Upper Murray Catchment Network
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Upper Murray Riparian Management Project

Natural Heritage Trust
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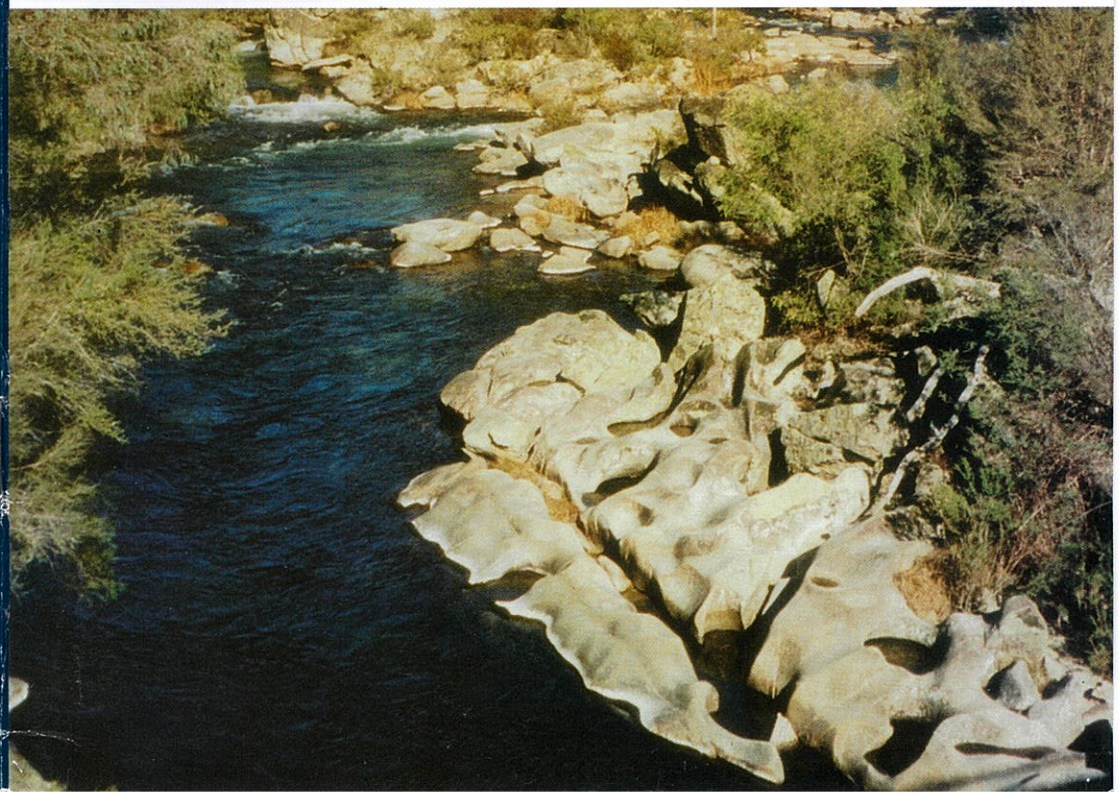
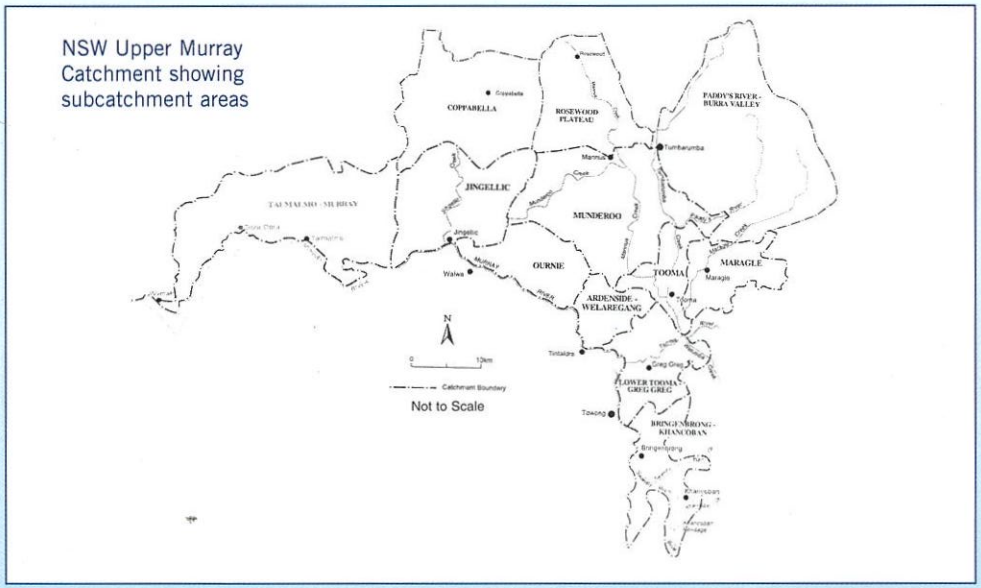
A Guide to Riparian Best Management Practice in the NSW Upper Murray Catchment



Introduction

This booklet has been produced with financial assistance from the Natural Heritage Trust as part of the Upper Murray Riparian Management Project (UMRMP).

The UMRMP was introduced to address riparian management issues in the NSW Upper Murray area. The major issues addressed include a decline of native riparian biodiversity, increasing invasion of exotic vegetation (mainly willows), streambank erosion, a decline in water quality, and a lack of community awareness regarding riparian issues and riparian best management practices.



The UMRMP incorporated an on-ground works component named the Riparian Management Incentive Scheme (RMIS). The RMIS saw over 27 kilometres of stream bank fenced and approximately 70 ha of riparian land protected, 48 ha of which was revegetated with almost 24,000 locally native trees and shrubs. The RMIS also enabled approximately 8 ha of willow control to be carried out.

What is a 'Riparian Zone'?

A 'Riparian Zone' (or riparian land) can be defined in many ways. For the purposes of this booklet, the functional definition contained in the Land and Water Resources Research and Development Corporation's (LWRRDCs) Riparian Land Management Technical Guidelines will be adopted. It defines riparian land as:
'any land which directly influences, or is influenced by a body of water'.

With this definition, riparian land includes

- the land immediately alongside small creeks and rivers, including the river bank itself;
- gullies and dips which sometimes run with surface water;
- areas surrounding lakes;
- wetlands on river floodplains which interact with the river in times of flood.

(Lovett & Price, 1999).

The width of riparian zones is often variable and can range from tens to hundreds of metres depending on the characteristics of your watercourse and surrounding landscape. As there is no 'rule of nature' which defines the actual width of buffer strips when undertaking riparian restoration works, the width of interest or concern is largely determined by the management objectives. For example, when managing for wildlife habitat, buffer strips will most likely need to be wider than if managing solely to reduce sediment entering the watercourse from overland flow.

Why are Riparian Zones Important?

Riparian zones are both ecologically and economically productive areas. They often support a significantly greater diversity of flora and fauna than surrounding areas and have higher levels of primary productivity, due to richer soils and greater availability of water, shade and shelter. They also act as corridors for wildlife, providing cover for movement across the landscape.

Riparian zones can be beneficial to farming systems in many ways, even when fenced off. Riparian areas:

- provide shelter for birds which help to control agricultural pests;
- provide areas for controlled grazing, particularly during dry periods;
- absorb floodwaters and release them slowly (wetlands);
- improve water quality by filtering sediments and nutrients from run-off;
- when vegetated, limit streambank erosion;
- provide shelter for some stock (eg lambs and newly shorn sheep) from extremes of cold weather;
- add to land value by aesthetically enhancing the landscape; and
- (when fenced) can increase stock health by preventing the consumption of contaminated water during low flows.

Since European settlement, Australian riparian areas have been considerably degraded, much of which is associated with land clearing in the catchment. It is becoming increasingly essential to improve management of riparian areas to ensure sustainable management of both farming systems and landscapes.

What are Riparian Best Management Practices (BMPs)?

- BMPs are a range of techniques and management tools that provide for the greater improvement in land and watercourse management, reflecting the current state of knowledge.
- BMPs indicate a commitment to ecology in the Upper Murray Catchment.
- BMPs have a direct impact, such as reducing erosion and vegetation decline.
- BMPs result in improved water quality and healthier more sustainable farming and ecological systems.

Riparian Management Issues for the Upper Murray

1. Protect and Enhance Native Riparian Vegetation

Biodiversity loss is one of the most serious environmental problems facing the Murray Catchment. Only 22% of the Catchment's woody native vegetation remains, and rivers, streams and adjacent vegetation have been flagged as priority areas for protection because of their ecological significance (Miles, 2001). Restoring native riparian vegetation can have multiple benefits for riparian systems and enhance biodiversity values.

Native riparian vegetation limits streambank and in-stream erosion, traps sediment, nutrients and other contaminants before they reach the waterway, provides essential habitat for terrestrial and aquatic ecosystems, helps control the growth of nuisance plants and algae and can act as a windbreak to shelter stock and crops.

BMPs for Restoring Native Riparian Vegetation

Protect, enhance and actively manage remnant riparian vegetation

- Identify and assess what remnant native riparian vegetation you have left and protect (fence) these areas first. They will have a more intact ecological system than areas of revegetation, and are more likely to survive harsh conditions as they have adapted to local conditions.

Revegetate

- When revegetating, use a diverse mix of locally native species (grown from locally sourced seed where possible) including trees and understorey (shrub layer) plants. The Nature Conservation Working Group (NCWG) recommends a mix of approximately 1:3, and a mix of colonising and long-term species.

- Rushes, sedges and emergent aquatic macrophytes (such as ***Phragmites australis*** - Common Reed) are a vital part of riparian biodiversity and can have benefits including bank stabilisation through binding soil and buffering banks from floodwaters.
- Consider direct seeding or using longstem tubestock as well as planting standard seedlings.
- Good site preparation is vital for planting success. Undertake weed control well before planting and, if using herbicides, only use those specified for use near waterways (eg a glyphosate herbicide). Never blanket spray a site as this opens the site up to wind and water erosion, weed invasion, and potential contamination of the waterway.

Before willow removal

After willow removal and revegetation

General

- Fencing will allow you to control and manage grazing pressure - it isn't necessary to exclude stock completely! Once plants have become established, managed grazing can be a useful tool to control weeds and reduce fire hazard while allowing for natural regeneration. Always include a gate for vehicular and stock access.
- The NCWG recommend a **minimum** riparian buffer width of 25m either side of the watercourse* to obtain benefits for biodiversity. (*Measured from the crest of the high bank).
- Provide alternative stock watering points and shelter away from fenced streams.
- Revegetating riparian areas is a great way to link existing patches of vegetation and provide a seed source for future revegetation projects.
- Monitor and evaluate both riparian remnant and revegetation sites.

2. Control Willows Along Watercourses

Willows (Salix spp) are no longer recommended for planting along watercourses.

Willow regrowth

Willows are exotic plants originally introduced to Australia for their stabilising benefits, as ornamentals, for providing shelter and stock feed, and producing baskets and cricket bats. Many of the hundreds of willow species in Australia are characterised by rapid growth and brittle branches. Eight species have the potential to cause stream management problems in the Murray region (AWWMWG, 2001, Guide 1).

While willows do have short-term stabilisation benefits, there are serious environmental issues associated with their presence along watercourses over the long term, including:

- Reduction in diversity of indigenous plants and animals,
- Displacement of indigenous plants (invasion & suppression of existing native vegetation), and
- Changes in watercourse behaviour (diversion of streams, bank erosion).

Not all willows in every situation are problem willows and each situation should be approached according to its own characteristics. However, where willow trees are causing stream instability, spreading by seed or broken branches, or serving no erosion control purpose, the Albury/Wodonga Willow Management Working Group (AWWMWG) recommends their removal and replacement with native vegetation.

BMPs for Willow Control

- Contact the Department of Land and Water Conservation (DLWC) before undertaking any willow control works to find out if your stream is a 'prescribed stream', as approval is required to remove willows from these streams. DLWC staff can tell you if your stream is classed as 'prescribed', and are available to assist in planning and offer advice regarding control methods suitable for your situation.
- Start from the top of your stream and work down to prevent re-infestation from willows upstream. Work with your neighbours to achieve better results for all.
- Undertake your willow control program in a staged or gradual manner and always include a native revegetation plan. (Indiscriminate removal can lead to further stream instability and decrease water quality).
- Obtain a set of Willow Guides from the DLWC, Albury. A detailed description of management and removal methods are contained in Guide 5 (Willows Along Watercourses: managing, removing and replacing), including organic methods, stem injection, cut & paint, hand pulling and foliar spraying.
- If employing a method that requires using herbicides, ensure you adhere to label instructions, follow OH&S procedures, and only use registered herbicides approved for use near waterways (eg a glyphosate herbicide).

  To be effectively absorbed and transported around the willow, herbicide must be applied **immediately** (i.e. within a matter of seconds) after cuts are made or the tree lopped.
- Always leave willow roots undisturbed to reduce streambank erosion and to bind soil while native vegetation establishes to replace the removed willows.
- Always undertake follow-up visits to ensure successful treatment and to pick up any broken twigs that may be regenerating.

Some Environmental Impacts of Willows

Deciduous - Timing of dense shading and leaf fall suppresses indigenous understorey vegetation and much river fauna. Heavy leaf fall in autumn creates a huge nutrient flux, which can adversely affect water quality and starve the aquatic system of food throughout the rest of the year.

Dense mat-forming roots - Roots and foliage encroaching into the stream trap silt and debris, building up the streambed and directing flows into banks causing erosion. Streams with willows tend to become wider and shallow over time, exacerbating flooding. Roots generally suppress growth of indigenous plants.

Ability to spread - Willows spread prolifically, both vegetatively from broken off twigs rooting downstream and by seeding between different willows. They are highly invasive and have earned the status of an 'environmental weed'.

Lack of predators - Few insects use willows leading to fewer insectivorous birds and fewer insects dropping into streams for the aquatic food web. Lack of predators gives willows an advantage over native vegetation.

Monoculture-forming - Ability to dominate entire sections of streams reduces biodiversity, accessibility and the intrinsic Australian 'sense of place' provided by native flora.

Shed few large branches - Provides poor habitat for hollow-dwelling animals and few snags for snag dependant fish. Branches that do fall rot quickly or take root.

Flowering - There are no records of nectar-feeding birds using willow flowers, only introduced honey-bees.

High maintenance cost - Removal and control works are a major expense for River Management Authorities.

Water use - Willows can dry out swamps and streams by using more water or having higher transpiration rates than native species.

Adapted from AWWMWG, 2001, *'Guide 3: Willows along watercourses: their impact compared to natives'.*

3. Control Pest Plants and Animals in Riparian Areas

Pest plants (weeds) and animals affect both habitat and wildlife. Weeds directly replace native vegetation by taking up space and using nutrients that would otherwise be used by native vegetation. They provide habitat more favoured for introduced animals, altering the balance against native animals, and some even produce chemicals that inhibit the germination of other plants. Introduced pest animals, such as hares and rabbits, eat off regenerating seedlings, while foxes, cats and wild dogs kill native animals. In-stream pests, such as aquatic weeds and carp, can also upset the natural balance and degrade overall stream health.

In Australia, the cost of pest animals and plants to the agricultural sector, in terms of control and lost agricultural production, is enormous. Streams and creeks can provide a means of transport for some weed seeds. It is important to implement appropriate weed control programs in riparian areas to preserve biodiversity and reduce their spread into agricultural areas.

BMPs for Pest Plant and Animal Control

- Use an Integrated Weed Management (IWM) approach to reduce costs and reliance on herbicides. Successful IWM requires long-term planning; knowledge of the weed's biology and life cycle, and appropriate weed control methods. Methods may include controlled grazing by stock/goats, herbicide control, biological control, fire, mulching, slashing, hot water application or cultivation.
- Consult your Shire Council Weeds Officer, nearest Rural Lands Protection Board (RLPB), NSW Agriculture or Greening Australia office for advice on suitable pest plant and animal control programs.
- Regularly monitor weed growth and pest animal presence along streams to allow early detection. It is far easier to tackle the problem when it is small than it is to address an infestation or large pest population that has had time to become established.

4. Manage Stock in the Riparian Zone

Uncontrolled stock access to riparian areas has many impacts. Livestock can contaminate streams through direct inputs of urine and manure, leading to raised nutrient levels and blue-green algae outbreaks under the right conditions. Stock excrement is also a source of disease-causing bacteria and viruses, which can affect stock drinking downstream. Overgrazing and trampling of streambanks and vegetation leads to bare patches of soil susceptible to colonisation by weeds, loss of vegetation, pugging of the soil at the waters edge and contributes to loss of land through instability and erosion of banks.

Integrating an approach of controlled stock access to the riparian zone into farming systems can have significant environmental and economical rewards. Placing fences a fair distance from the top of the bank should not make a difference to grazing returns if using the fenced riparian zone for future controlled grazing.

BMPs for stock management in the riparian zone

- Fencing is the easiest way to control stock access to the riparian zone. Make the buffer width large enough to treat the area as a 'small paddock'. Include a gate, and where possible, vehicular access for weed control. Consider using drop fences or electric fences in areas susceptible to flooding, and hanging fences to stop stock moving up and down streams with steep banks,
- A width of at least 25m either side will also benefit biodiversity and the vegetation that filters contaminants and traps sediment in run-off. It should also reduce the number of turns in the fence, reducing the number of end-assemblies required, and hence the capital cost.

- Provide alternative stock watering points away from the stream (eg, trough or dam). If this is not possible, provide designated access points to the stream on the inside of bends or on straight stretches of the stream where the bank is gently sloped. Never locate access points on outside bends as these areas are more susceptible to erosion. Reinforce the slope with materials such as compacted gravel or logs to form a walkway and protect the surface from erosion.
- Seek advice from RLPB, Greening Australia or NSW Agriculture staff to implement an appropriate grazing regime that tailors timing, intensity and duration of grazing to suit your management objectives.
- Enhance existing native vegetation and/or revegetate the fenced area. See Section 1 for more information.

5. Stabilise Streambanks

It is important to recognise that erosion of stream beds and banks is a natural, essential process which has been accelerated since European Settlement. Vegetation will not stop all erosion, but the key to controlling erosion with vegetation is to closely match the vegetation characteristics to the erosion processes that are occurring. The three main types of erosion that occur on streambanks are sub-aerial, slumping and bank scour.

Types of streambank erosion

Sub-aerial Involves loosening of soil on the streambank, which is then susceptible to being washed away.

Scour Involves the force of stream flow exceeding the bank's ability to withstand those forces.

Slumping Involves blocks of banks collapsing as a result of undercutting or structural weaknesses.

Sometimes vegetation alone will not be sufficient to control streambank erosion, in which case engineering solutions and/or rock work may be required. DLWC staff should be able to provide advice suitable for your situation.

BMPs for stabilising banks using vegetation and by limiting stock access

- Stabilise any streambed erosion before undertaking streambank stabilisation, as active streambed erosion can impact on streambank works. Seek professional advice if you are considering large-scale erosion control works along watercourses, such as timber groynes or concrete or rock flumes.

- Fence and restrict stock grazing in riparian areas. Often just getting the groundcover back after taking stock out is one of the largest contributing factors towards restoring bank stability. Preventing stock from trampling banks and loosening soil will also assist groundcover re-establishing on degraded banks.
- Restore native riparian vegetation - see Section 1 above.
- For Sub-aerial Erosion - Restrict stock access to reduce trampling impacts and restore vegetation cover to stop other loosening processes that cause subaerial erosion, such as rain impact, frost and wind. Vegetation also reduces the speed and erosive effect of water flowing along the bank.
- For Bank Scour - Restore flexible shrub and water plant species, such as *Phragmites australis* (Common Reed), along the toe of the bank to stop suspended particles in the flowing water from scouring away the bank. These plants lie against the bank in times of high flow and floods, physically protecting the bank. After flows subside, they return to their upright position. Roots also play an important role in binding vulnerable soils in the water's edge zone.
- For Slumping - Restore a mix of plants with fine roots and plants with deep roots to reinforce banks. Vegetation also uses water which could otherwise saturate banks and cause them to slump under the weight.
- Retain large woody debris (snags) as they can be an important control in bed and bank erosion as well as providing essential habitat for river dwelling organisms. Only in extreme circumstances do logs need to be moved or removed. If re-alignment is deemed necessary, move to an angle of 20-40° to the streambank.

6. Maintain Water Quality

High quality water is one of the most precious (but often overlooked) resources in the Upper Murray area. It provides a safe, healthy source of water for human, domestic, industrial and environmental use. The streams and rivers in the Upper Murray form the headwaters of the River Murray system. Activities in upper sub-catchments that affect water quality can have repercussions along the entire length of the river to its mouth at South Australia. Efforts to improve or maintain good water quality in the Upper Murray can benefit others downstream as well as the immediate catchment.

Streams can be polluted by sediments (soil particles), nutrients (eg phosphates and nitrates), chemicals (herbicides, pesticides, oil & road residues), salt, organic matter, faecal pathogens and bacteria from stock excrement, and algae. Even cold water releases from dams affect aquatic systems by disrupting temperature based triggers for breeding in some species. Good management of the riparian zone can help to preserve water quality and reduce contamination of waterways.

BMPs for maintaining water quality

- Minimise the movement of pollutants into watercourses by filtering run-off before it reaches streams. Riparian vegetation filters sediments and nutrients contained in overland flow.
- Minimise spray drift and time fertiliser application to avoid periods of intense run-off. This will also be more economically efficient.
- Rehabilitate and manage wetlands - Wetlands are effective nutrient filters and reduce the movement of nutrients into waterways. They mitigate flood waters, encourage wildlife and fish breeding, and can play an economic role by contributing to tourism and recreational activities.
- Implement effluent storage and recycling systems in dairying enterprises.
- Fence and revegetate riparian zones - This stops direct inputs of stock manure and urine, helps control light and temperature in streams (which can assist in the control of algae and nuisance aquatic plant growth), helps stabilise banks and limits sediment contribution from eroding banks, reduces siltation further downstream and filters sediment and contaminants from surrounding landuse.
- Remove willows from waterways - Willows are deciduous and their massive leaf drop in autumn can reduce water quality by overloading the stream with organic matter. This also means that the stream system is starved of food for the rest of the year. See Section 2 above for more information on willows.
- Monitor stream health by joining programs such as Streamwatch that monitor macroinvertebrates (water bugs). The presence or absence of certain species can indicate whether your stream is healthy or degraded.

DISCLAIMER.

Information contained in this publication is provided as a guide only. Obtain professional advice before undertaking riparian works.

References and Further Reading:

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Guide 1: Willow identification guide
Guide 2: Willows along watercourses: an introduction
Guide 3: Willows along watercourses: their impact compared to natives
Guide 4: Watercourse revegetation using indigenous plants
Guide 5: Willows along watercourses: managing, removing and replacing

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FS1 - Managing riparian land
FS2 - Streambank stability
FS3 - Improving water quality
FS4 - Maintaining in-stream life
FS5 - Riparian habitat for wildlife
FS6 - Managing Stock
FS7 - Managing woody debris in rivers
FS8 - Inland rivers and floodplains
FS9 - Planning for river restoration
FS 10 - River flows and blue-green algae
FS 11 - Managing phosphorus in catchments

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NOTES