	shrub 1-2m	Nov-Feb
Hibbertia obtusifolia	Grey Guinea Flower		**SC**,	
Isotoma fluviatilis	Swamp Isotome	wet, drainage lines	**CD**	Nov-Feb
Leucochrysum albicans	Hoary Sunray		**S**,	Sept-Feb

Scientific Name	Common Name	Preferred Habitat	Description*	Flowering
Lissanthe strigosa	Peach Heath	rocky ground	**S**, shrub -1m	
Melaleuca armillaris	Giant Honey-myrtle	sands, granite outcrops	large shrub-tree 2-14m	Nov-Feb
Poa species	Poa		**D**	
Pomaderris angustifolia	Pomaderris	near streams	dense shrub 1-3m	Oct
Pomaderris betulina	Birch Pomaderris	near streams	shrub 1-3m	Oct
Pultenaea foliosa, procumbens or subspicata	Bush Peas	dry	**SC**, low shrub -2m	Spring
Sorghum leiocladum	Wild Sorghum		**S**,	Dec-Feb
Stipa species	Grass		**SD**,	

Developed with the assistance of Rainer Rehwinkel (NPWS) and John Weatherstone

* *Method of Propagation:* ***S*** *- seed,* ***C*** *- cutting,* ***D*** *- Division*

EXPERTS, CONTRACTORS AND SUPPLIERS

Bywong Nursery
RMB 265 Millyn Road
Bungendore NSW 2621
Phone (02) 6236 9280

Geoff Butler (ecologist)
RMB 834 Birchman Grove
GEARY"S GAP NSW 2621
Phone (02) 6236 9158

Lyndfield Park Nursery
John Weatherstone
RMB 647 Hume Highway
GUNNING NSW 2581
Phone (02) 4845 1282

Hazelbrook Wholesale Nursery
18 William Street
OAKS ESTATE ACT 2600
Phone (02) 6297 2379

Dan and Dan Forestry Services
Hume Highway
YASS NSW 2582
Phone (02) 6226 2955

Yarralumla Nursery
Banks Street
YARRALUMLA ACT 2600
(02) 6207 2444

Econuts
21 McIntosh Circle
MURRUMBATEMAN NSW 2582
Phone (02) 6227 5634

Kurrajong Wholesale Nursery
Kambah Pool Road
Westwood Farm opp Gleneagles Estate
KAMBAH ACT 2902
Phone (02) 6231 8699

Danganelly Native Nursery
Towan
VIA GOULBURN NSW 2580
Phone (02) 4829 8135

Go Tree Nursery
Tea Drinking Creek, McCarthy Road
VIA HALL NSW 2616
Phone (02) 6227 5416

Raysw Trees
Ray Debritt
55 Swan Drive, Fernleigh Park
QUEANBEYAN NSW
Phone (02) 6299 3847

Southern Tablelands Farm Forestry Network
Sophie Clayton ph (02) 6207 2494
fax (02) 6207 2544
sophie.clayton@act.gov.au

Greening Australia ACT & SE NSW
Kubura Place
ARANDA ACT
Ph (02) 6253 3035

NSW State Forests
95 Castle Hill Rd
WEST PENNANT HILLS
1300 655 687

Australian Forest Growers Association
24 Napier Close
DEAKIN ACT
(02) 6285 3833

National Parks & Wildlife Service
6 Rutledge St
QUEANBEYAN NSW
(02) 6297 6144

Department of Land & Water Conservation
PO Box 23
YASS NSW
(02) 6226 1433

Note: this may not be a complete list of all suppliers in the region and buyers should also consult local directories for further information. The Yass Area Network of Landcare Groups does not endorse any particular supplier.

7.3 STREAM BANK ZONE MANAGEMENT

What is the stream bank zone ?

The stream bank zone refers to the area adjacent to waterways including the vegetation on both the banks and verges. The verge is the area of land up to 40 metres from the waterway channel.

Why is it important ?

In a natural stream environment, the bank and surrounding vegetation act as a buffer between the watercourse and surrounding land uses. This buffer can assist in:

- *Stabilising and maintaining stream bank*
- *Preventing excessive erosion*
- *Providing canopy shade.*
- *Protecting riparian condition*
- *Filtering and trapping soil particles*
- *Extracting nutrients from the water*

What causes stream bank degradation ?

The primary causes of stream bank degradation in the Yass catchment are: *lack of vegetation, stream bank erosion, willows and other weeds.*

Increased water flow, combined with a reduction in ground cover and soil disturbance, causes stream bank erosion. It is usually caused by the direct action of stream flow and can be exacerbated by erodible soil types. Other contributors to stream bank erosion include; damage by stock, flooding, carp, or channel blockages (by sand, gravel, vegetation etc).

The removal and degradation of stream bank vegetation in the Yass area has contributed to increased erosion, changed nutrient levels, water quality decline, and loss of aquatic habitat.

The decline of stream bank vegetation condition in the Yass area has allowed willow populations to spread. There is now a growing concern over willows, their impact on watercourses and their role in the landscape. Willows can have an increasingly large impact on a river system causing:

- *Flooding*
- *Erosion*
- *Water quality decline*
- *Disruption to water flow*
- *Changes to stream nutrients, aquatic habitat and food resources*
- *Potential threat to structures such as bridges and roads.*

More than 100 species or varieties of willows have been introduced to Australia, of which four major species are found in the Yass catchment (Cremer, 1995).

The four major species are:

- Crack Willow *(Salix fragilis)*
- Black Willow *(Salix nigra)*
- Golden Upright Willow *(Salix alba* var. *vitellina)*
- Weeping Willow *(Salix babylonica)*

What is the impact on the Yass catchment ?

Native stream bank vegetation in the upper Murrumbidgee area, which includes Yass Valley, is declining. The major threats to stream bank vegetation are rabbits, poor grazing management, weeds, willows and clearing.

The Yass Valley sub-catchment consists of 74 major drainage systems flowing into the Yass River. Land use mapping suggests 46% of the Yass river is dominated by exotic riparian vegetation, 27% is dominated by native stream bank vegetation, and the remaining 27% a mix

of native and exotic species (DLWC 2000b). For stream bank condition assessments for all streams in the Yass Valley sub-catchment see the Appendix section 7.3.

Aerial photographic mapping conducted by DLWC suggests 99.3kms of the Yass catchment is affected by stream bank erosion of which:

- *77% is less than 1.5 metres deep;*
- *17% is 1.5 to 3 metres deep;*
- *4% is 3 to 6 metres deep and;*
- *2% greater than 6 metres.*

Fish barriers, such as weirs, are having a detrimental effect on native fish movement and breeding. Gravel roads, saline areas and gullies are sending sediment and nutrients into the Yass River system (DLWC 2000b).

Fish species in the Yass area are dominated by carp. The greatest population of native fish occur in the Murrumbidgee River, but only constitute 8% of the total fish diversity.

According to the *Stressed Rivers Assessment Report* (DLWC 1999) the Yass River and tributaries are subject to high environmental stress, with the upper parts of Yass River displaying increased stress. The primary stress factors for the Yass River and tributaries **above** the Yass Weir include; high water extraction, salinity, dams and rural residential development. In the Yass River and tributaries **below** the Yass Weir, primary stress factors include sewerage, flow restrictions such as weirs, and salinity. Full development of this area below the weir could create a potential increase in hydrologic stress.

Stream bank vegetation has been assessed as poor in Yass River from Yass to Gundaroo (lower-mid), where poor indicates a dominance of exotic species. Stream bank condition has also been assessed as poor at Derringullen Creek (mid), Cooks Creek (mid), Mantons Creek (lower-mid), Gundaroo Creek (lower) and Bungendore Creek (upper), where poor indicates little effective vegetation on unstable or dispersive soils, recent bank movement or erosion.

Priority

Stream bank vegetation condition was established as a high priority issue by all six landcare groups in the Yass Valley sub-catchment. This is largely due to the dependence of the townships of Yass, Bowning and Binalong on the Yass River for their water supply. This concern is echoed by the Burrinjuck sub-catchment landcare groups, and in the overarching Murrumbidgee Catchment Action Plan which lists stream bank zone management as a high priority issue.

The groups stated willow management should focus on controlling their spread and to control willows in areas of greatest impact on stream health and stability.

1. *Seeding willows*
2. *Vegetative spreading willows*
3. *Islands – Willows on mid-stream islands/silt beds, channel blockage and erosion.*

Local Actions to Date

2000/2001

- Yass Urban Landcare Stream bank rehabilitation project

1999/2000

- Taylors & Allianoyomyiga Creeks Remnant Vegetation Protection & Enhancement Project
- Riparian Zone Revegetation - Moura Creek Stage 2
- Stream Bank Restoration Demonstration Sites
- Narrangullen Creek Stream Bank Revegetation & Erosion Control Project
- Sawpit Creek gully works

1998/1999

- Jerrawa Creek Rivercare
- Sutton Yass River Management Plan & Works
- Cooma Cottage Riverbank Rehabilitation
- Yass River Fencing & Revegetation
- Jeir Creek Fencing, Revegetation & River Management
- Riparian Zone Revegetation Moura Creek
- Dicks Creek Stream Bank Revegetation
- Murrumbateman Missing Links

1997/1998

- Jerrawa Creek Rivercare
- Yass Urban Willow Removal & Revegetation

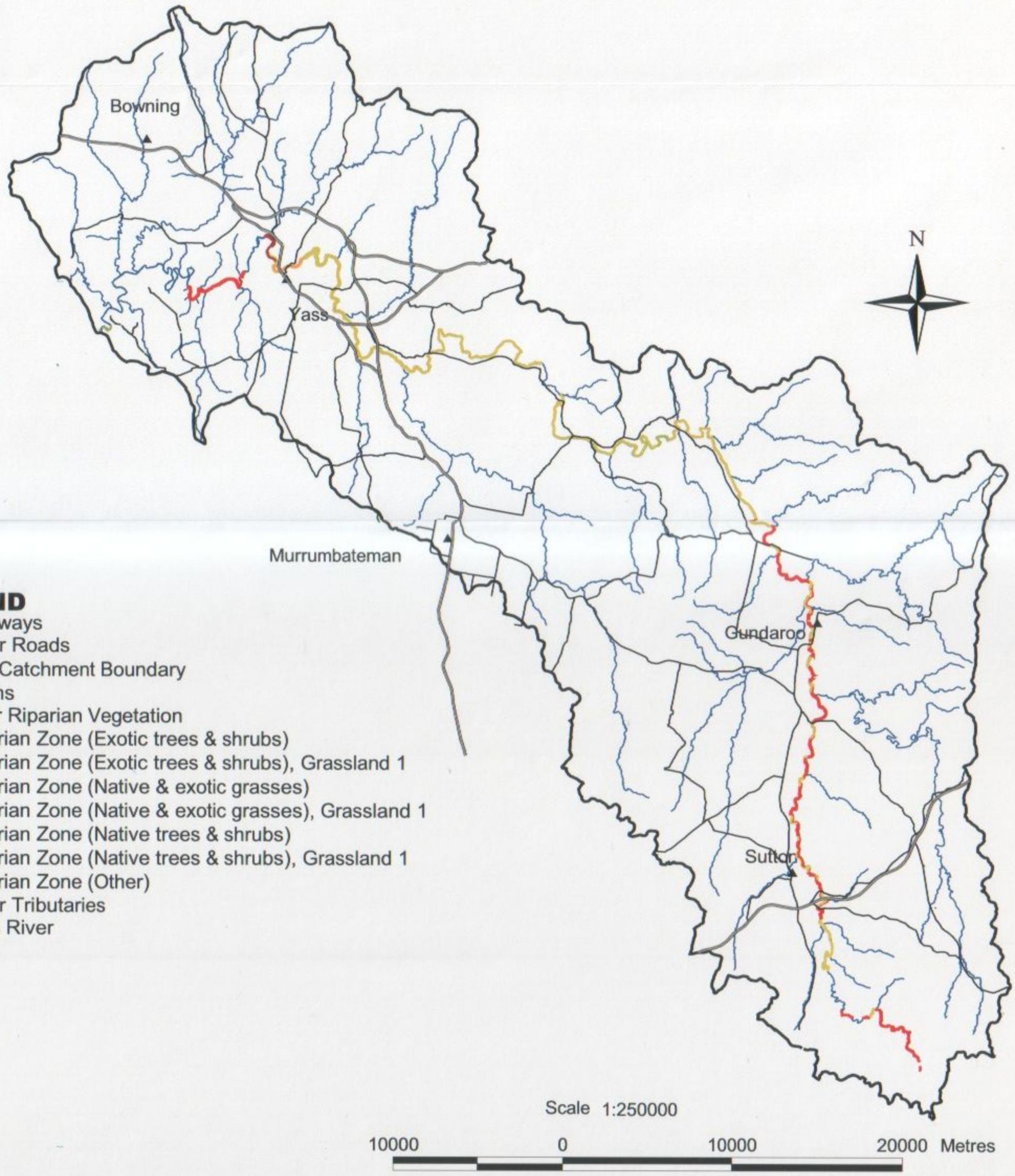
1996/1997

- Jerrawa Creek & Lachlan River Tributaries Riverine Corridor Stabilisation and Enhancement Project.
- Gundaroo - Yass River management plan and works.

See also in the Appendix:
Section 7.3 *Stream Bank Zone*
Table 13 Dominant native riparian vegetation for the Yass area
Table 17 Riparian vegetation and stream bank condition: Yass Valley Sub-catchment

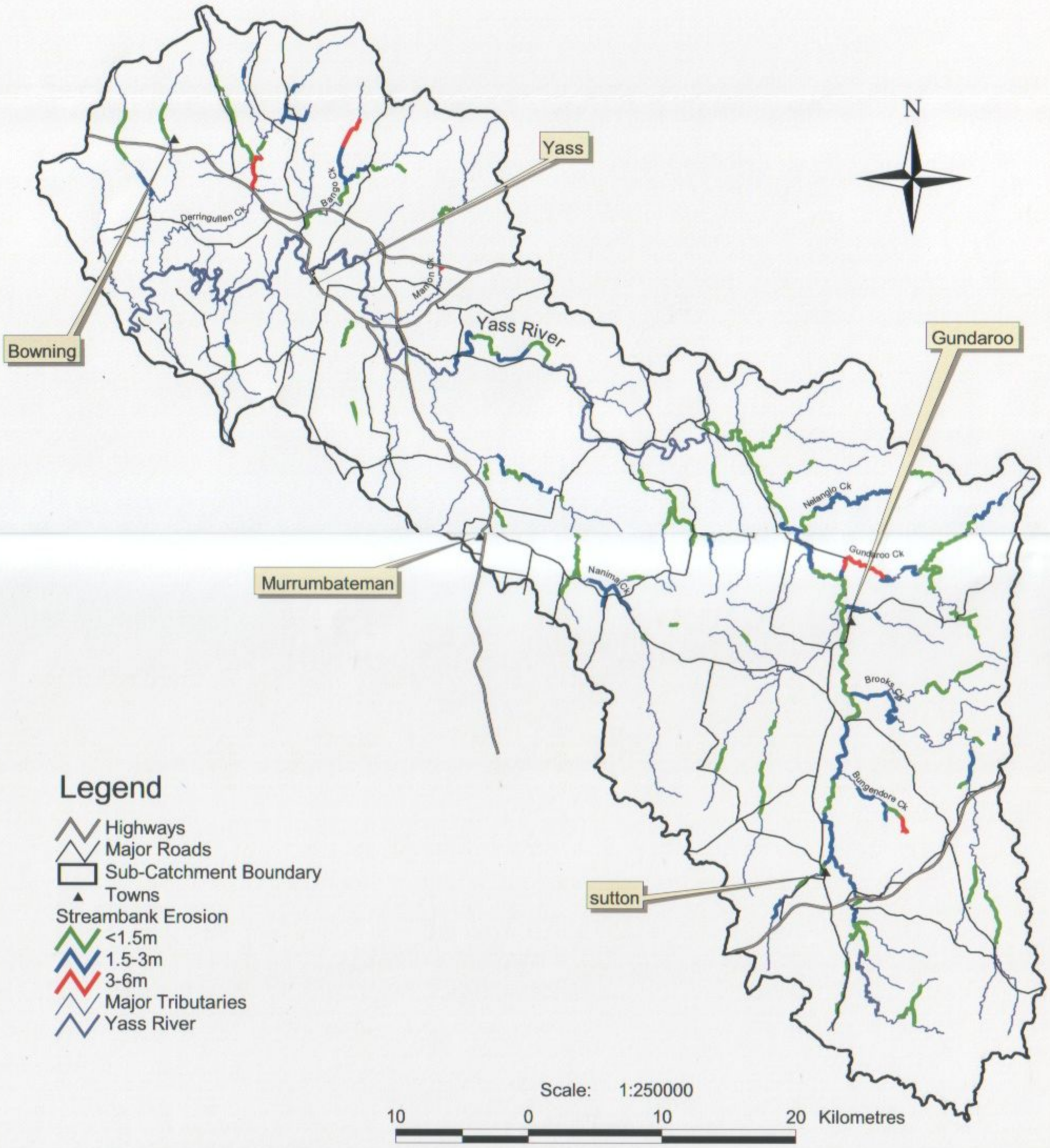
YASS VALLEY SUB-CATCHMENT

Map 11: Stream Bank Vegetation



YASS VALLEY SUB-CATCHMENT

Map 12: Stream Bank Erosion



Source DLWC 1999

3. STREAM BANK ZONE ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage creek and river corridors.	To prevent loss of productive farmland, minimise sediment & chemical content, and to maintain water quality.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

SZ1. Use the Riparian Catchment Assessment Sheets to identify and target high priority areas.

SZ2. Seek expert advice on the severity of the problem and possible local causes.

Implement management practices

SZ3. Manage stock access to protect areas of identified stream bank erosion, eg large mobs grazing for short periods to maximise ground cover. (WMA4, BMA2)

SZ4. Change practices to include buffer zones near stream banks.

SZ5. Encourage zoning of appropriate stream bank areas for public use, access and environmental benefit. (BMA2)

SZ6. Use 'environmentally-friendly' chemicals near waterways, and ensure other chemicals do not enter the stream bank zone.

On-ground works

SZ7. Where appropriate to individual farm plans, fence areas as necessary with the cooperation of land holders.

SZ8. Remove weeds such as Crack willows or Black willows. (WMA5)

SZ9. Improve stream bank vegetation cover and biodiversity. (BMA10)

SZ10. Undertake structural earthworks on severely eroding banks. (WMA6)

SZ11. Control carp populations through participation in regional actions. (WMA15)

Promote and educate

SZ12. Develop information kit/guidelines for landholders. (CBMA11)

SZ13. Develop demonstration and sponsor projects. (CBMA11)

SZ14. Encourage voluntary agreements such as land retirement, management agreements and covenants for stream bank areas.

Monitor

SZ15. Establish regular assessment and mapping of stream bank conditions (building on existing GIS data).

SZ16. Monitor change and the impacts of management practices (CBMA11)

SZ17. Monitor downstream sediment loads to test impact of actions taken.

BEST MANAGEMENT PRACTICES

STREAM BANK ZONE

What is the stream bank zone ?

The stream bank zone is the area adjoining a waterway including the vegetation on both the banks up to 40 metres from the waterway channel.

Why do we need to manage it ?

- to maintain good water quality
- to prevent erosion
- to maintain aquatic habitat
- to provide a wildlife corridor

What can I do ?

There are a number of things you can do to improve the sustainability and health of the stream bank. As a first step, the stream bank zone should be managed to allow controlled access of stock and to assist regeneration and weed control.

- willow control
- weed control
- revegetation, and
- structural works.

Facts sheets on each of these activities is attached.

Some general principles :

- don't build structures on, or close to a stream bank,
- leave a buffer zone
- don't remove trees, shrubs or grasses from the
- stream bank (unless noxious weeds)
- only allow stock watering points on gently sloping banks, and ensure erosion control measures are in place, eg paved ramp etc.
- don't allow excessive build-up of debris in the stream which can divert the stream flow
- access ramps to the stream should only be built on the inside of bends
- never excavate a stream without getting advice and permission !

!!! **Remember**: any works undertaken on a stream, creek or river may require a permit or permission from one or more agencies - ask for advice !!!

Who can help ?
Department of Land & Water Conservation, Yass Phone (02) 6226 1433

FACT SHEET

WILLOW CONTROL

Why should we control willows ?

Willows are familiar sight in the Australian rural landscape. And while they have some recognised values such as providing shade, shelter and bank stabilisation, they are a serious threat to the health of the waterways, native vegetation and stream banks.
Willows cause erosion by diverting the flow of water towards the banks. They also reproduce rapidly through a prolific production of seed, or by broken branches taking root.

How do I control willows ?

The most effective means of controlling willows is to completely remove them from the streambank. Removal should begin in the headwaters of the catchment, moving downstream. If possible, removal should be undertaken within a certain section, bounded by control points such as rock beds, culverts etc to minimise risk of erosion. Remove willows on straight sections first, then on the inside of bends, then on the outside bends.

- remove young willow seedlings **by hand**,

- **foliar spray**, Glyphosate (360 g/L) is registered for use as a foliar spray on trees up to two metres high at a rate of 1-1.3 L/100L water.

- **stem injection**, 1-2 mL of Glyphosate (360 g/L) injected into cuts around trunk spaced at 13 cm intervals

- **cut tree to a stump**, application of undiluted Glyphosate (360 g/L) immediately after cutting.

Any debris resulting from willow control should be removed immediately and the area revegetated with suitable plant species.

Where do I start ?

First priorities
- Willows growing in midstream that block or divert water should be removed first.
- Willows that divert water flows into banks.

Then
- Damaged, brittle or old willows that drop branches
- Species that produce viable seed (see below).

When is the best time to control willows ?

Chemical control should take place between December and March. The Department of Land and Water Conservation (DLWC) recommend that willow clearing should be carried out in as short a time as possible, to be finished within three (3) years of approval.

What are my legal obligations when removing willows ?

Approval must be obtained from DLWC before any vegetation is removed from within 20 metres of nominated waterways. DLWC's *Willow clearing guidelines for applicants* outlines the approval process and can be obtained from any DLWC office.

Approval must also be obtained for activity involving ground disturbance within 40 metres of a watercourse, (contact DLWC for more information).

Also seek advice about the restrictions on the use of weedicides near waterways of the *Clean Waters Act of NSW* (1970) from the DLWC.

Remember: Revegetate the sites with appropriate native vegetation and regularly check site for spread of any new willows.

Species contributing to seed production

Salix nigra
S. *alba* var *vitellina*
S. *matsudana* x S. *alba* and clones
S. *matsudana* 'Tortuosa'
S. *rubens*
S. *cinerea*
S. *purpurea*
S. *glaucophylloides*
S. *viminalis*
S. *fragilis*

Species for urgent control and management

S. *alba* var *vitellina* x S. *fragilis*
S. *babylonica*
S. *caprea*
S. *matsudana* 'Pendula'

Further reading

Willow Management Strategy for the Upper Murrumbidgee Catchment, June 1998; Willows Working Group of the ACT Environment Advisory Committee and Willow Working Group of the Upper Murrumbidgee Catchment Coordinating Committee.

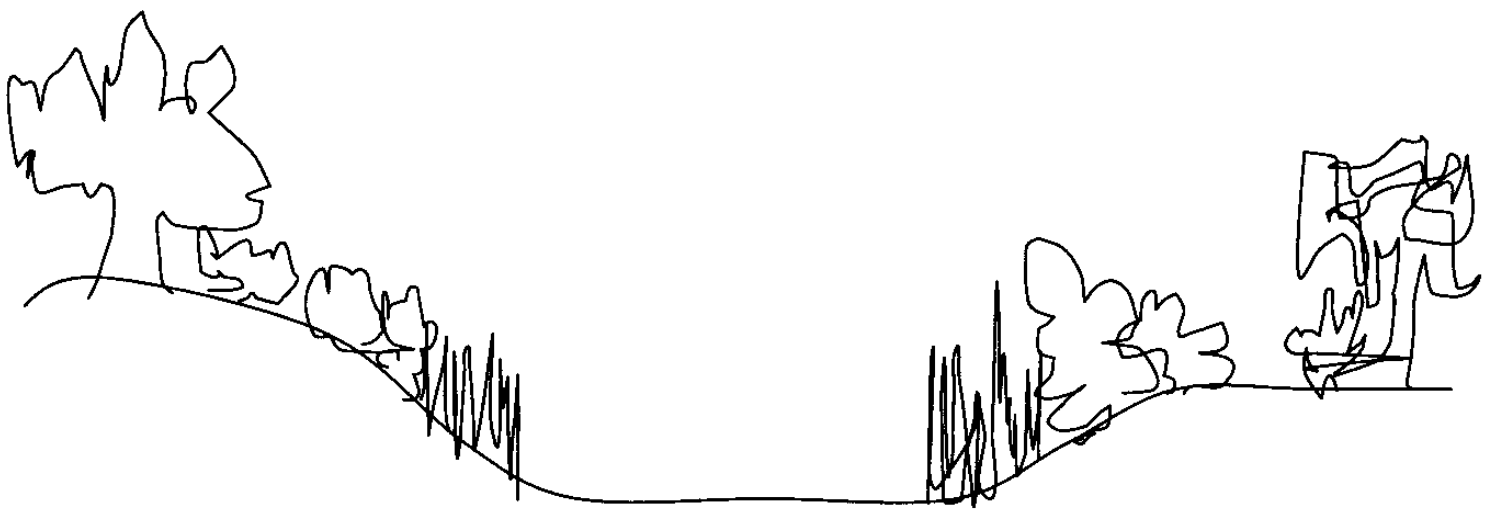
Who can help ?

Department Land and Water Conservation, Yass.	Ph: 6226 1433
Landcare Coordinator, Yass	Ph: 6226 1433

FACT SHEET

STREAM BANK REVEGETATION

When revegetating stream banks, a variety of trees, shrubs, groundcovers and grasses should be used.



Trees should be planted away from the banks, with shrubs and reeds closer to the stream.

The stream bank should be managed along best management practices (see BMP Stream Bank).

Greening Australia recommend a number of species for the stream bank zone including;

- Silver Wattle (*Acacia dealbata*)
- Red Stem Wattle (*Acacia rubida)*
- Tussock Grass *(Poa labillardieri)*
- River Tea-tree (*Leptospermum obovatum*)
- River Bottlebrush (*Callistemon sieberi*)
- Common Reed (*Phragmites australis*)
- Cumbungi (*Typha sp.*)

Further References

Greenotes Greening Australia ACT & SE. PO Box 538 Jamison Centre, ACT 2614 ph (02) 6253 3035 fax (02) 6253 3145 email gaact@netinfo.com.au

Who Can Help ?

Department Land and Water Conservation, Yass.	Ph:(02) 6226 1433
Greening Australia ACT & SE NSW	Ph:(02) 6253 3035

FACT SHEET

MANAGING STOCK ACCESS TO THE STREAM BANK ZONE

Why should stock access be managed ?

Unmanaged access of stock to the stream bank zone can destroy vegetation, compact the soil, push soil into the watercourse, create small gullies into the watercourse and endanger the stock themselves. This can lead to erosion of the stream bank and a decrease in water quality.

Stock should also be kept out of the watercourse. If allowed access, they damage water vegetation, add excess nutrients to the water, destroy native fish habitat and risk injuring themselves.

How can stock access the water without damaging the stream bank ?

Watercourses provide an important source of water for stock for many agricultural enterprises, and access to that water can be maintained without causing damage to the stream bank.

The best option is to fence off the stream bank zone and control stock access to that area. Options for managing access include installing a paved ramp down to the water, using a bore and tank in the paddock or a pump and a trough. Recommendations about the best places to set fences, access points and crossings are available (see Further References).

Before you install infrastructure to extract water from a stream or river, contact the Department of Land and Water Conservation for advice and to ensure you do not breach any legislation.

Can stock still access the vegetation for fodder?

Once the vegetation is established, stock can graze in the stream bank zone for short periods to eat the grass, but should be moved before they start to eat shrubs and trees.

How will I control weeds in the fenced area ?

Weed control should be undertaken. You should seek advice from the local Department of Land and Water Conservation as the *Clean Water Act* contains provisions regulating the use of chemicals near watercourses.

Further References

Livestock Control near Rivers: Ways of Keeping Livestock out of River Beds and Off the Banks, Riverwise Advisory Notes for Rural Landholders, DLWC, 1995.

Who can help ?

Department Land and Water Conservation, Yass. Ph:(02) 6226 1433

FACT SHEET

HOW TO ASSESS THE CONDITION OF STREAM BANK VEGETATION

RATING	VEGETATION	STABILITY
LOW	• Vegetation on banks generally sound • Good species diversity	• River channel is stable from erosion • No undermining of banks • No continuous damage to bank structure
MODERATE	• Vegetation on banks is sparse • OR vegetation is the wrong kind • OR there is excessive growth within the river channel	• River channel is starting to enter a state of decline and physical instability • Banks held by discontinuous vegetation or erosion resistant soils • Some obvious damage to bank structure and vegetation • Generally stable toe
SEVERE	• Vegetation on banks is missing • Banks are bare or falling into channel	• River channel is in an advanced stage of disintegration • Unstable or dispersive soils • Mostly undercut toe • May be recent bank movement or erosion

Further information and advice

Landcare, Yass Office C/- DLWC (02) 6226 1433
Department Land and Water Conservation, Yass. (02) 6226 1433

FACT SHEET

USEFUL SPECIES FOR REVEGETATION OF RIPARIAN AREAS IN THE YASS AREA CATCHMENT

BOTANICAL NAME	COMMON NAME	CATCHMENT AREAS
Acacia dealbata	Silver Wattle	Yass River, Brooks Creek, Murrumbateman Creek, Murrumbidgee River, Ginninderra Creek, Tuggeranong Creek, Mountain Creek, Goodradigbee River, Micalong Creek
Acacia rubida	Red Stem wattle	
Poa labillardieri	Tussock grass	
Phragmites australis	Common Reed	
Typha spp.	Cumbungi	
Casuarina cunninghamiana	River She-Oak	Murrumbidgee River, Ginninderra Creek, Tuggeranong Creek, Mountain Creek, Goodradigbee River, Micalong Creek
Eucalyptus camaldulensis	River Red Gum	Yass River, Brooks Creek, Murrumbateman Creek
Eucalyptus viminalis	Ribbon Gum	Goodradigbee River, Micalong Creek

ADDITIONAL NATIVE SPECIES SUITABLE FOR RIPARIAN REVEGETATION

BOTANICAL NAME	COMMON NAME	HABIT
Acacia pravissima	Wedge-leaf Wattle	Shrub
Acacia mearnsii	Black Wattle	Small tree
Bursaria lasiophylla	Blackthorn	Shrub
Callistemon sieberi	River Bottlebrush	Shrub
Calytrix tetragona	Common Fringe Myrtle	Shrub
Cassinia aculeata	Common Cassinia	Shrub
Cassinia longifolia	Cauliflower Bush	Shrub
Dodonaea viscosa	Hopbush	Shrub
Eucalyptus aggregata	Black Gum	Medium/large tree
Eucalyptus stellulata	Black Sallee	Medium/large tree
Eucalyptus pauciflora	Snow Gum	Medium/large tree
Eucalyptus rubida	Candlebark	Medium/large tree
Grevillea juniperina	Prickly Grevillea	Shrub
Grevillea lanigera	Woolly Grevillea	Shrub
Hakea microcarpa	Small-fruit Hakea	Shrub
Leptospermum brevipes	Slender Tea Tree	Shrub
Leptospermum lanigerum	Woolly Tea Tree	Shrub
Leptospermum obovatum	River Tea-tree	Shrub
Lomandra longifolia	Long-Leaf Mat Rush	Rush
Lomatia myricoides	Long Leaf Lomatia	Shrub
Lythrum salicaria	Purple Loosestrife	Herb/groundcover
Pomaderris angustifolia	Pomaderris	shrub

RIVER CORRIDOR SPECIES

Planting of the following species should be undertaken a suitable distance from the banks to prevent collapse into the river. This distance will depend on the stability and soil type forming the bank. For larger trees a distance of three times the bank height is recommended.

COMMON NAME	SCIENTIFIC NAME	REVEGETATION INFORMATION
Apple Box	***Eucalyptus bridgesiana***	alluvial soil, medium sized tree to 20m
Black Sallee	***Eucalyptus stellulata***	loamy, alluvial soils, will propagate on very cold river flats, and also on poorly-drained sites, height to 12m
Black Wattle	***Acacia mearnsii***	dry, shallow soils, very frost and drought hardy, vigorous spreading and anchoring root system, 5-15m
Blue Gum	***Eucalyptus globulus bicostata***	moist conditions, preferring loams or shallow clay soils, tall tree 25-60m
Broad-leaf Peppermint	***Eucalyptus dives***	prefers poor, shallow soils, 8-25m
Candlebark	***Eucalyptus rubida***	dry, shallow soils, hardy, suitable for cold areas, 2-10m
Hickory Wattle	***Acacia falciformis***	shallow, rocky soils, 4-12m
Lightwood	***Acacia implexa***	shallow, dry soils, 4-15m
Ribbon Gum/Manna Gum	***Eucalyptus viminalis***	prefers well drained, alluvial soils, large tree, 25-50m
River Bottlebrush	***Callistemon paludosus***	wet sand or rocky soils, also suitable base of eroding stream banks, 2-7m
River Red Gum*	***Eucalyptus camaldulensis***	prefers deep, moist, clay soils along rivers and watercourses eg. Yass and Murrumbidgee rivers, 12-25m. Large tree, plant well back from eroding or collapsing banks
River She-oak	***Casuarina cunninghamiana***	roots good at binding banks, 12-30m
Silver Gum?	***Eucalyptus crenulata***	cool, poorly drained sites
Silver Wattle*	***Acacia dealbata***	is frost and drought resistant, and will grow along watercourses, vigorous spreading root system, regenerates easily by seed and suckering
Snow Gum	***Eucalyptus pauciflora***	wide range of soils, very hardy on cold, open sites and where soils too shallow for Ribbon Gum, height to 20m
Yellow Box	***Eucalyptus melliodora***	loamy soils on lower slopes, but higher than the River Red Gums on the alluvial soils

* Most Useful Revegetation Species for Yass River and Murrumbidgee River Sub-Catchments

(As described in Upper Murrumbidgee Catchment Riparian Vegetation Survey - Greening Australia, 1996)

FACT SHEET

STRUCTURAL WORKS IN THE STREAM BANK ZONE

What structural works can I undertake to control erosion ?

- **Brush Groynes** are a series of low walls built out of logs and brush extending into the stream along the eroded bank. The groynes slow the flow, collect sediment and allow vegetation to establish. It is a low cost option, suitable for low to medium energy flow watercourses.
- **Fallen logs** in the watercourse can also be used to protect the bank from erosion by diverting the flow of water away from an eroding bank.
- **Log walls** can be constructed along the base of the bank which allows vegetation to establish.
- **Realignment of the water channel** can be carried out to direct flows away from the banks. Native vegetation is used to stabilise the new bank. Note that permits apply to this type of work. See local DLWC office for more information.
- **Gravel mesh sausages** are long mesh baskets filled with gravel that are used to slow the flow of the watercourse near the bank and guide it way, allowing sediment to deposit at the base of the bank.
- **Jacks** are a series of cross-shaped structures placed along the base of the eroded bank with vegetation planted in between to slow the flow near the bank, and allow vegetation to establish.
- **Timber weirs** provide bed erosion control, and restore shallow rapids and pools. They also provide for fish habitat and water supply.
- **Boulders** can be used to raise the bed level and direct flows away from banks. They also provide polls, riffles and holes for fish habitat.
- **Rock revetment** is the placing of rocks against the base of the bank to protect it and hold material in place.

It is important that you seek advice before planning any of the above works. Work undertaken in or near stream banks is subject to local and state legislation and you should seek advice regarding your obligations or any permits that may be required.

Who can help?

Department of Land and Water Conservation, Yass Office (02) 6226 1433.

Further References

Works to control stream bank erosion: Treatment Options. Riverwise Advisory notes for rural landholders, DLWC, 1998

FURTHER REFERENCES

Cremer, K.W.
Willow identification for River Management in Australia
Technical Paper No 3 1995
CSIRO Division of Forestry, Canberra, Australia

Ive, J. *Recommended Native Species for Planting in the Yass Valley.* Yass River Valley Re-vegetation project. October 1990.

Natural Resource Management, Special Issue, December 1999
Australian Association of Natural Resource Management

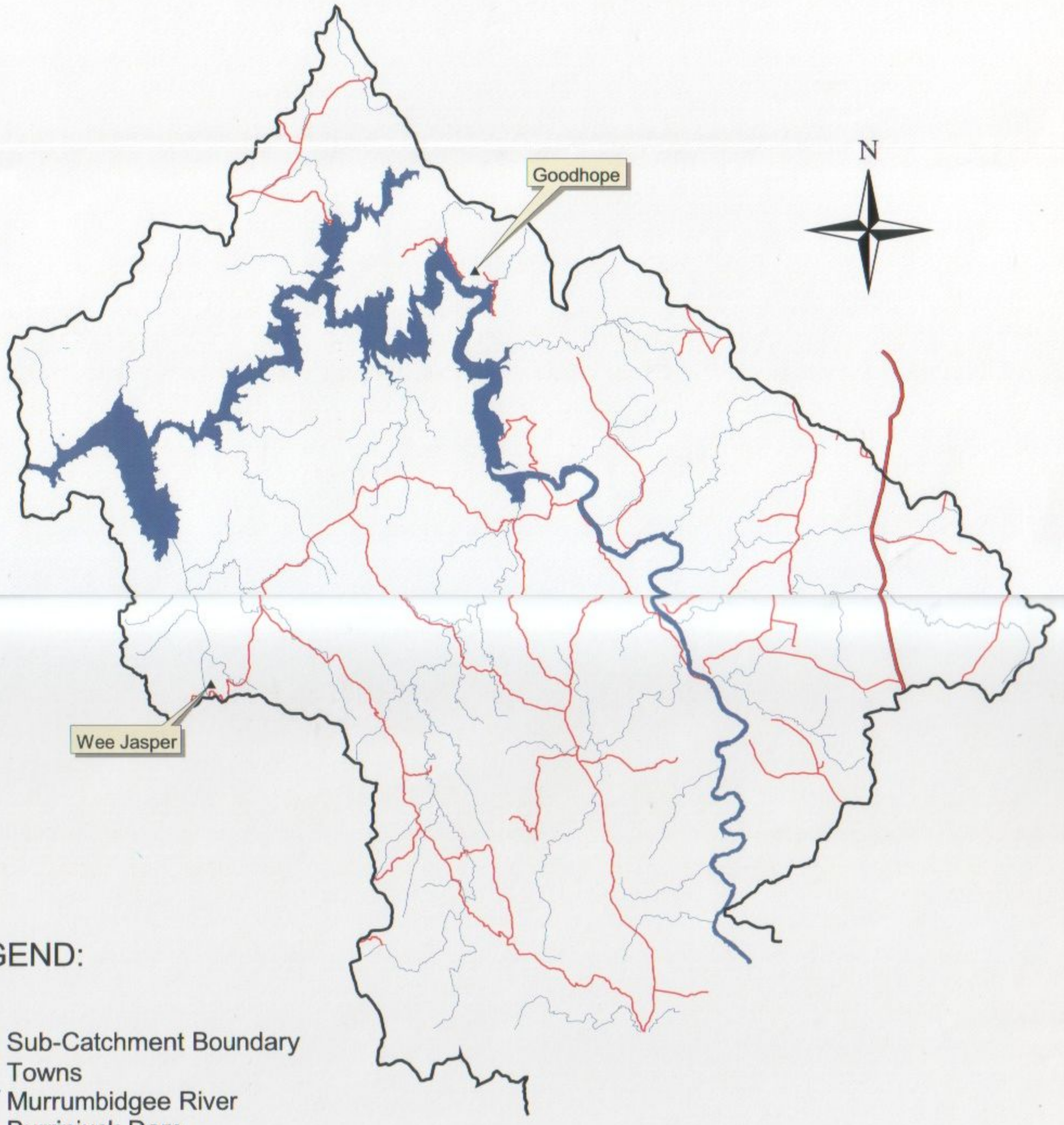
Riverwise: Advisory notes for rural landholders. DLWC Sydney.

BURRINJUCK

SUB-CATCHMENT

BURRINJUCK SUB-CATCHMENT

Map 13: Roads and Rivers



LEGEND:

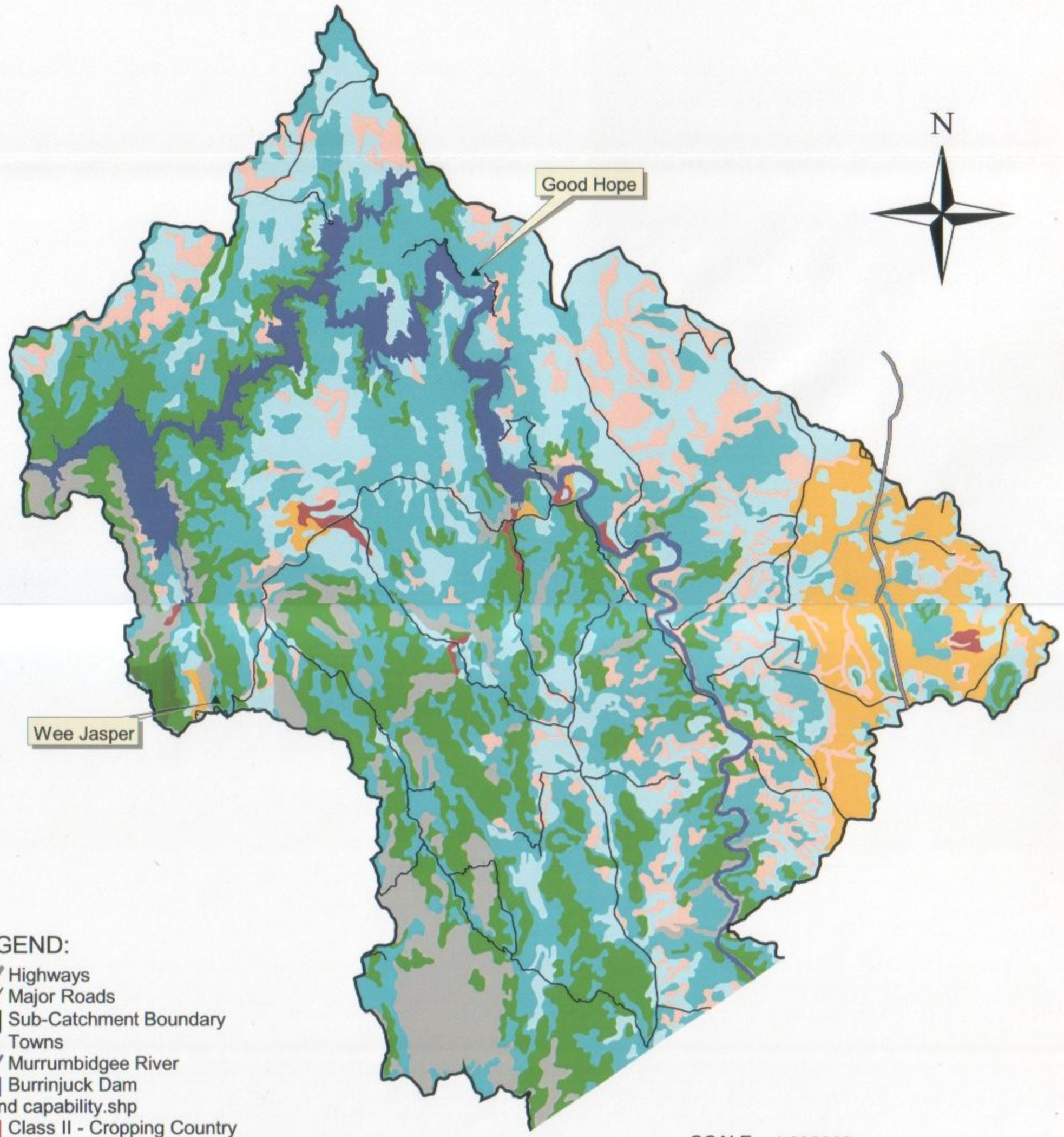
- Sub-Catchment Boundary
- Towns
- Murrumbidgee River
- Burrinjuck Dam
- Highways
- Major Roads
- Major Tributaries

SCALE: 1:200000

10 0 10 20 Kilometres

BURRINJUCK SUB-CATCHMENT

Map 14: Land Capability



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- Towns
- Murrumbidgee River
- Burrinjuck Dam

Bj land capability.shp

- Class II - Cropping Country
- Class III - Rotational Cropping Country
- Class IV - Occasional Cropping Country
- Class V - Moderate Grazing Country
- Class VI - Seasonal Grazing Country
- Class VII - Suited only for Green Timber
- Class VIII - Non-Agricultural Land
- Nature Reserve
- Water

SCALE 1:200000

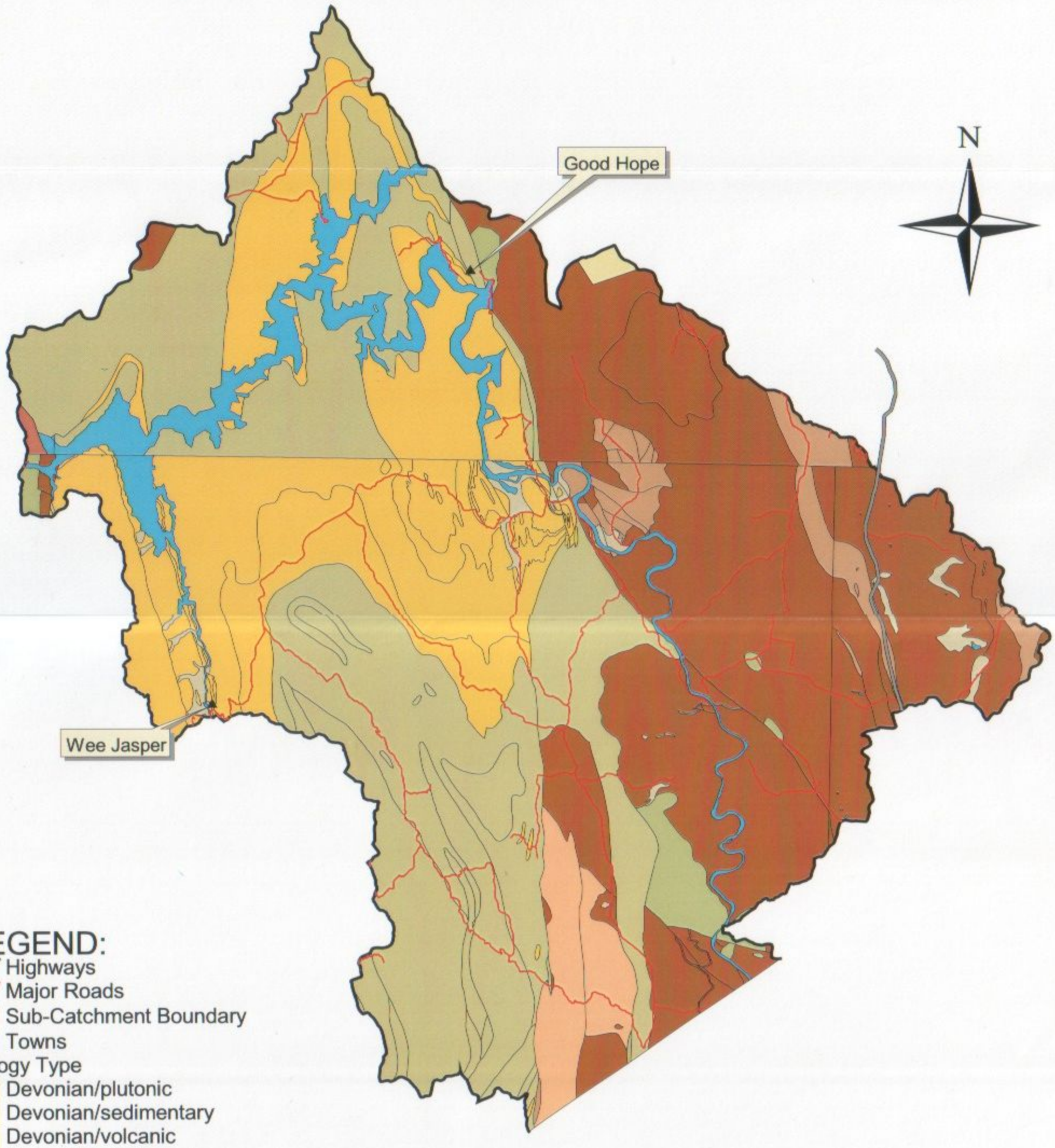
10 0 10 Kilometres

SOURCE: DLWC, 1999

BURRINJUCK SUB-CATCHMENT

Map 15: Geology

Yass Area Network of Landcare Groups
Working together



N

LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- ▲ Towns

Geology Type

- Devonian/plutonic
- Devonian/sedimentary
- Devonian/volcanic
- Ordovician/sedimentary
- Quaternary/sedimentary
- Recent/water
- Silurian-Devonian/sedimentary
- Silurian/plutonic
- Silurian/sedimentary
- Silurian/volcanic

SCALE 1:200000

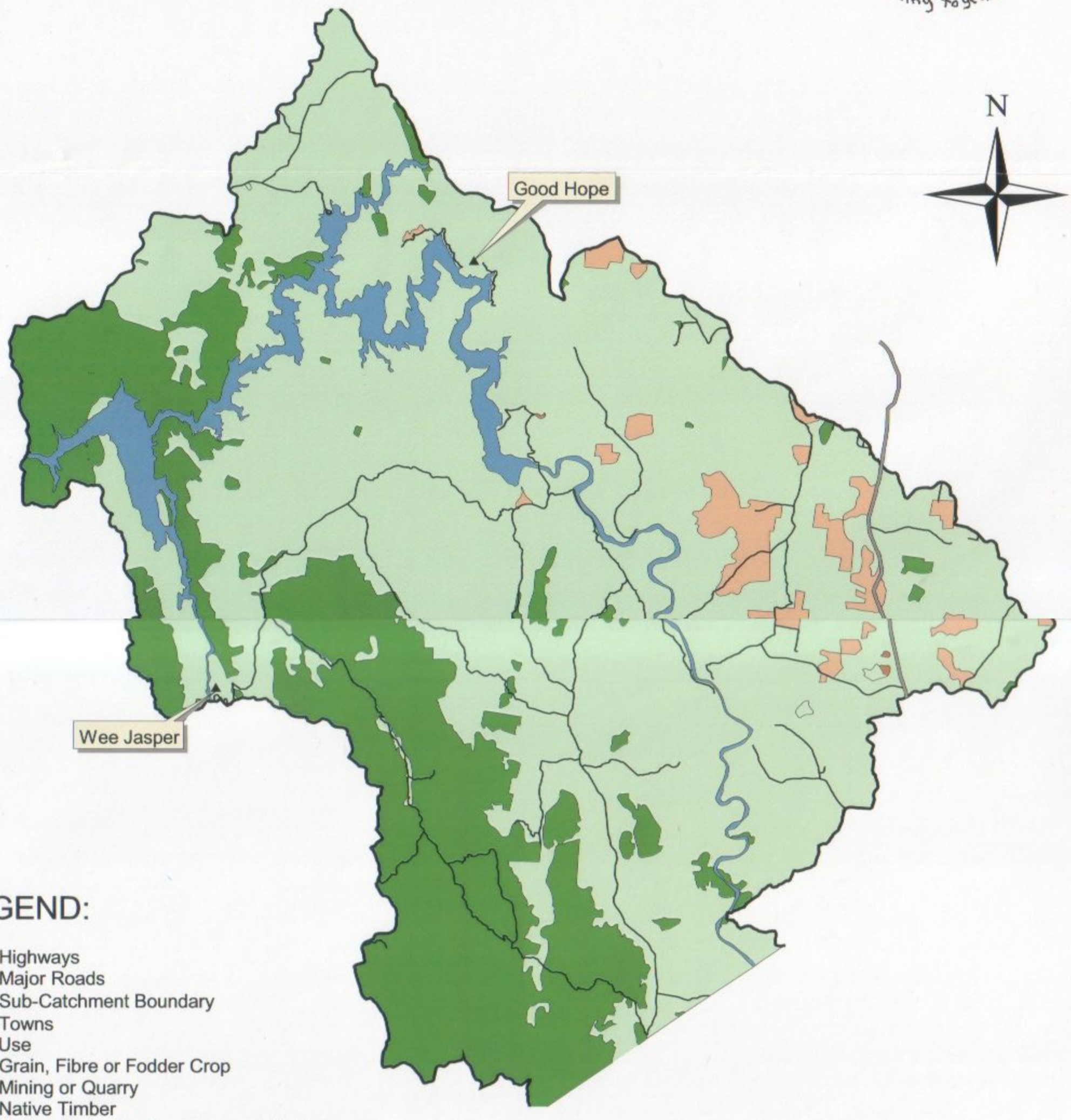
10 0 10 Kilometres

SOURCE: RACD, 1999

BURRINJUCK SUB-CATCHMENT

Map 16: Land Use

Yass Area Network of Landcare Groups
Working together



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- ▲ Towns

Land Use

- Grain, Fibre or Fodder Crop
- Mining or Quarry
- Native Timber
- Native, Naturalised or Improved Pasture
- Water Body - River, Lake, Swamp

SCALE 1:200000

10 0 10 Kilometres

SOURCE: DLWC, 1999

8.1 NATIVE VEGETATION MANAGEMENT

What is native vegetation management ?

Native vegetation management is the management of native trees, shrubs and grasses to increase the viability of rural communities, maintain biodiversity and to prevent land and water degradation. (DLWC 1998)

For the purpose of this plan, "remnant vegetation" does not necessarily refer to 'untouched' vegetation, as much of the catchment has been ringbarked, cleared, grazed or burnt since settlement. Much of the vegetation that remains today represents regrowth from this era, with many of the stands showing evidence of these past activities. It is important that these areas are preserved, as they may represent important samples of Yass area vegetation communities.

Why is native vegetation important ?

Protecting and managing areas of native remnant vegetation can have multiple benefits in promoting sustainable catchment health. These include:

- *providing windbreaks, shade and shelter for stock*
- *enhancing economic value (agroforestry, firewood, property value)*
- *providing a source of seed for regeneration*
- *reducing groundwater levels and recharge*
- *filtering nutrients and pollution in the stream bank zone*
- *controlling erosion*
- *increasing and maintaining biodiversity*
- *providing wildlife habitat and corridors.*

Shade and shelter provided by native vegetation can increase production. During a five year study at Armidale, sheep on sheltered plots produced 35% more wool and 6kg more liveweight than those without shelter. Shelter also reduced lambing losses by up to 50% (Dengate).

Native vegetation also provides an important aesthetic function in attracting tourism to farming areas, and plays an important role in local and regional cultural history.

What causes native vegetation decline ?

Native vegetation decline has occurred through *direct loss* of vegetation, *fragmentation* of vegetation and *degradation* of those areas (DLWC 1998).

Clearing, continuous grazing and dieback are the primary causes of native vegetation decline in the Yass area. Clearing in the catchment dates back to 1898 with much of the remaining vegetation consisting of small remnants or individual paddock trees. These small, segmented remnants are generally not protected from grazing pressure and as a result, are more susceptible to the pressures influencing dieback and tree decline. This can affect reproduction, species diversity and exposure of remnants to weather and the impacts from adjoining landuse (fertiliser/herbicide drift, weeds and stock) known as the 'edge effect'. Many isolated paddock trees in the catchment are also old and in their later stages of life, reducing their ability to recover from dieback.

How is it affecting the Burrinjuck area ?

The need for revegetation in the Burrinjuck Sub-catchment has been recognised by individuals and groups of landholders. Over recent years significant plantings of treelots, windbreaks, revegetation of gullies and fencing of remnants, have been undertaken. Several tree planting projects such as the Greening Australia Superb Parrot Revegetation and Natural Heritage Trust Webs of Green projects have provided assistance.

The priority now for groups in the area is to take a more strategic approach to revegetation through creating an extensive network to which all future plantings and protection activities can be linked.

Priority actions

The overall objectives of the suggested action plans are to:

1. protect existing remnants
2. revegetate degraded areas
3. establish vegetation corridor links, and,
4. improve biodiversity, habitat and aesthetics.

Local Actions to Date

2000/2001

- Dieback Revegetation Project
- Burrinjuck Webs of Green Project
- Burrinjuck Revegetation for Biodiversity Project

1999/2000

- Burrinjuck Webs of Green Vegetation Enhancement and Protection Project
- Burrinjuck Revegetation for Biodiversity Project
- Yass Area Dieback Revegetation Project
- Jerrawa Creek Catchment Green Corridors
- Yass Shire Vegetation Management Plan
- Tyrone tree Corridor
- Jerrawa Creek Wildlife Corridor

1998/1999

- Jerrawa Creek Wildlife Corridor
- Jerrawa Creek Catchment Green Corridors
- Tyrone Creek Corridor
- Burrinjuck Remnant Bush Preservation and Revegetation
- Yass Shire Vegetation Management Plan
- Burrinjuck Webs of Green
- Murrumbateman Missing Links
- Yass Area Dieback Revegetation

1997/1998

- Jerrawa Creek Catchment Green Corridors
- Burrinjuck Remnant Bush Preservation and Revegetation
- Yass Shire Vegetation Management Plan
- Gundaroo Common native vegetation survey
- Re-greening the Greenways
- Wee Jasper Nature Conservation Group.

1996/1997

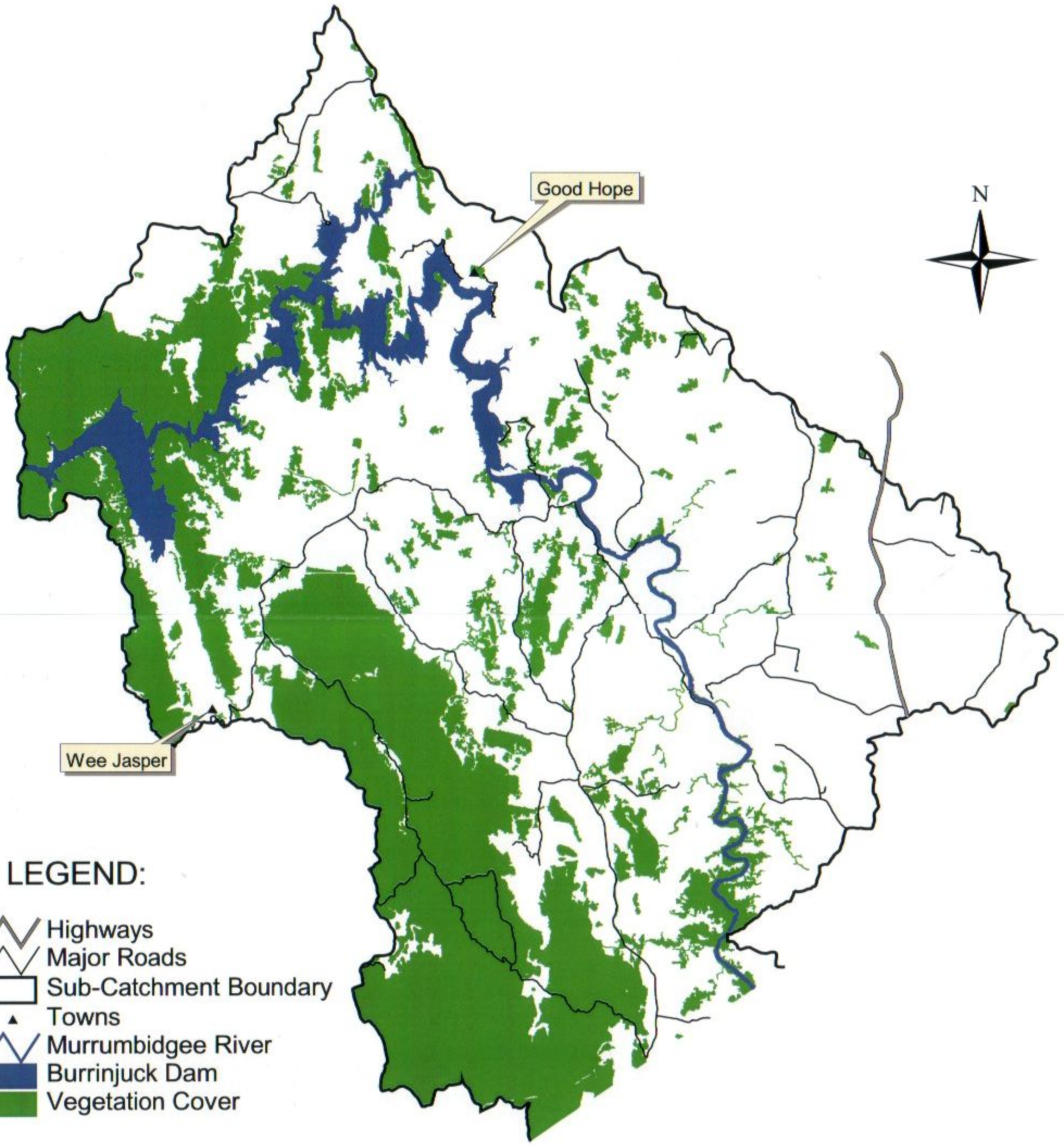
- Burrinjuck remnant bush preservation and revegetation
- Yass Shire Vegetation Management Plan

See also in the Appendix:
Section 6.4 Vegetation
Section 7.2 Native vegetation
Table 3: Threatened Flora in the Yass Area
Table 4: Noxious Weeds in the Yass Area
Table 5: Threatened Fauna in the Yass Area

BURRINJUCK SUB-CATCHMENT

Map 17: Vegetation Cover

Yass Area Network Landcare Groups
Working together



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- Towns
- Murrumbidgee River
- Burrinjuck Dam
- Vegetation Cover

SCALE 1:200000

10 0 10 Kilometres

SOURCE: RACD, 1999

1. NATIVE VEGETATION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Retain and enhance remnant vegetation and increase area of native vegetation.	To maintain and improve ecological health to ensure sustainable production and conservation.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Salinity √	Soil Health √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

NV1. Use assessment kits to assess the quality of native vegetation.

NV2. Seek expert advice to establish local reasons for decline (eg dieback).

Implement management practices

NV3. Create an extensive network of vegetation to link revegetation and remnant protection activities (eg Webs of Green). (BMA1, PrMA3)

NV4. Protect and manage remnant native vegetation on private land. (PrMA3, PrMA4)

NV5. Promote revegetation of native ecological communities listed as threatened or endangered, through fencing, reducing competition etc. (BMA6, BMA7)

NV6. Develop and encourage the use of local vegetation communities seedstock where possible. (PrMA4)

On-ground works

NV7. Enhance the health of remnants by encouraging natural regeneration and re-introducing a large range of local native understorey plants. (PrMA3, PRMA4)

NV8. Manage weeds and feral animals.

NV9. Retain dead standing and fallen timber for habitat. (BMA6)

NV10. Fence areas of important native vegetation & manage grazing appropriately.

NV11. Support more research on germination of native vegetation especially native grasses.

Promote and educate

NV12. Raise awareness of the importance of remnant vegetation. (BMA1, CBMA11)

NV13. Encourage local government to identify and protect high quality vegetation, particularly where it will be affected by development. (BMA1, BMA7)

NV14. Encourage financial rebates or incentive schemes for revegetation works (BMA7)

NV15. Develop identification information sheets for native perennial pasture management - grazing techniques, fencing, fires, allowing for seed set. (SMA8, PrMA1)

NV16. Promote native farm forestry through trial farm forestry sites.

Monitor

NV17. Monitor revegetation and remnant management activities to improve techniques, species selection and strategies. (BMA5)

BEST MANAGEMENT PRACTICE

NATIVE VEGETATION

What is native vegetation management?

Native vegetation is made up of trees, shrubs, grasses and all other plants native to Australia. Native vegetation management includes working with the community to increase and improve native vegetation cover and to better manage existing vegetation.

Why do we need to manage it ?

Native vegetation provides ecological, social and economic benefits. It contributes to biodiversity, protects from land degradation, maintains water quality, acts as a carbon sink, and provides for recreation, natural heritage, and research.

It provides fodder, products such as timber and honey, and habitat for beneficial pest predators. It also has important social, economic and cultural values for Aboriginal people.

What can I do ?

Manage remnant native vegetation to improve its condition. Ensure your revegetation or new plantings are consistent with your whole farm plan. Think about where they will provide the most benefit to your farming system. They might be to provide livestock shade and shelter, protect buildings, prevent groundwater recharge, stabilise stream banks or provide wood production.

How do I do it?

Retain

- Retain large trees, leaf litter, sticks and logs under remnant vegetation.

Protect

- Fence native vegetation areas to protect from stock
- Avoid fragmenting existing areas of vegetation by roads or fences.
- Keep a buffer between native vegetation remnants and other intensive land uses

Manage

- Manage grazing to allow regrowth of vegetation (ie don't graze in seed setting/flowering, or germination periods)
- Look after existing patches of remnant vegetation to allow natural regeneration
- Use appropriate native species when planting vegetation, particularly in existing vegetation areas
- Retain tree stumps, fallen trees, dead trees and understorey vegetation for habitat for pest predators
- Control weeds
- Minimise disturbance to soil and vegetation to maintain ground cover, keep weeds out and allow the understorey plants to establish.
- Reduce chemical and fertiliser drift from adjacent farm activities.

Who can help ?

Department of Land and Water Conservation, Yass phone (02) 6226 1433
Greening Australia, ACT phone (02) 6253 3035

8.2 STREAM BANK ZONE MANAGEMENT

What is the stream bank zone ?

The streambank zone refers to the area adjacent to waterways including the vegetation on both the banks and verges. The verge is the area of land up to 30 metres from the waterway channel.

Why is it important ?

In a natural stream environment, the bank and surrounding vegetation act as a buffer between the watercourse and surrounding land uses. This buffer can assist in:

- *Stabilising and maintaining stream bank*
- *Preventing excessive erosion*
- *Providing canopy shade*
- *Protecting riparian condition*
- *Filtering and trapping soil particles*
- *Extracting nutrients from the water.*

What causes stream bank degradation ?

The primary causes of stream bank degradation in the Yass catchment are: *lack of vegetation, stream bank erosion, willows and other weeds.*

Increased water flow, combined with a reduction in ground cover and soil disturbance, causes stream bank erosion. It is usually caused by the direct action of stream flow and can be exacerbated by erodible soil types. Other contributors to stream bank erosion include; damage by stock, flooding, carp, or channel blockages (by sand, gravel, vegetation etc).

The removal and degradation of stream bank vegetation in the Yass area has contributed to increased erosion, changed nutrient levels, water quality decline, and loss of aquatic habitat.

The decline of stream bank vegetation condition in the Yass area has allowed willow populations to spread. There is now a growing concern about willows, their impact on watercourses and their role in the landscape. Willows can have an increasingly large impact on a river system causing:

- *Flooding*
- *Erosion*
- *Water quality decline*
- *Disruption to water flow*
- *Changes to stream nutrients, aquatic habitat and food resources*
- *Potential threat to structures such as bridges and roads.*

More than 100 species or varieties of willows have been introduced to Australia, of which four major species are found in the Yass catchment (Cremer, 1995).

The four major species are:

- Crack Willow *(Salix fragilis)*
- Black Willow *(Salix nigra)*
- Golden Upright Willow *(Salix alba* var. *vitellina)*
- Weeping Willow *(Salix babylonica)*

What is the impact in the Burrinjuck area ?

Native stream bank vegetation in the upper Murrumbidgee area is declining. The major threats to stream bank vegetation are rabbits, poor grazing management, weeds, willows and clearing.

The Burrinjuck sub-catchment consists of 61 major tributaries flowing into the Murrumbidgee River. The Stressed Rivers Assessment Report conducted by DLWC ranks the area of the Murrumbidgee River and minor

tributaries between Numeralla and Burrinjuck as experiencing high environmental stress and high water extraction.

This area of the Murrumbidgee was rated as having poor connectivity and integrity, very poor bank stability and density, a shortfall of trees and significant dams and development. (see Appendix section 7.3, tables 15 and 16)

There is 99.3 kms of stream bank erosion in the Burrinjuck sub-catchment. Of which:
- 76.7kms (77%) <1.5 metres in depth
- 16.9kms (17%) is 1.5-3.0 metres in depth
- 4.0kms (4%) is 3.0-6.0 metres in depth
- 1.7kms (2%) is > 6.0 metres in depth.

Stream bank condition based on erosion depth and extent has been assessed as poor in Woolgarlo Creek (upper), Oaky Creek (upper), Little Swamp Creek (mid), Tea Drinking Creek (mid-upper), Spring Creek (mid) and MacPhersons Creek (upper). 'Poor' meaning little effective vegetation (predominantly exotic), on unstable or dispersive soils, mostly undercut toe, with recent bank movement or erosion. See the Appendix, table 16, for other assessments.

Priority

The Burrinjuck sub-catchment landcare groups lists stream bank zone management as a high priority issue.

The groups stated willow management should focus on controlling their spread and to control willows in areas of greatest impact on stream health and stability.

Local Actions to Date

1999/2000

- Taylors & Allianoyomyiga Creeks Remnant Vegetation Protection & Enhancement Project
- Riparian Zone Revegetation Project-Moura Creek Stage 2
- Stream Bank Restoration Demonstration Sites
- Narrangullen Creek Stream Bank Revegetation & Erosion Control Project

1998/1999

- Jerrawa Creek Rivercare
- Sutton Yass River Management Plan & Works
- Cooma Cottage Riverbank Rehabilitation
- Yass River Fencing & Revegetation
- Jeir Creek Fencing, Revegetation & River Management
- Riparian Zone Revegetation Moura Creek
- Dicks Creek Stream Bank Revegetation

1997/1998

- Jerrawa Creek Rivercare
- Yass Urban Willow Removal & Revegetation

1996/1997

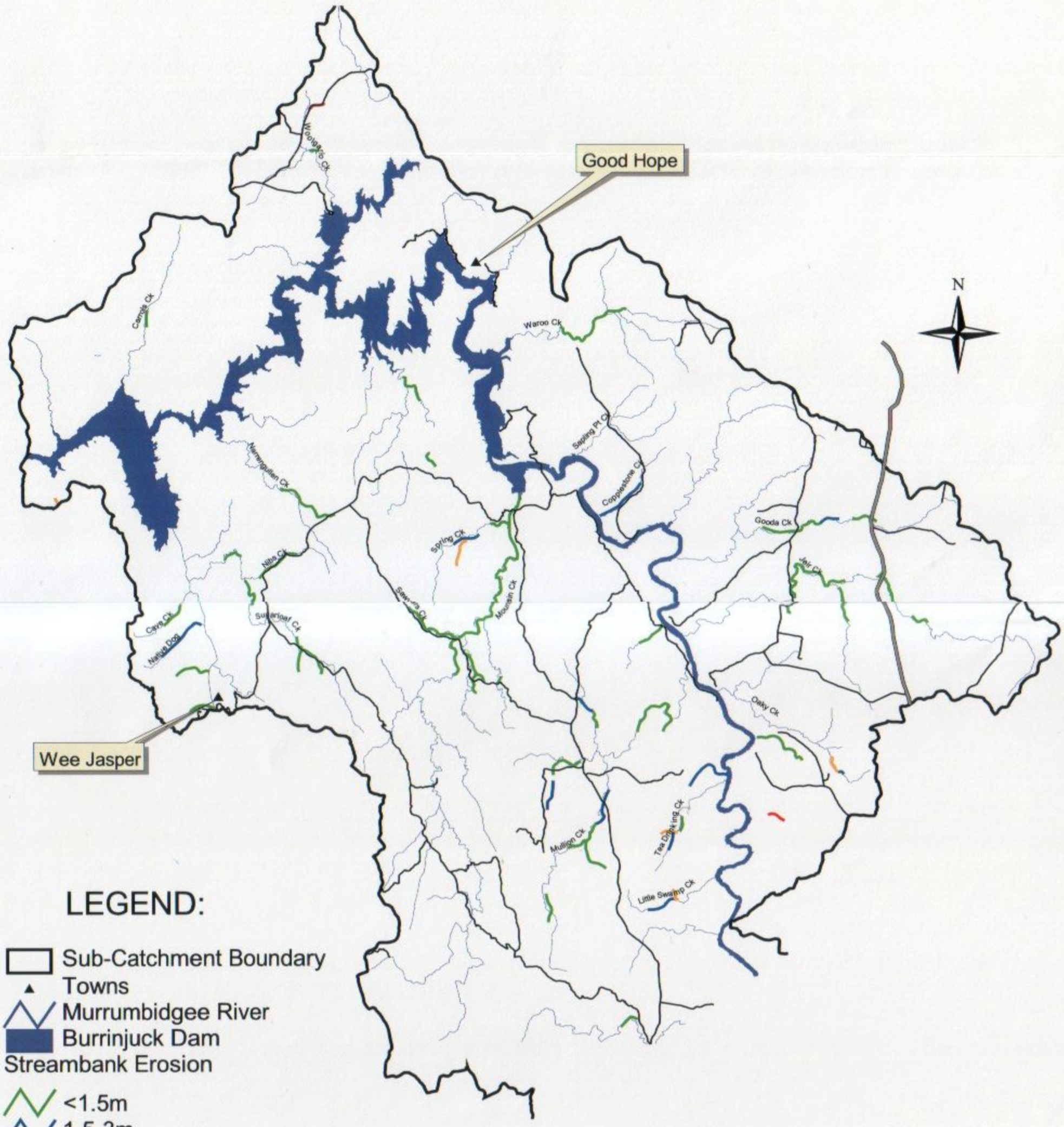
- Jerrawa Creek & Lachlan River Tributaries Riverine Corridor Stabilisation and Enhancement Project.
- Goodhope/Boambolo catchment management plan

See also in the Appendix:
Section 7.3 *Stream Bank Zone*
Table 13 Dominant native riparian vegetation for the Yass Area
Table 14 Current stress classifications
Table 16 Riparian Vegetation and stream bank condition: Burrinjuck sub-catchment.

BURRINJUCK SUB-CATCHMENT

Map 18: Stream Bank Erosion

Yass Area Network of Landcare Groups
Working together



SOURCE: DLWC, 1999 & NRPA, 2000

2. STREAM BANK ZONE ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Manage creek and river corridors.	To prevent loss of productive farmland, minimise sediment & chemical content and to maintain water quality.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √	Community Building √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

SZ1. Use the Riparian Catchment Assessment Sheets to identify and target high priority areas.

SZ2. Seek expert advice on the severity of the problem and possible local causes.

Implement management practices

SZ3. Manage stock access to protect areas of identified stream bank erosion, eg large mobs grazing for short periods to maximise ground cover. (WMA4, BMA2)

SZ4. Change practices to include buffer zones near stream banks.

SZ5. Encourage zoning of appropriate stream bank areas for public use, access and environmental benefit. (BMA2)

SZ6. Use 'environmentally-friendly' chemicals near waterways, and ensure other chemicals do not enter the stream bank zone.

On-ground works

SZ7. Where appropriate to individual farm plans, fence areas as necessary with the cooperation of land holders.

SZ8. Remove weeds such as Crack willows or Black willows. (WMA5)

SZ9. Improve stream bank vegetation cover and biodiversity. (BMA10)

SZ10. Undertake structural earthworks on severely eroding banks. (WMA6)

SZ11. Control Carp populations through participation in regional actions. (WMA15)

Promote and educate

SZ12. Develop information kit/guidelines for landholders. (CBMA11)

SZ13. Develop demonstration and sponsor projects. (CBMA11)

SZ14. Encourage voluntary agreements such as land retirement, management agreements and covenants for stream bank areas.

Monitor

SZ15. Establish regular assessment and mapping of stream bank conditions (building on existing GIS data).

SZ16. Monitor change and the impacts of management practices. (CBMA11)

SZ17. Monitor downstream sediment loads to test impact of actions taken.

BEST MANAGEMENT PRACTICES

STREAM BANK ZONE

What is the stream bank zone ?

The stream bank zone is the area adjoining a waterway including the vegetation on both the banks up to 40 metres from the waterway channel.

Why do we need to manage it ?

- to maintain good water quality
- to prevent erosion
- to maintain aquatic habitat
- to provide a wildlife corridor

What can I do ?

There are a number of things you can do to improve the sustainability and health of the stream bank. As a first step, the stream bank zone should be managed to allow controlled access of stock and to assist regeneration and weed control.

- willow control
- weed control
- revegetation, and
- structural works.

Facts sheets on each of these activities is attached.

Some general principles :

- don't build structures on, or close to a stream bank,
- leave a buffer zone
- don't remove trees, shrubs or grasses from the
- stream bank (unless noxious weeds)
- only allow stock watering points on gently sloping banks, and ensure erosion control measures are in place, eg paved ramp etc.
- don't allow excessive build-up of debris in the stream which can divert the stream flow
- access ramps to the stream should only be built on the inside of bends
- never excavate a stream without getting advice and permission !

!!! **Remember**: any works undertaken on a stream, creek or river may require a permit or permission from one or more agencies - ask for advice !!!

Who can help ?
Department of Land & Water Conservation, Yass Phone (02) 6226 1433

For fact sheet information on the stream bank zone – refer to the stream bank zone section under the Yass Valley Sub-catchment in this plan

TOPICS INCLUDE:

- Willow control
- Stream bank revegetation
- Managing stock access to the stream bank zone
- How to assess the condition of vegetation
- Useful species for revegetation of riparian areas
- Structural works in the stream bank zone
- Further references

8.3 GULLY EROSION

What is Gully Erosion ?

Gully erosion is the dislodgment and movement of soil by water flowing in drainage depressions and flow lines.

What causes gully erosion ?

Gully erosion often starts as a 'nickpoint' or 'drop off' in a drainage depression. These can sometimes be caused by stock tracks, vehicle tracks and plough lines. Once gully erosion starts at these 'nickpoints', activities which reduce ground cover such as cultivation, overstocking and clearing, accelerate the problem. Increased run-off and highly erodible soil types also contribute to quicken the rate of erosion. Water then moves this sediment into farm dams, rivers and water storages causing water quality problems.

The primary causes of gully erosion in the Yass area relate to:

- Clearing
- Access tracks
- Overstocking
- Cultivation
- Development and road drainage
- Vegetation decline
- Soil types susceptible to erosion

What is the impact in the Burrinjuck area ?

The main impacts on landholders are farm management issues. These include access across or around gullies, danger to stock and water quality of farm water supplies. There is also a loss of productive agricultural land and a visual eyesore.

The extent of gully erosion in the Burrinjuck sub-catchment has been mapped using catchment surveys and previous research (see table following).

The total length of gully erosion in the Burrinjuck sub-catchment is 510.6 kms. Of this:

- 135 kms minor gully erosion (26%)
- 146 kms moderate gully erosion(29%)
- 127.8 kmssevere gully erosion (25%)
- 101.7 kmsvery severe gully erosion (20%)

Priority

The landcare groups in the Burrinjuck sub-catchment have identified gully erosion as a priority issue for management and a focus for on-ground works.

Local Actions to Date

2000/2001

- Burrinjuck Gully Stabilisation Project

1999/2000

- Burrinjuck Gully Stabilisation Project
- Merung / The Brook Gully Restoration
- Sawpit Creek Gully Works

1996/1997

- Murrumbateman - gully fencing, revegetation & erosion control.

See also in the Appendix:
Section 7.4 *Gully and soil erosion*
Table 18 *Soil erosion in the Yass area catchment*
Table 19 *Gully erosion in the Yass area catchment*

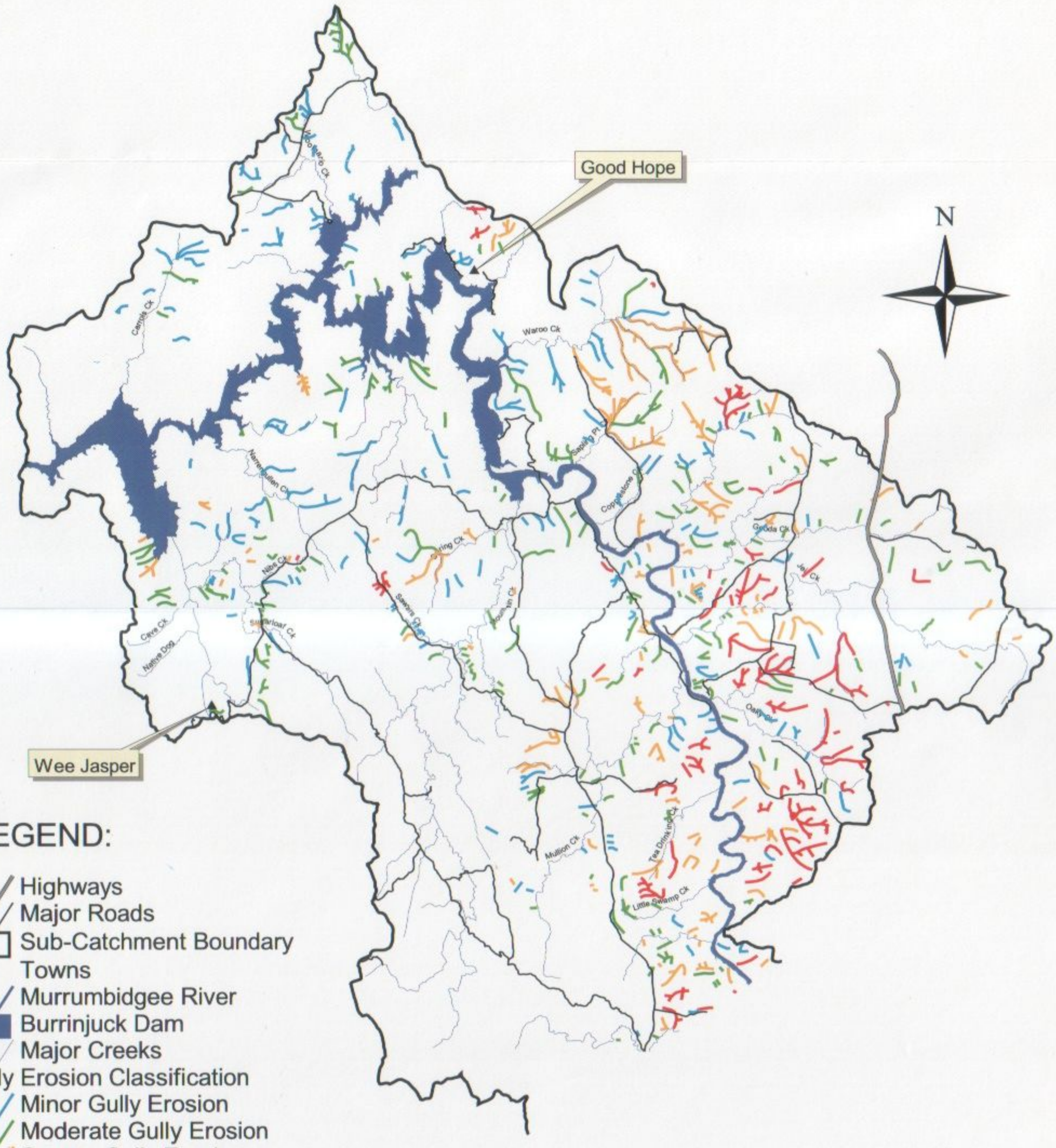
Table 4: Extent of gully erosion in the Burrinjuck Sub-catchment.

EROSION CLASSIFICATION	LENGTH KMS	% OF EROSION
Gully Erosion: (Total)	**510.6 kms**	
Minor: total	**135.0kms**	**26%**
Depth: - <1.5 metres	*124.1*	*(92)*
- 1.5-3 metres	*10.3*	*(7)*
- 3-6 metres	0.6	*(1)*
Moderate: total	**146.0kms**	**29%**
Depth: - <1.5 metres	*111.5*	*(76)*
- 1.5-3 metres	*33.0*	*(23)*
- 3-6 metres	*1.5*	*(1)*
Severe: total	**127.8 kms**	**25%**
Depth: - <1.5 metres	*63.2*	*(50)*
- 1.5-3 metres	*55.5*	*(43)*
- 3-6 metres	*9.1*	*(7)*
Very Severe: total	**101.7 kms**	**20%**
Depth: - <1.5 metres	*11.5*	*(11)*
- 1.5-3 metres	*39.5*	*(39)*
- 3-6 metres	*25.9*	*(26)*
- >6 metres	*24.8*	*(24)*

BURRINJUCK SUB-CATCHMENT

Map 19: Gully Erosion

Yass Area Network of Landcare Groups
Working together



LEGEND:

- Highways
- Major Roads
- Sub-Catchment Boundary
- Towns
- Murrumbidgee River
- Burrinjuck Dam
- Major Creeks

Gully Erosion Classification

- Minor Gully Erosion
- Moderate Gully Erosion
- Severe Gully Erosion
- Very Severe Gully Erosion

SOURCE: DLWC, 1999 & NRPA, 2000

SCALE 1:200000

10 0 10 Kilometres

3. GULLY EROSION ACTION PLAN

WHAT WILL WE DO ?	WHY ARE WE DOING IT ?
Prevent, treat and manage active gully erosion.	To minimise on-farm management problems associated with gully erosion and reduce water quality impacts.

HOW DOES IT CONTRIBUTE TO MURRUMBIDGEE CATCHMENT BLUEPRINT TARGETS ?

Water Quality √	Biodiversity √

HOW WILL WE DO IT ?

(codes in brackets indicate Matching Blueprint Actions)

Identify the problem

GE1. Continue detailed surveys using Gully Erosion Assessment Kit.
GE2. Evaluate gullies in regard to degree of activity and connection.
GE3. Evaluate gullies as to potential for sediment entrapment and storage.
GE4. Update vegetation and soils mapping.

Implement management practices

GE5. Control stock access and maintain groundcover. (WMA1, WMA4)
GE6. Retain and enhance existing riparian vegetation in discharge areas. (WMA1, WMA2)
GE7. Retain native vegetation on land with high susceptibility to erosion. (WMA1, BMA1)
GE8. Implement remedial measures in high priority areas.

Carry-out on-ground works

GE9. Remediate most severe gullies, which have been mapped and assessed using revegetation and soil works. (WMA3, WMA6, WMA7)
GE10. Undertake gully control earthworks where necessary. (WMA6)
GE11. Fence and revegetate gullies to assist in reducing erosion and sediment movement. (WMA3)
GE12. Fence and revegetate all moderate to minor erosion problems. (WMA3, WMA7)
GE13. Divert surface water flows away from gully 'head'.

Promote and educate

GE14. Use successful projects as encouragement for others embarking on work.

Monitor

GE15. Evaluate techniques for sediment entrapment.
GE16. Evaluate results of structural gully treatment.

BEST MANAGEMENT PRACTICES

GULLY EROSION

What is Gully Erosion ?

Gully erosion is the loss of soil along water channels caused by water. It is caused by continuous cropping, overstocking or clearing leading to vegetation decline along water channels and erosion.

Why do we need to fix it ?

Sediment transported by gullies causes problems in watercourses, farm dams and water storages. It also causes management problems on-farm such as access across or around the gully, danger to livestock, a decrease in farm water quality and a visual blight on the landscape.

What can you do?

- Improve grazing/cropping management practices to control erosion
- Reduce grazing pressure to allow for regeneration
- Fence off pockets of remnant native vegetation near gullies to assist in holding the soil together and as a seed source for gully revegetation
- Divert water from the gullies to allow stabilisation (structural earthworks)
- Revegetate gullies using native species appropriate for the local area.
- Reduce siltation and sediment build up in streams
- Arrest active gully erosion (headward advancement or deepening)

A Gully Erosion Assessment Kit is available to help you identify the severity of gullies on your property. Contact DLWC.

Who Can Help ?
Department of Land and Water Conservation,
Yass Office phone 6226 1433

FACT SHEET

REPAIRING GULLY EROSION

Before you begin repair works, consider the characteristics of each gully. What is its size (length, depth, width), soil type, the size of the catchment, and the amount of runoff. These will dictate which option you might undertake to repair the gully. The following options are suitable for small to large gullies. Refer to the Gully Erosion Assessment Kit available from DLWC to help you assess your gully.

Fencing - In most cases fencing out the gully will assist in stabilisation of the gully sides and allow vegetation to establish. It is also important to keep stock from the gully, particularly if it is eroding.

Gully diversion and shape - Water is diverted away from gully head to a safe disposal area via a diversion bank on low grade. The gully below the bank can then be shaped and revegetated. This is a good option for small to medium gullies. It allows gullies to become productive providing topsoil is stockpiled and spread back over the site after the gully is reshaped.

Rock Flume – provides a more stable base. Rock should be placed on filter fabric so that water flows over it and not around the sides. This is a cheap alternative to concrete, however, they should not be designed for large or prolonged volumes of runoff.

Concrete Flume – forms a long life stable structure for highly active gullies where there are high volumes of water. These need to be properly designed and constructed. Contact DLWC for advice.

Dam -This can be built above the gully to stop the water flowing over the gully head or can be built in the gully with top water level drowning the active head. Storm water can be diverted away from the gully, or contained in the dam and released into the gully slowly over time through a trickle pipe.

Low Cost Wire Weirs - For gullies where earthworks are impractical or uneconomic, such as large gullies, or where the gully head is off the property, other measures can be taken. Gully bed and gully wall stabilization can be undertaken with low cost wire weirs. These are built from a combination of steel posts, reinforcing mesh, wire netting, concrete blocks, etc. They catch sediment, reducing the grade on the gully floor. This slows water down decreasing its erosive force.

Revegetation - Trees, shrubs and grasses assist in gully control in several ways. They; hold soil together with roots, dry out wet areas, protect the soil surface, and act as silt and debris traps.

Future Management - The fill area and water entry points to the creek/stream should be fenced out (at least temporarily) and de-stocked for a minimum of 12 months to allow establishment of ground cover. After this time the site may be brought back into production to a limited extent. Grazing should be undertaken on a rotational or crash grazing basis with the emphasis being on maintaining at least 70% ground cover, and not grazing grasses lower than 4.5 cm in height.

Once works are complete they need to be looked after to increase their life span. Overgrazing and stock tracks can erode the works, reducing their effectiveness.

Who can help?

Department of Land and Water Conservation, Yass (02) 6226 1433

Soil Note 15/85 'Gully Control – Why Wait': Farm Trees series No. 4 'Tree Planting for Gully Erosion Control'.

FACT SHEET

SUITABLE SPECIES FOR REVEGETATING GULLIES

Good vegetation coverage is very effective in providing long-term gully stability. The combined root systems of trees, shrubs and grasses bind together cobbles, gravel, sand and soil.

TOE

The area where the gully floor and side walls meet (the toe), is the most susceptible part of a gully to erosion. Stabilisation requires the establishment of a good cover of vegetation. Some good species to use include;

COMMON NAME	SCIENTIFIC NAME	REVEGETATION INFORMATION
Alpine Bottlebrush	***Callistemon pityoides***	Prefers periodically wet ground near swamps and watercourses
Broad-leaf Cumbungi	***Typha orientalis***	
Common Reed*	***Phragmites australis***	Likes damp to saturated soil and will also grow in deep brackish water. Is commonly seen growing along stream banks in the region, very useful at stabilising stream banks and undercuts, and can tolerate deep shade
Common Rush	***Juncus usitatus***	Will grow in shallow water as well as the bank because it likes damp to well saturated soil
Cumbungi*	***Typha spp.***	Grows on damp or saturated soils, usually in stationary or slow flowering water up to two metres deep, has the potential to blanket areas of slow moving water
Purple Loosestrife	***Lythrum salicaria***	damp mud or wet sand, perennial herb to 1.5m, dies back in winter, re-shoots from crown
Red Stem Wattle*	***Acacia rubida***	dry, alluvial soils, including steep well drained banks
Rice Sedge	***Cyperus difformis***	poorly drained soils, grass-like perennial tussock, to 2m
River Clubrush	***Schoenoplectus validus***	damp or saturated soils, perennial to 3m, survives periodic wet, prevents erosion
River Tea Tree	***Leptospernum obovatum***	sandy, gravelly sites and rock outcrops, excellent for protecting stream banks,
Rushes	***Juncus spp.***	damp or saturated soils, perennial to 1m, survives periodic wet conditions
Silver Wattle	***Acacia dealbata***	dry sites, frost and drought hardy, vigorous spreading and anchoring root system, regenerates easily by seed and suckering
Spiny Headed Mat Rush	***Lomandra longifolia***	height to 80cm, dense, fibrous root system
Tussock Sedge **Tassle Sedge** **Tufted Sedge**	***Carex appressa*** ***Carex fascicularis*** ***Carex gaudichaudiana***	Sedges: generally grow in poorly drained soils along streams and wetlands, copes with periodic wet and dry conditions. Tassle and Tufted Sedge: perennial tussocks, helps prevent erosion

BANK FACE

Shrubs and grasses are generally best for revegetation of banks. Many of the following species can also be planted as River Corridor Species.

COMMON NAME	SCIENTIFIC NAME	REVEGETATION INFORMATION
Australian Anchor Plant	*Discaria pubescens*	near streams, shrub 1-2m
Bertya	*Bertya rosmarinifolia*	prefers near streams, height 1-2m
Blackthorn	*Bursaria lasiophylla*	thorny shrub, grows readily along river, creeks and gullies, wide spreading root system that binds the soil effectively, 2-4m
Box Micranteum	*Micrantheum hexandrum*	rocky sites near streams, shrub 2-4m
Burgan	*Kunzea ericoides*	near streams, shrub 2-4m, may invade cleared country
Cauliflower Bush	*Cassinia longifolia*	shallow soils, shrub 1-3.5m
Common Cassinia	*Cassinia aculeata*	shrub 1.3-5m
Common Fringe-myrtle	*Calytrix tetragona*	rocky, gravelly soils and sand, shrub 1-2m
Crimson Bottlebrush	*Callistemon citrinus*	damp, sandy flats and near swamps, shrub 1-3m
Dagger Wattle	*Acacia siculiformis*	prefers sandy or rocky soils, very hardy
Giant Hop-Bush	*Dodonaea viscoasa* subsp. *spatulata*	rocky outcrops, dry sandy soils, shrub to 6m
Hemp Bush	*Gynatrix pulchella*	near streams, shrub 2-4m,
Long-leaf Lomatia	*Lomatia myricoides*	Will grow on poorer soils, along creeks and gullies, shrub 2-5m, intolerant of high phosphorus alluvial sites
Narrow-leaf Bitter Pea	*Daviesia mimosoides*	various soils, shrub to 2m, hardy, useful for poor open sites, regenerates quickly after fire
Narrow-leaf Hopbush	*Dodonea viscosa* subsp. *angustissima*	rocky outcrops, dry sandy soils, shrub 1-4m
Ovens Wattle	*Acacia pravissima*	common near streams and on damp sheltered sites, shrub to small tree 3-8m
Prickly Grevillea	*Grevillea juniperina*	sand or rock near rivers, creeks, shrub 1-2.5m, suitable for low phosphorus soils
Poa Tussocks* (Tussock Grass)	*Poa sieveriana, Poa labillarbiera*	perennial, prefers dry, alluvial soils on stream banks and low-lying sites, unpalatable for stock
Pomaderris species	*Pomaderris andromedifolia, angustifolia, subcapita, aspera, eriocephala, betulina*	in scrub, usually near streams, shrub 1-4m
River She-Oak	*Casuarina cunninghamiana*	along streams, roots bind banks
River Tea-Tree	*Leptospermum obovatum*	sandy, alluvial soils and rocky outcrops, periodically wet sites along watercourses, shrub 2-3m, excellent for streambank protection, thinning may be

		in riverbed
Slender Tea-Tree	***Leptospermum brevipes***	near streams, damp or rocky sites, shrub 2-4m
Small-fruited Hakea	***Hakea microcarpa***	rocky soils, next to watercourses and swamps, shrub to 2m, not tolerant of phosphorus, therefore no suited to rich, alluvial soils
Swamp Paperbark	***Melaleuca ericifolia***	poorly drained soils, swamps and stream flats
Swamp Tea-Tree	***Leptospermum myrtifolium***	periodically wet soils, near streams, swamps and soaks, shrub 1-2.5m, may invade cleared, wet areas
Tussock Grass	***Poa labillardieri***	grows readily along stream banks, unpalatable for stock
Woolly Grevillea	***Grevillea lanigera***	Small shrub, grows readily in lighter soils along watercourses, well draining sandy or rocky soils with clay subsoil, will regenerate naturally during good seasons, soil with low phosphorus content
Woolly Tea-Tree	***Leptospermum lanigerum***	wet, sandy or alluvial soils and rocky sites, shrub 2-6m

Who can help?

Landcare, Yass Office C/- DLWC (02) 6226 1433
Department Land and Water Conservation, Yass. (02) 6226 1433

FURTHER REFERENCES

Rizvi, S.A and Crouch R.J. *Gully Stabilisation: 20 Promising Native Species.* CaLM Technical Paper 2, Department of Conservation and Land Management, Sydney, 1993.

FACT SHEET

IMPORTANT THINGS TO KNOW ABOUT REPAIRING GULLIES

❖ Active gullies take priority.

While filling a stable gully is possible, it is a low priority as there is no environmental benefit compared to treating an actively eroding gully.

❖ Design and Construct Earthworks.

Have all earthworks designed and construction to Council/DLWC standards. In the site plan allowance should be made for vehicular access so that heavy trucks do not create an erosion problem.

❖ Catchment Size >25 ha.

Catchments above 25 ha can periodically yield large volumes of water, which is difficult to control. Any works would require a detailed design to cater for appropriate storm events (ie. 20 year return period).

❖ Catchment Size 15 – 25 ha.

Jobs should be designed and approved by Council and DLWC.

❖ Catchment Size <15 ha.

Below 15 ha catchment, DLWC minimum standards is recommended and no further design is usually necessary.

❖ Suitable Dam Site.

A site is suitable for a dam if the site is flat <5% and/or in a minor gully or flow line where there is suitable earth material for dam construction (ie. clay).

What is a

Diversion Bank? A bank constructed by a dozer or grader, which is designed to safely divert runoff water from one point to another.

Flume? A stable area which allows water to flow into the bottom of a gully without causing erosion.

Bank and Pipe? A diversion bank with a pipe (usually 150-mm poly pipe) to cater for flows from minor run-off events or from spring flows, which protects the outlet from eroding.

Who can help?
Landcare, Yass Office C/- DLWC (02) 6226 1433
Department Land and Water Conservation, Yass. (02) 6226 1433

9. BIBLIOGRAPHY

Dengate,J., Windbreaks and shade trees help landowners and wildlife, National Parks & Wildlife Services NSW, *Habitat*, ACF.

DLWC (1998) Rural Production and Native Vegetation Conservation: Adding Value to the natural assets of New South Wales. Department of Land and Water Conservation, Sydney.

DLWC (2000) NSW Salinity Strategy. New South Wales Department of Land and Water Conservation, Sydney.

DLWC (2000) Yass Valley, Land Use and Catchment Condition. NSW Department of Land and Water Conservation, 2000.

Franklin, J. (1999) *Dryland Salinity: a Land Management Issue - not a Disaster*, Rising Water Tables and Salinity in Yass River Valley. Murrumbidgee Landcare Association, Wagga Wagga

NLWRA (2001) Australian Dryland Salinity Assessment 2000. National Land and Water Resources Audit, Canberra 2001

Native Vegetation Advisory Council of NSW (1999) Setting the Scene: The Native Vegetation of NSW, A background paper of the Native Vegetation Advisory Council of NSW. NVAC.

National Environmental Consulting Services (1999) Yass Shire Vegetation Mapping, Stage 1, Main Report October 1999, Watson, ACT.

National Environmental Consulting Services (2001) Yass Shire Vegetation Management Plan (Draft), Stage 3, October 2001, Watson, ACT.

APPENDIX

to the

YASS AREA CATCHMENT ACTION PLAN

Yass Area Network of Landcare Groups

October 2002

CONTENTS

Figures, Tables and Maps

1. Yass Area Network of Landcare Groups

The Yass Area Network of Landcare Groups was formed in 1996, in response to the need for a coordinated approach to address land management and natural resource issues across the Yass area. The network provides a forum for landcare groups, government agencies, local government, catchment and community organisations to meet and work together on natural resource issues within and beyond the Yass area.

The Yass Area Network of Landcare Groups incorporates 15 landcare groups and employs a Landcare Coordinator and (until October 2001) a Natural Resource Planning Advisor based in Yass. Landcare groups span approximately 62% of the Yass catchment with a membership base of an estimated 450 landholders. Many of the landcare groups formed from existing Bushfire Brigade and community organisations with some groups extending over a number of sub-catchments, covering a range of land uses and land management issues. The Yass area catchment covers an area of 283,255ha incorporating both the Yass Valley and Burrinjuck sub-catchments and encompassing nine of the 15 landcare groups. Some of these groups are planning to amalgamate in 2002.

Since 1996/97, 69 new and continuing projects have been funded by the Natural Heritage Trust providing the Yass Area Network of Landcare with an estimated $1,840,479 (and an estimated community contribution of $2,179,109) for natural resource management projects.

Projects have included:

- *Tree planting, direct tree and shrub seeding*
- *Targeted revegetation to control recharge*
- *Fencing off areas for salinity recharge revegetation and watertable control, streambank erosion control, remnant native vegetation enhancement and protection, tree corridors, biodiversity planting and farm windbreaks.*
- *Erosion control works including gully control structures, contour banks and tree planting*
- *River works such as revegetation, weed removal and invasive willow control*
- Devolved grant revegetation projects with neighbouring catchments and Landcare groups

Figure 1: The Yass Area Network of Landcare Groups

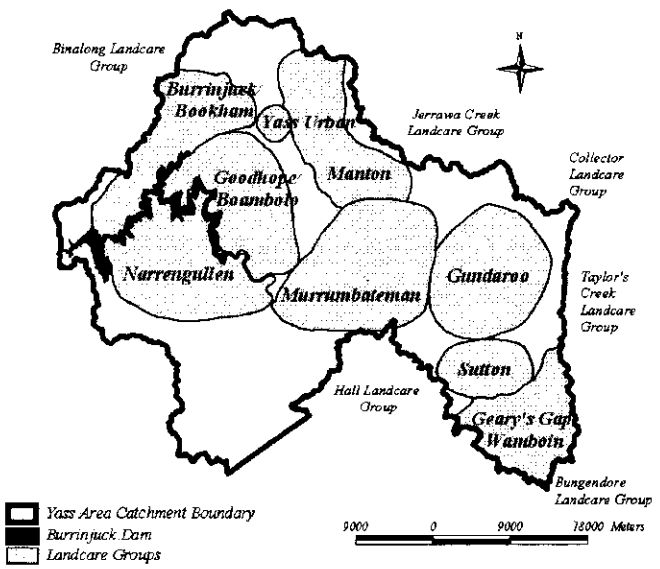


Table 1: NHT projects undertaken by the Yass Area Network of Landcare Groups

Year	Projects **Continuing Projects*
2000/01	
	• Yass Landcare Coordinator
	• Implementing the Yass Valley Sub-Catchment Plan - Salinity On-ground Works*
	• Stop our salt & soil entering Yass River
	• Burrinjuck Gully Stabilisation Project*
	• Burrinjuck Revegetation for Biodiversity Project
	• Burrinjuck Webs of Green*
	• Picaree Hill Conservation Project
	• Dieback Revegetation Project*
	• Manton (Yass) gully stabilisation, salt mitigation and bio-diversity project
	• Targeted revegetation for salinity recharge in upper-mid Lachlan & upper Murrumbidgee catchments
	• Taylors & Allianoyomyiga Creeks Remnant Vegetation Protection & Enhancement Project
	• Bungendore/Hoskinstown/Rossi Revegetation Project
	• Catchment planner: Yass Area Network of Landcare Groups
1999/2000	
	• Burrinjuck Gully Stabilisation Project
	• Yass Catchment Planner*
	• Burrinjuck Webs of Green Vegetation Enhancement and Protection Project
	• Burrinjuck Revegetation for Biodiversity Project
	• Yass Area Dieback Revegetation Project
	• Jerrawa Creek Catchment Green Corridors
	• Implementing the Yass Valley Sub-Catchment Plan - Salinity On-ground Works
	• Catchment Planner: Yass - Burrinjuck - Murrumbidgee Action Plan
	• Landcare Coordinator: Yass
	• Taylors & Allianoyomyiga Creeks Remnant Vegetation Protection & Enhancement Project
	• Bungendore/Hoskinstown/Rossi Revegetation Project
	• Riparian Zone Revegetation - Moura Creek Stage 2
	• Streambank Restoration Demonstration sites
	• Merung / The Brook Gully Restoration
	• Narrangullen Creek Streambank Revegetation & Erosion Control Project
	• Sawpit Creek Gully Works
	• Yass Shire Vegetation Management Plan
	• Tyrone Tree Corridor
	• Jerrawa Creek Wildlife Corridor
1998/99	
	• Jerrawa Creek Salinity
	• Jerrawa Creek Wildlife Corridor
	• Jerrawa Creek Catchment Green Corridors
	• Jerrawa Creek Erosion control

	• Tyrone Tree Corridor
	• Jerrawa Creek Rivercare
	• Landcare Coordinator
	• Yass Catchment Planner*
	• Burrinjuck Remnant Bush Preservation and Revegetation*
	• Yass Shire Vegetation Management Plan
	• Burrinjuck Webs of Green
	• Sutton Yass River Management Plan & Works
	• Cooma Cottage Riverbank Rehabilitation
	• Yass River Fencing & Revegetation
	• Murrumbateman Missing Links
	• Jeir Creek Fencing, Revegetation & River Management
	• Yass Area Dieback Revegetation
	• Riparian Zone Revegetation Moura Creek
	• Dicks Creek Streambank Revegetation
1997/98	
	• Yass Catchment Planner*
	• Yass Landcare Coordinator
	• Jerrawa Creek Rivercare
	• Jerrawa Creek Rivercare
	• Jerrawa Creek Rivercare
	• Jerrawa Creek Catchment Green Corridors
	• Burrinjuck Remnant Bush Preservation and Revegetation
	• Yass Urban Willow Removal & Revegetation
	• Yass Shire Vegetation Management Plan
	• Gundaroo Common Native vegetation survey
	• Re-greening the Greenways
	• Jerrawa Creek Dryland salinity reparation
	• Wee Jasper Nature Conservation Group
1996/97	
	• Burrinjuck remnant bush preservation and revegetation
	• Hall-Murrumbidgee Erosion Reclamation & Prevention
	• Upper Jerrawa Creek catchment rehabilitation*
	• Yass Landcare Coordinator
	• Landcare Guide for the Hobby farm and Bush Block
	• Yass Shire Vegetation Management Plan
	• Gundaroo - Yass River management plan and works
	• Jerrawa Creek - Lachlan River Tributaries & Jerrawa Creek riverine corridor stabilisation and enhancement
	• Goodhope/Boambolo catchment management plan
	• Murrumbateman - gully fencing, revegetation & erosion control
1995/96	
	• Jerrawa Creek Rivercare
	• Jerrawa Creek Salt Action
1994/95	
	• Jerrawa Creek Rivercare
1993/94	
	• Jerrawa Creek Salt Action

2. Role of the Natural Resource Planning Advisor

In March 1998 the YANLG Management Committee employed a Natural Resource Planning Advisor (NRPA) funded through a three year Natural Heritage Trust (NHT) grant.

The role of the NRPA was to liaise with landcare groups, government agencies, and the broader community to develop a catchment plan. This involved collecting data and producing maps for the key land degradation issues in order to develop the subsequent sub-catchment action plans and best management practice guidelines. The NRPA project was overseen by a Steering Committee, established as a sub-committee of the YANLG Management Committee. The role of the steering committee was to direct the progress, outcomes and budget expenditure of the project.

3. Community Consultation

Community consultation was conducted through:

- *Catchment Action Plan workshops/Landcare meetings*
- *Property visits – Catchment surveys/Assessment Kits*
- *Presentations/meetings with local groups, government agencies and various catchment committees*
- *Field days*
- *Catchment planning updates through Landcare newsletters, local and regional media*
- *Liaison with NRPA Steering Committee and YANLG Management Committee.*

4. Data Collection

Data was collected from a variety of sources including government departments, agencies, regional catchment committees, catchment assessments and local knowledge. The Catchment Assessments provided a standard method of assessing and mapping the broad land degradation issues and can be used for future assessments, monitoring of sites and to update existing data.

Data for the Yass Area was obtained from:

DLWC **Resource Information Unit Wagga Wagga**	Salt Affected Areas, Erosion, Land Use, Land Capability, Hydrology, Stressed Rivers Assessment Report – Murrumbidgee Catchment
NPWS, Queanbeyan	Regional Vegetation Mapping Endangered/Threatened Species Lists
Yass Shire Council	Yass Shire Vegetation Plan
Salinity Catchment Assessments (NRPA)	Assessed as Minor/Moderate/Severe based on recognised signs and symptoms for saline sites. *(Developed with assistance from Andrew Wooldridge, Salt Action DLWC, Cowra)*
Gully Erosion Catchment Assessments (NRPA)	Ranking system (High/Moderate/Low priority) to assess the degree of erosion activity and gully depth. *(Developed by John Franklin, DLWC Yass)*
Streambank Condition & Riparian Vegetation Catchment Assessments (NRPA)	Ranking system (Good/Moderate/Poor) based on streambank condition, vegetation diversity and density
Native Vegetation Decline Catchment Assessments (NRPA)	Broad assessment of native vegetation composition, health and structure.

5. Map Production

Maps were produced using ArcView® GIS 3.2 computer software and Spot-Lite® satellite imagery both purchased with funding assistance from the Murrumbidgee Catchment Management Committee (MCMC).

The Spot-Lite® data provides a photo-like image of the catchment, which can be used as a base layer onto which the land degradation data is mapped. ArcView® enables the data to be entered, displayed, manipulated and stored as a series of overlays to produce maps and generate statistics for the catchment. The satellite imagery used was a Spot-Lite® Spot-Pan chromatic image captured on 5th and 26th March 1996, 8th June 1997 and 5th March 1998 with $10m^2$ pixel resolution.

6. The Yass Area Catchment

6.1 Climate

The Australian Climate classification for the Yass region is " Temperate". Temperate regions are described as having no dry season, a warm summer and cold winter. Weather conditions can be variable with cool, cloudy days alternating with warmth and sunshine. Temperate regions also have relatively uniform rainfall throughout the year.

Average maximum daily temperature:	*12.5 ℃ in winter and 28.7 ℃ in summer*
Relative Humidity:	*Ranges from 74% in winter to 53% in summer*
Average annual rainfall:	*650 mm (ranging from 148mm in summer to 174mm in winter)*
Average number of raindays:	*92 days/year*
Average number clear days:	*83 days/year*
Average number of cloudy days:	*104 days/year*

In the Yass area rainfall generally increases with altitude, with higher rainfalls (800-1400mm) recorded in the far south-west of the catchment at Burrinjuck and the Brindabella Range (Soil Cons. Service, 1974 & ANZECC, 2000). Local topography also influences the occurrence of frosts with heavy frosts likely to occur from late May until early September.

Table 2: CLIMATE AVERAGES *(Long term mean values of weather data)*

Location: YASS COMPOSITE *State:* NSW
Commenced: 1898 *Last record:* 1996
Latitude: 34.83 S *Longitude:* 148.91 E *Elevation:* 520.0 m

Mean Daily Max Temp (°C)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
29.4	29.0	25.6	21.0	16.2	12.5	11.5	13.4	16.5	20.5	24.3	27.7

Range: 11.5 – 29.4°C
Annual Mean: 20.7°C

Highest Max Temp (°C)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
40.9	41.1	38.0	29.7	24.6	20.0	22.0	25.8	28.9	32.7	38.9	39.3

Range: 20.0 – 41.1°C
Annual Mean: 31.8°C

Lowest Min Temp (°C)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4.0	3.1	0.0	-2.6	-7.0	-6.2	-8.8	-7.5	-3.9	-1.8	-0.4	1.5

Range: -8.8 – 4.0°C
Annual Mean: -2.5°C

Relative Humidity (%)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
47	51	53	61	71.5	76	75	70.5	58	53	45.5	61

Range: 45.5 – 76%
Annual Mean: 60.2%

Mean Rainfall (mm)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
52.2	43.2	47.6	51.0	52.6	56.0	59.7	58.5	55.4	66.6	54.2	52.2

Annual: 649.2mm *Range: 43.2 – 66.6mm*
Annual Mean: 54.1mm

Mean no. of Raindays

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5.9	4.8	5.4	6.3	7.3	9.9	11.0	10.6	9.1	8.7	7.0	6.2

Annual: 92.2 days *Range: 4.8 – 11.0 days*
Annual Mean: 7.7 days

Mean no. of Clear Days

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
9.4	7.5	8.0	8.5	5.5	4.0	4.9	6.5	6.5	6.9	6.4	9.0

Annual: 83.1 days *Range: 4.0 – 9.4 days*
Annual Mean: 6.9 days

Mean no. of Cloudy Days

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7.2	6.3	5.9	7.1	11.1	12.1	12.4	10.7	9.2	8.2	7.5	6.6

Annual: 104.3 days *Range: 5.9 – 12.4 days*
Annual Mean: 8.7 days

SOURCE: Bureau of Meterology,2000

6.2 Geology and Soils

The Yass Valley sub-catchment is situated in the centre of the Lachlan Fold Belt underlain by three dominant bedrock types – Ordovician and Silurian sediments, Silurian acid volcanics and some outcrops of granitic bedrock (Nicoll & Scown, 1993).

Such sediments are generally low in fertility and present a high erosion hazard if not carefully managed. In some areas these sediments are interbedded with volcanic rocks such as tuff and occasional limestone outcrops (SoE, 1997). The oldest strata in the Yass catchment are Upper Ordovician sediments, which were deposited in a former shallow marine environment (Soil Cons, 1981). The general lithology of the catchment is sedimentary (50%) and volcanic (45%), with smaller areas of metamorphic and plutonic. There are numerous geological boundaries and fault lines occurring throughout the catchment, in particular south of Murrumbateman-Gundaroo Rd and also to the east of Burrinjuck Dam through to the Brindabella Range.

6.3 Soil Landscapes

Soils derived from sedimentary rocks are poor quality and shallow. Granitic soils are generally deeper, more fertile and have better moisture retention but can also be highly erodable. Volcanic soils are generally fertile but stony such as in the Yass Valley sub-catchment. Soils in the Yass catchment are generally red podzolics (on better drained side slopes) grading to yellow podzolic soils (on the lower slopes and more waterlogged country) through to yellow solodic soils (on the lower footslopes and in the drainage lines). These yellow solodic soils often present a high salinity hazard. In addition, listhosols are found on the upper slopes and rocky ridge tops. Red podzolic soils are moderately acid, of low fertility and are often hard-setting. Yellow podzolic soils, Listhosols are often characterised by shallow soils and rock fragments. In addition, some areas in the catchment are developed on acid igneous rock such as porphyry and dacite, which represent the better quality land. These soils are generally more fertile, less susceptible to erosion and are the areas best suited for intensive agricultural land use. (SoE Report, 1997)

6.4 Vegetation

The Yass Area is described by early explorers as a *"park-like landscape with open grassy plains surrounded by thin eucalypt forests . . . a landscape attractive for pastoralists"* (Gallagher, W., 1989).

Early surveying maps of the Yass Valley also provide descriptions of the vegetation types. For example, the area of Warroo, Forest, Sapling Point and Spring Creeks were described as *"principally good open undulating forest land . . . well suited for agricultural purposes" and "the timber is Box, Blue Gum, Stringy Bark, Gum and Apple".* The surveyed areas surrounding Gundaroo are described as *"alluvial flats", "undulating grassy hills", "steep scrubby ranges", "steep scrubby slaty ranges" and "open forest" (Webb, 2000).*
The vegetation types for the Yass area are classified as open forest (dry-sclerophyll) and woodland (savanna) (Jenkins, 2000). Dry sclerophyll forests are found on the drier slopes, and have a relatively short growth form, often with prickly shrubs and sparse ground cover. The dominant species are:

Brittle Gum *(E. mannifera)* Scribbly Gum *(E. rossii)*
Red Stringybark *(E. macrorhyncha)* Broad-leaved peppermint *(E. dives)*

Also found in the Yass Area is *E. polyanthemos* (Red Box), and occasionally *Callitris endlicheri* (Black Cypress Pine), *E. pauciflora* (Snow Gum) and *E. rubida* (Candlebark)

(Jenkins, 2000 & Gunn *et.al.*, 1969). As a timber resource most of the tree species are poor, with only a few suitable for fencing.

Woodland (Savanna) vegetation types are found on low-lying areas. Gunn *et.al.,* (1969) suggest that much of the country described as savannah woodland was once dry sclerophyll forest, having been thinned and cleared since settlement to give a more open, sparse woodland appearance.

The dominant species are:

Yellow Box *(E.melliodora)*	Blakely's Red Gum *(E. blakelyi)*
Apple Box (*E. bridgesiana*)	Argyle Apple *(E. cinerea)*

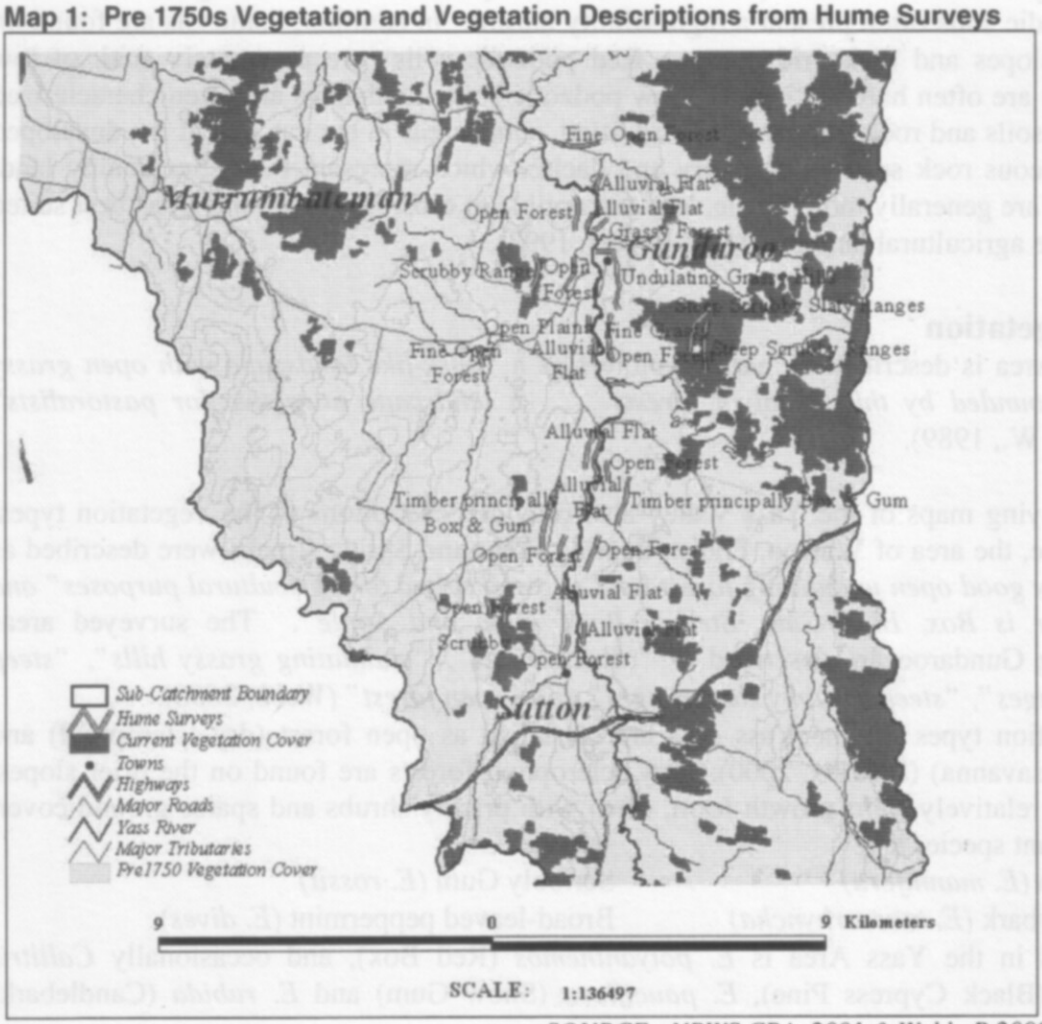
The dominant understorey species consist of:

Grevillea	Wattles (*Acacia* spp.)
Callistemon	Bursaria
Tea-Tree	

Native grasslands are dominated by (Jenkins, 2000):

Speargrass (*Stipa* spp.)	Wallaby Grass (*Danthonia* spp.)
Kangaroo Grass *(Themeda australis)*	
Red Grass *(Bothriochloa macra)*	

Map 1: Pre 1750s Vegetation and Vegetation Descriptions from Hume Surveys



SOURCE: NPWS CRA, 2001 & Webb, R 2000

Table 3: Threatened Flora in the Yass Area
V – Vulnerable, E – Endangered, X – Extinct

Species	Common Name	Legal Status	Status in Yass Area
Ammobium craspedioides	Yass Daisy	V	Locally common in remnant woodland
Senecio garlandii		V	Not seen in this area since early 20th Century
Grevillea iaspicula	Wee Jasper Grevillea	E	Restricted to limestone outcrops in the Burrinjuck area
Diuris aequalis	Buttercup Doubletail	V	Restricted to the woodlands in the vicinity of the Great Dividing Range and extremely rare
Pomaderris pallida	Pale Pomaderris	V	Rocky hillsides above the Murrumbidgee and its tributaries (uncommon)
Pomaderris betulina subsp. actensis			Mostly in the ACT but just extending into Yass Shire
Euphrasia scabra	Rough Eyebright	E	Probably extinct in the Lake George area
Senecio georgensis		X	Probably extinct in the Lake George area
Natural Temperate Grasslands of the Southern Tablelands of NSW & ACT		E	Endangered Ecological Community

SOURCE: National Parks and Wildlife – Threatened Species Unit Queanbeyan 2000

6.5 Weeds

The Southern Slopes Noxious Plants Authority has identified 46 noxious plants within the Southern Slopes County Council control area which includes Yass, Boorowa, Harden and Young Shires. Of the 46 noxious plants 33% are classified as W1, 46% as W2, 13% as W3, 4% as W4f and 4% as W4g.

A list of noxious weeds in the Yass area is below in table 4.

Category	Action for Control (Under the Noxious Weeds Act 1993)
W1	*Weeds must be notified to Local Council then fully and continuously suppressed and destroyed.*
W2	*Weed must be fully and continuously suppressed and destroyed.*
W3	*Weed must be prevented from spreading and its numbers and distribution reduced.*
W4g	*Shall not be sold, propagated or knowingly distributed*
W4f	*Shall not be sold, propagated or knowingly distributed. Any biological control or other control program directed by a local control authority must be implemented.*

SOURCE: Southern Slopes Noxious Plants Authority, 2001

Table 4 Noxious Weeds in the Yass Area Catchment

Common Name	Botanical Name	Category
African Boxthorn	*Lycium ferocissimum*	W2
African Love Grass	*Eragrostis curvula*	W2
Alligator Weed	*Alternanthera philoxeroides*	W1
Bathurst, Noogoora, Californian & Cockle Burrs	*Xanthium spp.*	W3
Black Knapweed	*Centaurea nigra*	W1
Blackberry	*Rubus fruticosus (agg. spp.)*	W2
Buffalo Burr	*Solanum rostratum*	W2
Cabomba spp.	*Cabomba*	W4g
Columbus Grass	*Sorghum x almum*	W2
Devil's Claw (Purple flower)	*Proboscidea louisianica*	W2
Devil's Claw (Yellow flower)	*Ibicella lutea*	W2
Dodder	*Cuscuta campestris*	W2
Fireweed	*Senecio madagascariensis*	W2
Galvanised Burr	*Sclerolaena birchii*	W2
Green Cestrum	*Cestrum parqui*	W2
Harrisia cactus	*Harrisia spp.*	W4f
Hawkweed	*Hieracium spp.*	W1
Horehound	*Marrubium vulgare*	W2
Horstetail	*Equisetum spp.*	W1
Johnson Grass	*Sorghum halepense*	W2
Karoo Thorn	*Acacia karoo*	W1
Kochia	*Kochia scoparia*	W1
Lagarosiphon	*Lagarosiphon major*	W1
Longstyle Feather Grass	*Pennisetum villosum*	W2
Miconia	*Miconia spp.*	W1
Nodding Thistle	*Carduus nutans*	W2
Pampas Grass	*Cortaderia spp.*	W2
Parthenium weed	*Parthenium hysterophorus*	W1
Patterson's Curse, Vipers Bugloss	*Echium spp.*	W3
Prickly Pears	*Opuntia spp.*	W4f
Rhus Tree	*Toxicodendron succedanium*	W2
Salvinia	*Salvinia molesta*	W1
Scotch/English Broom	*Cytisus scoparius*	W2
Scotch/Illyrian/Stemless Thistle	*Onopordum spp.*	W3
Senegal Tea Plant	*Gymnocoronis spilanthoides*	W1
Serrated Tussock	*Nassella trichotoma*	W3
Siam Weed	*Chromolaena odorata*	W1
Sifton Bush	*Cassinia arcuata*	W3
Silverleaf Nightshade	*Solanum elaeagnifolium*	W2
Spiny Burrgrass	*Cenchrus incertus C. longispinus*	W2
Spotted Knapweed	*Centaurea maculosa*	W1
St John's Wort	*Hypericum perforatum*	W3
Sweet Briar	*Rosa rubiginosa*	W2
Water Hyacinth	*Eichhornia crassipes*	W1
Water Lettuce	*Pistia stratiotes*	W1
Wild Raddish	*Raphanus raphanistrum*	W2
Willows	*Salix spp.*	W4g

SOURCE: Southern Slopes Noxious Plants Authority

6.6 Fauna

The following is a list of threatened fauna for the Yass catchment. Loss of habitat by removal of native vegetation has been the primary cause for the decline in native fauna populations, also predation by humans, cats and foxes.

Table 5: Threatened Fauna in the Yass Area

V – Vulnerable, E – Endangered, RS – Regionally Significant, X – Extinct

Species	Common Name	Status	Status in Yass Area
Birds			
Oxyura australis	Blue-billed Duck	V	Uncommon occasional visitor
Stictonetta naevosa	Freckled Duck	V	Uncommon occasional visitor
Ardeotis australis	Australian Bustard	E	Possibly extinct
Botaurus poiciloptilus	Australasian Bittern	V	Rare; few records from isolated sites
Lophoictinia isura	Square-tailed Kite	V	Very uncommon; mainly in large areas of well timbered habitat
Ninox strenua	Powerful Owl	V	Uncommon; associated with taller forests in east of area
Cacatua leadbeateri	Pink Cockatoo	V	Vagrant
Calyptorhynchus lathami	Glossy Black Cockatoo	V	Uncommon; occasional records in woodlands with *Allocasuarina* species
Polytelis swainsonii	Superb Parrot	V	Locally common breeding resident
Grantiella picta	Painted Honeyeater	V	Rare; no records in ACT region since 1987
Xanthomyza phrygia	Regent Honeyeater	E	Uncommon; occasional visitor, usually in spring/summer
Melanodryas cucullata	Hooded Robin	RS	Uncommon; mainly occurs in larger woodland remnants
Pachycephala olivacea	Olive Whistler	V	Uncommon; associated with wet forest gullies in spring/summer; other forest and woodland areas in winter
Climacteris picumnus	Brown Treecreeper	RS	Uncommon; mainly occurs in larger woodland remnants
Mammals			
Mastacomys fuscus	Broad-toothed Rat	V	Rare; restricted to montane grasslands and heathlands
Miniopterus schreibersii	Large Bent-wing Bat	V	Cave dweller
Myotis adversus	Large-footed Mouse-eared Bat	V	Cave dweller; forages over pools in creeks and rivers
Dasyurus maculatus	Spotted-tailed Quoll	V	Rare; restricted to extensive areas of suitable habitat (eg. Brindabella NP)
Dasyurus viverrinus	Eastern Quoll	E	Extinct
Petaurus australis	Yellow-bellied Glider	V	Uncommon; associated with taller forests
Petroica rodinogaster	Pink Robin	V	Uncommon winter visitor in woodland and forest areas
Phascolarctos cinereus	Koala	V	Rare to very rare
Amphibians			
Pseudophryne corroboree	Corroboree Frog	E	Rare; found in restricted habitats in alpine areas
Litoria aurea	Green and Golden Bellfrog	E	Possible only
Reptiles			
Delma impar	Striped Legless Lizard	V	Very rare, few sites known
Suta flagellum	Little Whip Snake	V	Very rare, few sites known
Varanus rosenbergi	Heath Monitor	V	

SOURCE: National Parks and Wildlife – Threatened Species Unit Queanbeyan 2000

6.7 Land Use

The Yass Area is predominantly an agricultural and pastoral district famous for its merino wool, cattle and sheep studs. Cropping occurs on the more productive land of Silurian/volcanic origin, however these areas are reducing due to the problems of soil acidification and degradation. Native vegetation is found in areas where land is unsuitable for agricultural production due to slope limitations, or soil fertility and depth.

Table 6: Current land use in the Yass area

Land Use	Area	*% of catchment*
Native, Naturalised, Improved Pasture	223,572ha	*78.9*
Native Timber	44,345ha	*15.7*
Grain, Fibre, Fodder Crops	7,964ha	*2.8*
Water Body – River, Lake	5,726ha	*2.0*
ACT	1,009ha	*0.4*
Urban	404ha	*0.1*
Mining & Quarrying	131ha	*>1*
Electricity/Pipeline Easement	105ha	*>1*

Source: DLWC RIU, 1999

The Yass area also supports sites of significant conservation value which include:

- *Brindabella National Park*
- *Hattons Corner Nature Reserve*
- *Wee Jasper Nature Reserve*
- *Burrinjuck Nature Reserve*
- *Mundoonen Nature Reserve*
- *Narrangullen stone arrangement near Wee Jasper*
- *Burrinjuck State Recreation Area*
- *Geoheritage Sites – Environment Australia (1998) has identified 108 sites of geoheritage significance in the Yass catchment, predominantly sites of invertebrate fossils.*

6.8 Land Capability

Land capability refers to the rating land is given according to its potential to achieve a sustained level of production (Soil Con., 1981).

Table 7: Distribution of Land Capability Classes in the Yass Area Catchment

Land Capability Class	Area (ha)	% of Catchment
Class I	95	0.03
Class II	5,668	2.00
Class III	33,044	11.66
Class IV	75,421	26.63
Class V	43,037	15.19
Class VI	81,451	28.76
Class VII	27,209	9.61
Class VIII	9,745	3.44
Water	5,153	1.82
Nature Reserve	1,601	0.57
Urban	632	0.22
ACT	138	0.05
Mining	61	0.02

6.9 Community Profile

The Yass catchment incorporates three local government areas – Yass, Yarrowlumla and Gunning Shires. The Yass Shire covers the largest proportion of the Yass area.

Table 8: Estimated Population in the Yass Shire (1998)

Year	Total Persons
1996	9370
1997	9398
1998	9380
1999	9421

Source: ABS, 2000

Table 9: Age Distribution in the Yass Shire (1998)

Total Population	% Population 0-19 Years	% Population 20-64 Years	% Population 65+ Years
9380	29.3	58.3	12.4

Source: ABS, 2000

- *Average annual rate of change 1991-1996 0.98%*
- *Births (1997-98) 117*
- *Deaths (1997-98) 67*

Table 10: Community Statistics for the Yass Shire

POPULATION	Statistics 1996 (Change between 1991-1996)
• Number of Persons Per Square Kilometre	1-10
• Population Change 1991-1996	0-5% increase
• Population Age (1996): 0 – 14 years	0-10% above non-metro average (0-10% increase)
15-24 years	10-20% below non-metro average (10-20% decrease)
25-64 years	0-10% above non-metro average (0-10% increase)
65 years or older	10-20% below non-metro average (20%$^{+}$ increase)
• Median Age of the Total Population (1996)	34 - 37 years
• Population Sex Ratio	100 males to 125 females
LABOUR FORCE	
• Labour Force Participation (1996)	10-20% above non-metro average
• Male Labour Force Participation	10-20% above non-metro average
• Female Labour Force Participation	10-20% above non-metro average
• Unemployment Rate	20-40% below non-metro average
• Employment in Agriculture	50-100% above non-metro average (0-10% decrease)
• Employment in Service Industries	0-30% above non-metro average (20% or greater increase)
• Employment in Manufacturing	60% or greater below non-metro average
• Median Age of Farmers & Farm Managers	48-53 years (increased by 0-2 years)
• Median Age of Agricultural Workers	33-36 years (increased by 2-4 years)
INCOME	
• Mean Annual Taxable Income	0-10% above non-metro average
For the Murrumbidgee Region:	
• Annual Broadacre Farm Family Cash Income	$50,000 - $70,000 (increase by 75-100%)
• Annual Broadacre Farm Family Cash Income Derived from Farm Cash Income	Between 70-80% (increase by 10-15%)

SOURCE: Bureau of Rural Sciences, 1999

Table 11: Value of production in the Upper Murrumbidgee for 1994-95

SHEEP:
- 1,846,390 Sheep
- 488,995 Sheep and lambs sold
- Total value of sheep and lambs slaughtered was $7,193,356
- The total value of wool sold was $50, 564, 605

CATTLE:
- 117, 225 Beef cattle
- 49,285 cattle sold
- Total value of beef cattle slaughtered was $18,734,061
- *(Dairy cattle $887,524)*
- *(Pigs $22,283)*

CROPS:
- Total value of crop production $7,396,135
- *(Pasture hay $1,773,506)*
- *(Oats $563,468)*

FRUIT (other than Grapes):
- Value $235,963
- Grapes: 102 tonnes on 25ha, valued at $64,241

SOURCE: MCAP, 1998

6.10 Geoheritage Sites in the Yass Area

Table 12 Geoheritage sites in the Yass area

Place Name	TYPE	SIZE (Ha)	Criteria*	Fragility **
Boambolo, Hall's Creek (Por. 61)	Secondary Limestone	>1	A1,B1	3
Cavan (Por. 94)	Volcanic Ash	-	A1	X
Cavan Hill (Sth Of Taemas Bridge)	Bloomfield Limestone	1-100	A1, C1,	4
Taemas Bridge (1 Mile Sth)	Majurgong Sandstones	>1	A1, C1,	3
Taemas Bridge (Nth Approach At Sharp Turn)	Majurgong Sandstones	>1	A1, C1,	3
Taemas Bridge Road (Nth Bank Of Murrumbidgee)	Fossil Site, Invertebrate	>1	A1, C1,	3
Goodradigbee Cave	Fossil Site, Vertebrate	-	A1,C1,D	2
Goodradigbee Cave	Karst	-	A1,C1,D	1
Oakey Creek (Cutting Nth Of Mouth)	Shales & Limestones	>1	A1,C1,D	3
Oakey Creek Valley	Limestones	1-10km^2	A1,C1,D	3
Cavan (Por. 136)	Limestone Breccia	-	A1,C1,D	X
Cavan (Por. 136)	Bluff Limestone/Fossils	-	A1,C1,D	2
Cavan (Por. 136)	Currajong Limestone/	-	A1,C1,D	2
Cavan (Por. 136)	Yellow Limestone/Fossils	-	A1,C1,D	2
Clear Hill	Fossil Site, Invertebrate	1-100	A1,C1,D	4
Clear Hill (Near Taemas Bridge)	Fossil Site, Invertebrate	1-100	A1,C1,D	4
Clear Hill, Cavan (Pors. 5,136)	Cavan Limestone	1-100	A1,C1,D	4
Narrengullen Mountain	Rhyolites	<10 km^2	A1,C1,D	4
Mountain Creek Tuffs	Tuff	-	A1,C1,D	4
Mountain Creek (Road-Cuttings West Of Bridge)	Cavan Limestone	>1	A1,C1,D	3
Mountain Creek (Road-Cuttings West Of Bridge)	Evidence Of Shallow	>1	A1,C1,D	3
Cavan (Por. 5)	Volcanic Breccia	-	A1,C1,D	X
Cavan (Por. 5)	Yass Porphyry	-	A1,C1,D	X
Westmead Park Formation	Fossil Site, Invertebrate	-	A1,C1,D	2
Westmead Park Formation	Stratigraphic Format	-	A1,C1,D	X
Glenesk Formation	Stratigraphic Format	-	A1,C1,D	X
Devil's Elbow	Fossil Site, Invertebrate	>1	D1, C1	3
Devil's Elbow	Fossil Site, Invertebrate	>1	D1, C1	3
Devil's Elbow (Taemas Anticline)	Yassensis Limestone	>1	D1, C1	3
Murrumbidgee River (Western Bank Below Taemus Bridge)	Anticline	>1	D1, C1	3
Cave Island	Fossil Site, Invertebrate	>1	A1,C1,D	2
Cave Island	Karst	>1	A1,C1,D	1
Cave Island	Fossil Site, Vertebrate	>1	A1,C1,D	2
Cave Island	Karst	>1	A1,C1,D	1
Duffy's Point (Nth End, Across Murrumbidgee River)	Fossil Site, Invertebrate	-	A1,C1,D	2
Duffy's Point (Nth Of Majurgong Trig Station)	Bloomfield Limestone	-	A1,C1,D	X
Good Hope Public School (Nth Of)	Yass Porphyry	-	A1,C1,D	X
Goodhope (In Vicinity)	Cavan Limestone	-	A1,C1,D	X
Goodhope, Yass	Fossil Site, Invertebrate	-	A1,C1,D	2
Murrumbidgee River Opposite Dawes (Duffy	Fossil Site, Invertebrate	-	A1,C1,D	2
Hatton's Corner	Fossil Site, Invertebrate	1-100	D1, H1,	2
Silverdale Formation (Barrandella Shale)	Fossil Site, Invertebrate	>1	D1, H1,	2
Silverdale Formation (Barrandella Shale	Type Section	>1	D1, H1,	3
Silverdale Formation (Bowspring Limeston	Fossil Site, Invertebrate	>1	D1, H1,	2

Place Name	TYPE	SIZE (Ha)	Criteria*	Fragility **
Silverdale Formation (Bowspring Limeston	Type Section	>1	D1, H1,	3
Silverdale Formation (Hume Limestone)	Fossil Site, Invertebrate	>1	D1, H1,	2
Silverdale Formation (Hume Limestone)	Type Section	>1	D1, H1,	3
Yass (Hattons Creek, 2 Km Nw Of)	Fossil Site, Invertebrate	-	D1, H1,	2
Narrengullen Caves	Limestone Cave	-	A1,C1,D	1
Narrengullen Caves	Cavan Limestone	-	A1,C1,D	3
Narrengullen Caves	Vertebrate Fossil	-	A1,C1,D	2
Taemas	Karst	-	A1,C1,D	1
Shearsby's Wallpaper	Fossil Site, Invertebrate	>1	C1, D1,	2
Alum Creek	Breccia Bands Within	-	A1,C1,D	X
Alum Creek (In Vicinity)	Cavan Limestone	-	A1,C1,D	X
Bushranger's Creek Valley	Cavan Limestone	-	A1,C1,D	X
Derringullen Creek	Fossil Site, Invertebrate	1-100	A1,C1,D	3
Derringullen Creek	Fossiliferous Limestone	1-100	A1,C1,D	3
Taemas-Cavan (Burrinjuck Dam)	Limestone Series	<10 km^2	A1,C1,D	1
Devil's Pass	Gorge	1-100	D1	3
Devil's Pass (Black Range Road; 5 Miles)	Lava Flow	-	A1	X
Boambolo (Por. 107)	Limestone/Fossil Site	-	C1	2
Boambolo (Por. 61)	Limestone/Fossil Site	-	C1	2
Boambolo (Por. 79)	Limestone/Fossil Site	-	C1	2
Boambolo (Pors. 80,151)	Limestone/Fossil Site	-	C1	2
Boambolo Formation	Fossil Site, Invertebrate	-	C1	2
Boambolo Formation	Type Section	>1	C1	3
Glen Bower Formation	Fossil Site, Invertebrate	-	C1	2
Glen Bower Formation	Type Section	Linear place of minimal width	C1	3
Taemas Bridge Road (Nth Bank Of Murrumbidgee)	Fossil Site, Invertebrate	-	C1	2
Uriarra Volcanics (Swamp Creek Member)	Type Locality	>1	C1	3
Wee Jasper Road (1 Mile From Taemas Bridge)	Fossil Site, Invertebrate	-	C1	2
Murrumbateman Creek Formation (East & West)	Type Area	>1	C1	3
Boorowa (Elmside Formation)	Fossil Site, Invertebrate	-	C1	2
Black Bog Shale	Type Section	Linear place of minimal width	C1	3
Black Bog Shale (Yarwood Siltstone Member)	Fossil Site, Invertebrate	-	C1	2
Bowning	Fossil Site	>1	C1	2
Bowning (Near)	Fossil Site, Invertebrate	>1	C1	2
Bowning Railway Station	Fossil Site, Invertebrate	>1	C1	2
Bowning Railway Station	Fossil Site, Invertebrate	>1	C1	2
Burrinjuck Dam	Fossil Site, Fish	>1	C1	2
Cliftonwood (Near; Yass River)	Fossil Site Invertebrate	-	C1	2
Cliftonwood Limestone	Type Section	>1	C1	3
Willow Bridge Tuff	Type Section	Linear place of minimal width	C1	3
Cowridge Siltstone	Fossil Site, Invertebrate	>1	C1	2
Cowridge Siltstone	Type Section	>1	C1	3
Elmside Formation (Mudstone Member)	Fossil Site, Invertebrate	-	C1	2

Place Name	TYPE	SIZE (Ha)	Criteria*	Fragility **
Elmside Formation (Mudstone Member)	Type Section	Linear place of minimal width	C1	3
Elmside Formation (Sandstone Member)	Type Section	>1	C1	3
Laidlaw Formation (Euralie Limestone Member)	Fossil Site, Invertebrate	>1	C1	2
Laidlaw Formation (Euralie Limestone Member)	Type Section	>1	C1	3
Laidlaw Formation (Excursion Creek Sands)	Fossil Site, Invertebrate	>1	C1	2
Laidlaw Formation (Excursion Creek Sands)	Type Section	>1	C1	3
Silverdale Formation (Gums Road Limestone)	Fossil Site, Invertebrate	>1	C1	2
Silverdale Formation (Gums Road Limestone)	Type Section	>1	C1	3
Silverdale Formation (Tullerah Sandstone)	Type Section	>1	C1	3
O'briens Creek Sandstone	Fossil Site, Invertebrate	>1	C1	2
O'briens Creek Sandstone	Type Section	>1	C1	3
Rosebank Sle (Marl Member)-(Rainbow Hill)	Fossil Site, Invertebrate	>1	C1	2
Rosebank Sle (Marl Member)-(Rainbow Hill)	Type Section	>1	C1	3
Rosebank Sle (Sle Member)	Fossil Site, Invertebrate	>1	C1	2
Rosebank Sle (Sle Member)	Type Section	>1	C1	3
Spring Mount (300m NW Of; Road Cutting)	Fossil Site, Invertebrate	>1	C1	2
Warroo Creek	Fossil Site, Fish	-	C1	2
Taemas House (0.5 Mile Nth)	Fossil Site, Fish	-	C1	2
Yass (Booroo Ponds Creek, 2 Km NW Of)	Fossil Site, Invertebrate	-	C1	2
Taemas (Por.65)	Fossil Site, Invertebrate	-	C1	2

Source: CRA, 2000

* **CRITERIA** – Criteria for Register of the National Estate relevant to place type

** **FRAGILITY**:

1 – Places sensitive to unintentional human impact
2 – Places sensitive to intentional human impact including use of hand tools. This includes those places sensitive to sampling, collecting or vandalism.
3 – Places sensitive to mechanical interference at any scale
4 – Places generally immune to human interference
X – Insufficient sensitivity data available

7. Priority Issues - Further Information

7.1 Dryland Salinity

Dryland salinity can occur when the water tables rise to between 2-3 metres of the surface. Capillary action brings the salts to the soil surface in concentrated amounts affecting the surrounding environment (Nicholson, A & Wooldridge, A. 2000).

Objectives for Managing Dryland Salinity

The processes that have contributed to salinity and rising groundwater levels such as vegetation clearing and agricultural practices over the past 150 years cannot be reversed. Instead, land use practices need to be modified to accept saline conditions and find productive uses for working with saline land as the impacts of salinity are slowly controlled.

- *Reduce recharge - Native vegetation has a greater potential to intercept rainfall before reaching the groundwater with deep roots and organic material.*
- *Protect and manage native vegetation.*
- *Use water more effectively and efficiently*
- *Implement engineering solutions*
- *Productive use of salt affected land focus on-ground actions on priority areas*
- *Reduce spread of salinity*
- *Reduce visual impact of salinity such as scalds, improving aesthetics*
- *Reduce the risk of erosion by providing soil cover and stabilisation*
- *Reduce topsoil salinity by reducing groundwater levels that could otherwise bring salts to the surface*
- *Re-establish landscape to deep-rooted perennial vegetation*

7.2 Native Vegetation

Dieback refers to the decline in health and vigour of trees over time and is caused by an ecosystem imbalance which impacts on the natural systems that support native vegetation. Dieback is caused by the interaction of a number of factors, which include:

- *Clearing*
- *Rising watertables and salinity*
- *Insect attack*
- *Tree ageing and natural regeneration decline*
- *Habitat decline (understorey) for insectivorous predators*
- *Soil nutrient imbalance – from fertilisers, stock camps, cropping systems and changes in pasture species*
- *Pasture improvement*
- *Weed competition*
- *Mistletoe*
- *Drought*
- *Ringbarking – from stock and clearing*
- *Changes to water balance – runoff, erosion, dams*
- *Grazing pressure – stock, native fauna & rabbits*

Table 13: Dominant native riparian vegetation for the Yass area

RIVER/CREEK	SUB-CATCHMENTS	DOMINANT NATIVE VEGETATION
Yass River	Yass River, Brooks Creek, Murrumbateman Creek	*Bottlebrush and Burgan dominated shrubland, Poa dominated grasslands, River Red Gum dominated woodlands.*
Murrumbidgee River (Downstream & including the ACT)	Murrumbidgee River, Ginninderra Creek, Tuggeranong Creek	Bottlebrush and Burgan dominated shrubland, Poa dominated grasslands, River she-oak dominated woodland.
Mountain Creek	Mountain Creek	Burgan dominated shrubland and River she-oak dominated woodland.
Goodradigbee River	Goodradigbee River, Micalong Creek	Tea-tree dominated shrubland, River she-oak dominated woodland, Ribbon Gum dominated woodland.

7.3 Stream Bank Zone

Stressed Rivers Assessment Report
The Yass Area Catchment falls within the Yass Upper, Yass Lower and Murrumbidgee II sub-catchments of the Stressed Rivers Assessment Report (DLWC 1999). 'Yass Upper' and 'Yass Lower' constitute the Yass Valley Sub-Catchment, while the Burrinjuck Sub-Catchment covers both "Burrinjuck Dam' (a regulated catchment) and the upper section of 'Murrumbidgee II'. The Murrumbidgee II data only represents the south-eastern area of the Burrinjuck sub-catchment.

Yass Upper:
Yass Upper includes the Yass River and tributaries above Yass weir which were assessed as having high environmental stress and high water extraction. The primary stress factors for the Yass Upper catchment include salinity, dams and rural residential development. NSW Fisheries identified a high conservation value with threatened species present such as Macquarie Perch and Silver Perch expected to occur.

Stream bank vegetation was rated as *poor* in relation to; width of rip zone, indigenous cover, connectivity and structural integrity.

Yass Lower:
Yass Lower includes the Yass River and tributaries below Yass weir, which were assessed as having high environmental stress and low water extraction. The primary stress factors for the Yass Lower catchment include sewerage, weir and salinity. Similar to Yass Upper, NSW Fisheries identified a high conservation value due to the expected presence of threatened species. Full development of the Yass Lower catchment creates a potential increase in hydrologic stress which could see Yass Lower ranked in the highest overall stress category (S1) similar to Yass Upper and Murrumbidgee II.

Stream bank vegetation was rated as *fair* in relation to indigenous cover, connectivity and structural integrity, and *good* in relation to cover of bank and width of rip zone.

Murrumbidgee II:
Murrumbdigee II includes the Murrumbidgee River and minor tributaries between Numeralla and Burrinjuck which were assessed as having high environmental stress and high water extraction. The primary stress factors on stream condition being Canberra and surrounds. NSW Fisheries ranked Murrumbidgee II as having an Identified Conservation Value with high fish species diversity and containing threatened species such as Trout Cod, Macquarie Perch and Silver Perch.

Table 14: Current Stress Classifications

Sub-Catchment	**Yass Upper**	***Yass Lower***	***Murrumbidgee II***
Present Management Classification	S1	S5	S1
Hydrologic Stress	High	Low	High
*Environmental Stress**	High	High	High
High Conservation Value	No	No	No
Identified Conservation Value			
NPWS	Yes	No	Yes
Fisheries	Yes	Yes	Yes

Source: DLWC, 1999

Present Management Classification:
S1 – High environmental stress and high water extraction (of high priority for the preparation of river management plan).
S5 – High environmental stress and low water extraction (of medium priority for preparation of river management plan).

Hydrologic Stress:
Hydrologic stress is based on an estimation of water extraction in proportion to the estimated stream flow.
High – 70-100% extraction **Low** – 0-30% extraction

Environmental Stress:
Environmental stress refers to a measure of stream health indicators, each ranked to reflect average stream condition.
High – Stream health indicators reflect high environmental stress on stream health

High Conservation Value & Identified Conservation Value:
This assessment was conducted by NPWS and NSW Fisheries using environmental value indicators. Indicators included: physical disturbance, presence of wetlands, national park, riparian vegetation, water birds, threatened species, fish species diversity. Using this data streams were assigned a high conservation or identified conservation value.

Table 15: Stream Condition Assessment

Stream Health Indicators:		**Yass Upper**	**Yass Lower**	**M'bidgee II**
Riparian Vegetation	*Cover*	Fair	Good	Fair
	Width	Poor	Good	Good
	Indigenous	Poor	Fair	Fair
	Connectivity	Poor	Fair	Poor
	Integrity	Poor	Fair	Poor
Geomorphology	*Bank Stability*	Fair	Poor	Very Poor
	Active Bank Density	Poor	Poor	Very Poor
	Bed Stability	Good - stable with some siltation	Good - stable with some siltation	Good - stable with some siltation
Anthropogenic Catchment Effects	*Fish Barriers*	Poor - many passable	Poor - many passable	Fair - some passable
	Dams & Development	Very Poor (extensive development)	Poor (agriculture/urban)	Poor (agriculture/urban)
	Conservation	Very Poor	Very Poor	Fair
	Tree – Shortfall	Good	Poor	Poor
	Over-grazing	Very Good	Good	Fair
	% Cropping	Fair 2.70%	Fair 2.69%	Fair 2.29%
	Over-cropping	Very Good	Very Poor	Very Good
	Areal Erosion Index	Very Poor	Poor	Very Poor
Water Qualtiy	*Total Phosphorus*	Poor 65 μgL^{-1}	Poor 65 μgL^{-1}	Poor 65 μgL^{-1}
	Turbidity	Fair 23 NTU	Good 10 NTU	Good 10 NTU
	Salinity	Poor 1400EC	Fair 550EC	Good 200EC
	pH	Good 6	Good 6	Good 6
Stress Assessment		**HIGH**	**HIGH**	**HIGH**

RIPARIAN VEGETATION & STREAM BANK CONDITION

Data collated from Catchment Assessments conducted by the Natural Resource Planning Advisor, DLWC Catchment Condition and Erosion mapping.

Table 16 Burrinjuck sub-catchment: Riparian vegetation & stream bank condition

Refer to Map: "Burrinjuck Riparian Condition".

	GOOD	MODERATE	POOR
Riparian Condition*	• Cobblestone Ck (lower-mid) • Carrol Ck (mid)	• Waroo Ck (mid), Brikeys Ck (mid), Brassil Gully (mid-upper), Sapling Point Ck (mid), Cobblestone Ck (mid-upper), Jeir Ck (lower-mid), Mountain Ck (lower)	
Streambank Condition*	• Woolgarlo Ck (mid), Carrolls Ck (mid), Warroo Ck (mid), Gooda Ck (mid & mid-upper), Jeir Ck (mid & mid-upper), Chainoponds Ck (lower), Swamp Ck (mid-upper), Tea Drinking Ck (mid), Mullion Ck (lower-mid, mid-upper & upper), Ledgers Ck (mid), Johnsons Ck (mid), Oaky Ck (lower), Razorback Ck (mid), Sawyers Ck (lower to mid), Mountain Ck (lower to mid), Flinty Mountain Ck (lower to mid), Spring Ck (lower), Salt Blx Ck (lower & upper), Narrangullen Ck (mid-upper), Nibs Ck (lower-mid), Sugarloaf Ck (lower-mid & mid-upper), Cave Ck (mid), Oaky Ck catchment (lower), Goodradigbee River catchment (lower)	• Cobblestone Ck (lower) • Gooda Ck (mid-upper) • Little Swamp Ck (mid-upper) • Mullion Ck (mid-upper) • Johnsons Ck (mid) • Native Dog Ck (lower to mid) • Spring Ck (mid) • Oaky Ck (upper) • Ledgers Ck catchment (upper) • Tea Drinking Ck catchment (lower)	• Woolgarlo Ck (upper) • Oaky Ck (upper) • Little Swamp Ck (mid) • Tea Drinking Ck (mid-upper) • Spring Ck (mid) • MacPhersons Ck (upper)

Assessment based on dominance of native or exotic vegetation and streambank erosion (limited information available)

Assessment based on erosion depth and extent.

Good *Good vegetative cover (predominantly native), of highly erosion resistant soil. No undermining of banks, may be some isolated erosion. Streambank erosion <1.5m and no continuous damage to bank structure of vegetation.*

Moderate *Banks held by discontinuous vegetation (native & exotic) or erosion resistant soils. Some obvious damage to bank structure and vegetation, streambank erosion 1.5-3m, generally stable toe.*

Poor *Little effective vegetation (predominantly exotic), on unstable or dispersive soils. Mostly undercut toe, may be recent bank movement/erosion, streambank erosion 3-6m and >6m.*

RIPARIAN VEGETATION & STREAM BANK CONDITION

Riparian Condition data collated from Catchment Assessments conducted by the Natural Resource Planning Advisor, DLWC Catchment Condition and Erosion mapping.

Table 17: Yass Valley sub-catchment: Riparian vegetation & stream bank condition
Refer to Map "Yass Valley Riparian Vegetation & Streambank Condition"

	GOOD	MODERATE	POOR
Riparian Vegetation*	• Yass River – lower (west of Yass township)	• Yass River mid-upper (Gundaroo to Sutton) • Yass River upper (Sutton to headwaters)	• Yass River lower-mid (Yass to Gundaroo)
Streambank Condition**	Two Mile Ck (mid-upper), Bowning Creek (mid-upper), Limestone Ck (mid-upper), Derringullen Ck (mid), Bango Ck (lower & mid), Mantons Ck (mid-upper), Nowlands Ck (lower), Five Mile Ck (lower-mid), Five Mile Ck (lower-mid), Nelanglo Ck (lower & upper), Gundaroo Ck (mid), Deep Creek (lower & mid), Dairy Ck (mid & upper), Brooks Ck (mid and mid-upper), Gum Flat Ck (lower), Bungendore Ck (mid-upper), Black Joes Ck (lower), Birchams Ck (lower & mid), Amungula Ck (lower, mid, upper), McLaughlins Ck (lower-mid), Back Ck (mid), Bendy Ck (mid), Spring Flat Ck (mid-upper), Williams Ck (lower-mid), Dicks Ck (lower & mid), Scabing Ck (lower), Murrumbateman Ck (mid), Graveyard Gully (mid), Broken Dam Ck (lower and mid) Reedy Ck (mid)	• Two Mile Ck (mid) • Gallop Ck (mid) • Derringullen (mid-upper) • Cooks Ck (lower) • Bango Ck (mid) • Nelanglo Ck (mid) • Gundaroo Ck (mid & upper) • McLeods Ck (lower) • Brooks Ck (lower & mid) • Bungendore Ck (mid) • McLaughlins Ck (lower & mid) • Dicks Ck (mid-upper) • Murrumbateman Ck (lower-mid & mid-upper) • Reedy Ck (mid)	• Derringullen (mid) • Cooks Ck (mid) • Mantons Ck (lower-mid) • Gundaroo Ck (lower) • Bungendore Ck (upper)

Assessment of vegetation based on dominance of native or exotic species.
****Assessment of stream bank condition based on erosion depth and extent.***

Good *Good vegetative cover (predominantly native), of highly erosion resistant soil. No undermining of banks, may be some isolated erosion. Streambank erosion <1.5m and no continuous damage to bank structure of vegetation.*

Moderate *Banks held by discontinuous vegetation (native & exotic) or erosion resistant soils. Some obvious damage to bank structure and vegetation, streambank erosion 1.5-3m, generally stable toe.*

Poor *Little effective vegetation (predominantly exotic), on unstable or dispersive soils. Mostly undercut toe, may be recent bank movement/erosion, streambank erosion 3-6m*

7.4 GULLY AND SOIL EROSION

Gully erosion is a complex form of erosion whereby large quantities of soil are removed by runoff. The volume and velocity of water movement generated is great enough to cut large channels in the landscape which provide for rapid movement of soil material, sediment and water into catchment drainage systems. Gully erosion is accelerated by the dispersion of unstable subsoils due to seepage, causing the collapse of the surface soils, evident in the slumping and slipping of gully heads and walls.

Forms of Gully Erosion include:

***Head Erosion*:** Enlargement of the gully channel in an upstream direction caused by concentrated runoff forming a 'waterfall' effect and subsequent pooling of water at the gully head. This leads to undercutting and slumping, and can be further affected by sub-surface seepage, sheet and splash erosion.

***Lateral Erosion*:** Enlargement of a gully in a sideways direction caused by concentrated runoff at the gully walls leading to undercutting, slumping, sheet, rill and splash erosion.

***Attrition*:** Erosion of poorly structured (highly dispersive) material such as gravel and sand which is easily dislodged from the banks.

***Slumping*:** Collapse of the bank, leaving blocks of soil on the gully floor.

***Toe*:** Area where the gully walls meet the gully floor, and is most prone to erosion.

***Undercutting*:** Removal of soil from the toe steepening the slope and producing an overhang, which can lead to slumping.

The erosion of soil sediments can contribute to numerous other forms of land degradation within a catchment, particularly within the drainage systems. For example:

- *Increased nutrient loads (eg. phosphates and nitrates)*
- *Siltation and sedimentation*
- *Streambank erosion*
- *Increased salt loads - salt crystals on the soil surface become mobilised*
- *Pollution*
- *Algal blooms*
- *Water quality decline*

Causes of Erosion

Erosion is caused by water flowing across the surface, occurring in areas where there is insufficient groundcover to provide soil protection. Erosion is a natural process which has been accelerated by human activities as suggested by Gallagher (1989) with evidence of gully erosion in the Burrinjuck reservoir catchment dating back to the early settlers of the 1800s (ANZECC, 2000).

Erosion is the result of several interacting processes relating to soil type, landform, land use and climate. Erosion begins when there is a change in drainage discharge (runoff) and/or decreased soil resistance to detachment and transport. This is commonly caused by a reduction in ground cover (vegetation) exposing topsoil to the processes of erosion and

damaging the soil structure. Vegetation cover strongly influences the rate of erosion with other factors such as soil type and slope also impacting on the potential and extent of erosion. The primary causes of erosion in the Yass Area relate to:

Vegetation Decline	*Increases runoff and peak flows during storm events, and reduces soil strength along drainage lines*
Land management	*Overstocking, poor pest animal and weed control, repeated cultivation, inappropriate clearing, lack of deep rooted perennial pastures*
Landuse practices	*Cultivation and compaction caused by machinery and stock*
Rabbits	*Destabilising soils and contributing to gully formation*
Infrastructure	*Development and road drainage, railways, etc.*
Vegetation Decline	*Decline of native vegetation and deep rooted perennial pastures*
Dryland salinity	*Loss of vegetation cover and soil structure*
Soil Type	*Naturally unstable soils, with most soils in the Upper Murrumbidgee have a moderate to high erosion hazard (MCAP, 1988)*
Economics	*Financial pressures leading to over clearing and non-sustainable agricultural practices to maximise land use*
Drought and flood	*Climatic conditions*

Table 18: Soil erosion in the Yass area catchment

Erosion Classification	Area (Ha)	% of Catchment (% of total)
Erosion: (total)	**201 622**	
Rill Erosion: (total)	**1703**	**1**
- moderate	*(75)*	*(4)*
- severe	*(166)*	*(10)*
- very severe	*(127)*	*(8)*
- salting	*(1335)*	*(78)*
Sheet Erosion: (total)	**199721**	**70**
- minor	*(133,345)*	*(67)*
- moderate	*(61,915)*	*(31)*
- severe	*(3094)*	*(1)*
- very severe	*(1119)*	*(>1)*
- salting	*(249)*	*(>1)*
Mass Movement: (total)	**198**	**>1**
- avalanche/soil debris	*(90)*	*(45)*
- slump	*(108)*	*(55)*
No Appreciable Erosion	**81,421**	**28**
ACT	**212**	**>1**

Statistics:

Minor Erosion	*133,345ha*
Moderate Erosion	*61,990ha*
Severe Erosion	*3260ha*
Very Severe Erosion	*1246ha*
Salting	*1584ha*

Table 19: Gully erosion in the Yass area catchment

EROSION CLASSIFICATION	LENGTH KMS	% OF EROSION
Total Erosion	**1578 kms**	
• **Streambank Erosion: (total)**	**311 kms**	**20%**
Depth: - <1.5 metres	*205*	
- 1.5-3 metres	*90*	
- 3-6 metres	*14*	
- >6 metres	*2*	
• **Gully Erosion: (total)**	**1267 kms**	**80%**
Minor: total	***384 kms***	***30%***
Depth: - <1.5 metres	*338*	
- 1.5-3 metres	*27*	
- 3-6 metres	*1*	
- Salting	*18*	
Moderate: total	***407 kms***	***32%***
Depth: - <1.5 metres	*273*	
- 1.5-3 metres	*89*	
- 3-6 metres	*3*	
- Salting	*42*	
Severe: total	***294 kms***	***23%***
Depth: - <1.5 metres	*130*	
- 1.5-3 metres	*136*	
- 3-6 metres	*12*	
- Salting	*16*	
Very Severe: total	***182 kms***	***15%***
Depth: - <1.5 metres	*31*	
- 1.5-3 metres	*69*	
- 3-6 metres	*55*	
- >6 metres	*25*	
- Salting	*2*	

Statistics:

Minor Gully Erosion	*384kms*
Moderate Gully Erosion	*407kms*
Severe Gully Erosion	*294kms*
Very Severe Gully Erosion	*182kms*
Streambank Erosion	*311kms*
Salting	*79kms*

8. Related Policies, Programs and Funding Sources

Given the wide range of government programs and policies relating to natural resource management, it is difficult to summarise all available funding programs. Below is a list of relevant government and community web sites that are useful in seeking out further information on current programs.

Agriculture, Fisheries and Forestry Australia (AFFA)
www.affa.gov.au

Bureau of Rural Sciences (BRS)
www.affa.gov.au/brs

Commonwealth Scientific and Industrial Research Organisation (CSIRO)
www.csiro.gov.au

Department of Land & Water Conservation NSW (DLWC)
www.dlwc.nsw.gov.au

Environment Australia
www.ea.gov.au

Environment Protection Authority NSW (EPA)
www.epa.nsw.gov.au

Greening Australia
www.greeningaustralia.org.au

Gunning Shire Council
www.micropal.com.au/gunningweb/welcome.htm

Landcare Australia
www.landcareaustralia.com.au

Murrumbidgee Catchment Management Board
www.murrumbidgee-catchment.org.au

National Parks and Wildlife Service (NPWS)
www.npws.nsw.gov.au

Natural Heritage Trust
www.nht.gov.au

NSW Department of Agriculture
www.agric.nsw.gov.au

Yarrowlumla Shire Council
www.yarrowlumla.nsw.gov.au

Yass Shire Council
www.nsw.gov.au

9. LOCAL CONTACTS

Bushcare Program
ACT Parks & Conservation Service
PO Box 1065
TUGGERANONG ACT
Phone (02) 6207 7802

Greening Australia ACT & SE NSW
PO Box 538
JAMISON CENTRE ACT 2614
Phone: (02) 6253 3035

Landcare Coordinator
C/- DLWC
PO Box 23
YASS NSW 2582
Phone: (02) 6226 1433

NSW Department of Agriculture
Rossi Street
YASS NSW 2582
Phone: (02) 6226 2199

Rivercare Program
DLWC
QUEANBEYAN NSW 2620
Phone: (02) 6299 7688

Water Watch Program
PO Box 446
HOLT ACT 2615
Phone (02) 6951 2603

Yass Area Network of Landcare Groups
Sylvia Gleeson (Chair)
RMB 1856
Back Creek Road
GUNDAROO NSW 2620
Ph: 6236 8309

Or contact;

Landcare Coordinator
C/- Department of Land and Water Conservation (DLWC)
PO Box 23
YASS NSW 2582
Phone: (02) 6226 1433

10. BIBLIOGRAPHY

Australian and New Zealand Environment and Conservation Council, State of the Environment Reporting Task Force, 2000 *"Core Environmental Indicators for Reporting on the State of the Environment"* . Environment Australia, Canberra

Australian Bureau of Statistics. 2000 "Regional Statistics New South Wales" Australian Bureau of Statistics, Canberra.

Australian Conservation Foundation, 2000 *"A national scenario for strategic investment"*. Australian Conservation Foundation & National Farmers' Federation.

Briefing notes for Workshop Feb 2000 "Reading and Designing the Landscape". Nicholson, A. & Wooldridge, A

Bureau of Meterology, 2000 www.bom.gov.au

Bureau of Rural Sciences. 1999 *"Country Matters – Social Atlas of Rural & Regional Australia"*. Bureau of Rural Science, Agriculture, Fisheries & Forestry, Australia.

Community Biodiversity Network. 2000 *"Developing a Market in Biodiversity Credits"*, Life Lines Vol. 6, No. 2, p. 6

Cremer, K., 1995 *"Willow Identification for River Management in Australia"*, CSIRO, NLP & NSW Agriculture, Aust.

CaLM & Department of Water Resources, *Dryland Salinity 1: The Causes,* Department of Conservation and Land Management & Department of Water Resources NSW.

DLWC. 2000 "NSW Salinity Strategy – Quick Guide". NSW Department of Land & Water Conservation

DLWC 1999 "Stressed Rivers Assessment Report" Region Murrumbidgee, Catchment Murrumbidgee Sydney
Ellis, M., 1994 *"Roadside Management Manual"*, Shires of South Gippsland & Woorayl, Victoria.

Environment Protection Authority. 2000 "Draft: Guidance for the Use of Herbicides Near Water" Environment Protection Authority, New South Wales.

Gallagher, W., 1989 "Landuse and Land Degradation in the Catchment of Burrinjuck Dam Since European Settlement". Upper Murrumbidgee Catchment Coordinating Committee

Greening Australia, 1999 *"Greening Australia Together Yearbook 1999"* Executive Media Pty. Ltd., Melbourne.

Gunn, R., Story, R., Galloway, R., Duffy, P., Yapp, G., McAlpine, J. *1969 "Lands of the Queanbeyan-Shoalhaven Area, ACT and NSW"*. Land Research Series No. 24. CSIRO, Melbourne.

Jeffress, S. 2000 "The Effects of Grazing on Bird Diversity in Woodlands" University of Sydney, Orange.

Jenkins, B., 2000 *"Soil Landscapes of the Canberra 1:100 000 Sheet"* Department of Land and Water Conservation, Queanbeyan.

Landcare Australia & BHP, n.d., *Catchments - The Big Picture*, BHP Steel Pty. Ltd., Aust.

Murphy, D. & Woodford, J. 1999, "Salt of the earth turns Australia's rivers to poison", *Sydney Morning Herald*, 23 Oct., p.1.

Murray-Darling Basin Commission, June 1999, "Confronting the changing face of salinity", *Australian Landcare Journal*, pp. 14-15.

Murrumbidgee Catchment Management Committee 1998, *Murrumbidgee Catchment Regional Strategy 1999/02* : A strategy for natural resource and environmental management. Wagga Wagga
National Landcare Program, June. 2000, *"Salinity: gloom but not necessarily doom"*, Australian Landcare Journal, pp. 49-50.

National Landcare Program, Sept. 1999, *"War on Salinity gets NLP boost"*, Australian Landcare Journal, pp. 26-29.

Nicoll, C. & Scown, J. 1993 *"Dryland Salinity in the Yass Valley Processes & Management"* Department of Conservation and Land Management.

Personal Communication – Hollingsworth, K. 2001 YANLG Landcare Coordinator

Soil Conservation Service, 1974 *"Technical Manual – Yass"* Soil Conservation Service, NSW

Soil Conservation Service, 1981 *"The Joint Shires Study"* Soil Conservation Service, NSW

Thorman, R. & Heath, I. 1997 *"Regional Environmental Strategies"*. Australian Local Government Association, ACT.

Webb, R., (2000) Member of Gundaroo Landcare Group