

A man wearing sunglasses and a dark shirt is kayaking on a river. He is holding a red paddle. The kayak is red and has "Sevylor RIVER X10" written on it. The background is a dense forest with green and brown foliage. The water is calm and reflects the surrounding trees.

7

Recreational use of waterways

Enjoying the Glenelg River.
Photographer: Johanna Slijkerman

Recreational use of waterways

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What are the issues with existing arrangements?

The social and economic values that waterways provide should be more comprehensively considered in waterway management planning and management activities. In some cases, managing for social values (such as recreational fishing) can conflict with managing for environmental values (such as threatened native fish populations). Recreational use of lakes, reservoirs and storages can be affected by periods of drought so clear roles and responsibilities need to be defined for management during these times.

What improvements does the Strategy make?

For recreational use of waterways the Strategy will:

- encourage and support community involvement in waterway planning for, and management of, recreational use of waterways
- acknowledge the importance of waterways for recreation and promote sustainable recreational use
- manage risks associated with recreational use of waterways through guidelines, protocols and education.

7.1 Context

Victoria's scenic and diverse waterways provide vital opportunities for communities to engage with the natural environment and enjoy water-based recreational activities such as fishing, waterfowl hunting, swimming, canoeing, rowing, sailing and motor-boating.

There are also many recreational activities that occur beside waterways such as walking, hiking, cycling, picnics and viewing native plants and animals. Coastal waterways, like the Gippsland Lakes system, are a magnet for thousands of local and interstate visitors during the summer months. These iconic waterways, and the recreational and tourism opportunities they provide, deliver significant benefits to the well-being of individuals and to regional economies. In more remote parts of Victoria, waterways in near natural areas provide opportunities for recreational fishers and bushwalkers to enjoy fishing, hiking and camping along small mountain streams. Recreational activities (or access to waterways for recreational purposes) are also common on riparian land along waterways (see Section 9.3.7).

It is important that the condition of Victoria's waterways is maintained or improved to ensure that valuable recreational opportunities persist into the future. Fish populations, particularly native species, often cannot survive without appropriate habitat or water quality. Tourists and locals cannot swim or enjoy waterways when there are persistent algal blooms.

The *My Victorian Waterway* survey (see Chapter 2, Box 2.1) found that recreational users of waterways have very high aspirations for waterways. It is clear from this that recreational users understand that healthy waterways are vital to support the recreational opportunities they enjoy. Recreational users are important stakeholders in waterway management. The Victorian Government will encourage and support their involvement in waterway planning and management as part of the broader commitment to work together with relevant stakeholder groups on waterway management issues.



Fishing is enjoyed by many Victorians. Courtesy Parks Victoria

7.2 Recreational fishing

7.2.1 Improving waterway condition to support fish populations

Recreational fishing is an activity enjoyed by many people in Victoria and it makes an important contribution to the Victorian economy. A study in 2008/09, found that 721,000 Victorians participated in recreational fishing and contributed \$825 million per year to the total Victorian Gross State Product¹. Inland fishing, including estuarine recreational fishing, was found to account for around 60 per cent of all recreational fishing activity.

Inland Victoria sustains a range of freshwater recreational fisheries in rivers and lakes. The most popular are introduced species such as trout and redfin, although anglers are increasingly targeting native species such as Golden Perch, Murray Cod and Australian Bass. All of these fish species, other than redfin, are stocked regularly by Fisheries Victoria to enhance recreational fishing opportunities for anglers. Native fish are also stocked for conservation purposes; to re-establish locally extinct populations or to boost numbers within their natural range. Yabbies and Spiny Freshwater Crayfish are also targeted by recreational fishers, but are not stocked by Fisheries Victoria. Fishing for estuarine species, such as bream and Estuary Perch, is a popular activity for those enjoying coastal holidays.

Fishing has always been an integral part of the cultural and economic life of Victorian Traditional Owners. Fishing provided, and continues to provide, not only sustenance and trade but also a strong connection to Country (see Chapter 6). The Victorian Government recognises Aboriginal customary fishing as unique and separate to recreational fishing and is committed to working together with the Aboriginal community to sustainably manage fish resources in freshwater and saltwater Country. The Victorian *Aboriginal Fishing Strategy*² focuses on achieving protection and recognition of Aboriginal customary rights, sustainable fisheries management in collaboration with Aboriginal communities and better economic opportunities for Aboriginal people in fishing and related industries.

Victoria's inland waters have been impacted by human use and the degraded environmental condition of many waterways has adversely affected recreational fishing. Over the last decade, this impact has been exacerbated by the long period of drought and may be further affected given the potential impacts of climate change. Recreational fishing is highly dependent on the environmental condition of waterways. This means that there are mutual interests in recreational fishers working with waterway managers and other resource management agencies to support works that improve connectivity, water quality, water regimes and instream habitat. Recreational fishers spend considerable time on Victorian waterways and their interest and advocacy for river restoration is growing. Programs that bring together governments, recreational fishing groups and regional waterway managers are increasingly popular and often have a strong focus on improving fish habitat. The Fish Habitat Network is one example that brings together organisations and individuals that are dedicated to 'making more fish naturally by rehabilitating fish habitat'.

7.2.2 Responsibilities for managing freshwater and estuarine fish in Victoria

The Department of Environment and Primary Industries (DEPI) is responsible for managing the environment in which fish live. The DEPI has legislative obligations under the *Flora and Fauna Guarantee Act 1988* (FFG Act) to protect, conserve and manage threatened fauna, including native fish. Further obligations exist under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The DEPI is involved in developing and implementing Recovery Plans and Action Statements for fish listed under these Acts and also for monitoring these fish populations. The DEPIs Arthur Rylah Institute also undertakes extensive research on threatened native fish species.

In 2013, nine native freshwater fish species in Victoria were listed as being nationally threatened under the EPBC Act and 19 species (and one native fish community) were listed as being threatened under the FFG Act. The conservation status of many of our native fish, and hence the DEPIs legislative responsibilities, requires action to support native fish and implement recovery actions. Victorian communities also place high value on our native freshwater fish and have strong expectations that fish populations will be well managed.

Within the DEPI, Fisheries Victoria is responsible for regulating the commercial and recreational take of fish and for the ecologically sustainable development, use and management of fisheries in Victoria in accordance with the *Fisheries Act 1995* and the FFG Act. They also work with recreational fishers to improve their recreational fishing experiences. Fisheries Victoria manage the stocking of waterways with recreational fishing species, fishing licences, the movement of fish species and protection of fish of recreational and economic importance from invasive competitors. Regulations to ensure sustainable fish populations include setting limits on the size and amount of fish people can take, fishing gear restrictions and seasonal or area closures. Fisheries Management Plans have previously been developed for most catchments that sustain inland fisheries, within the broader context of the integrated waterway management framework.

Policy 7.1

The Victorian Government is committed to maintaining or improving the environmental condition of waterways to enhance native fish populations and recreational fishing opportunities. Priorities include protecting existing fish populations, restoring fish passage, environmental water management, improving instream habitat and providing strategic research into waterway condition, threatened species and impacts of invasive species.

Waterway managers and land managers will consider opportunities to work more closely with the recreational fishing sector to enhance the recreational fishing experience.

Victoria is a partner in the Murray-Darling Basin Authority *Native Fish Strategy*, which recognises that native fish populations in the Murray-Darling Basin have fallen to 10 per cent of pre-European settlement levels. The *Native Fish Strategy*³ for the Murray-Darling Basin 2003-2013 aims to increase native fish populations back to 60 per cent of their estimated pre-settlement levels, within 50-years, through a suite of key actions.

Waterway managers are responsible for implementing onground works programs (for example, fencing and revegetation, building stabilisation structures, controlling invasive species, improving public access to waterways and constructing fishways) that maintain or improve the environmental condition of waterways. They also regulate activities that could threaten native fish under the *Water Act 1989*.

7.2.3 Recreational fish species

For generations, Victorians have not only enjoyed catching native fish species (such as Murray Cod, Australian Bass and Golden Perch) but also exotic species (such as salmon, trout and redfin). Fishing for these exotic species is not only a popular hobby, but supports a large industry in regional Victoria. These exotic species are important recreational species that now permanently occur in many of our waterways. Exotic species can negatively affect native fish species by eating young or small bodied native fish, competing with native species for scarce food resources or through aggressive behaviours such as fin nipping. This means that there can be competing management priorities in some reaches where rare or threatened native fish species co-occur with exotic recreational fish species.

While protecting native fish populations remains a legislative responsibility for the DEPI, it is common for the DEPI and waterway managers to incidentally improve conditions for exotic fish species as a consequence of restoration works

aimed at providing improved condition of waterways for native fish populations. This is because all aquatic life benefits from healthy waterways, and the associated good water quality, adequate water regimes, appropriate habitat and ability to move freely up and down rivers.

Stocking of both native and exotic fish species takes place in Victoria to improve recreational fishing opportunities. Fisheries Victoria stocks approximately 2.5 million fish every year into public waters throughout Victoria for recreational fishing purposes. At the State level, the Translocation Evaluation Panel advises Fisheries Victoria on issues related to the translocation of live aquatic organisms in accordance with protocols and guidelines. Regionally, stocking is dealt with through a consultative process involving regional input from land and waterway managers and recreational fishers.

Policy 7.2

The Victorian Government aims to maintain or improve the environmental condition of priority waterways to support healthy, self sustaining or stocked fish populations, including species that are fished for recreational, customary (cultural) and commercial purposes. Within this framework, the government undertakes stocking to enhance recreational fishing opportunities and as a recovery method for threatened native fish species.

Stocking will be assessed in accordance with the *Guidelines for Assessing Translocations of Live Aquatic Organisms in Victoria* and controls specified in the *Protocols for Translocation of Fish in Victorian Inland Public Waters*, which take into account the Government's responsibilities under state and national biodiversity legislation.



Victorian's have enjoyed fishing for the Murray Cod for many generations. Courtesy Arthur Rylah Institute

Case study 7.1: Working together to save a rare native fish

In early 2013, a partnership between Government agencies, recreational fishing groups and scientists was instrumental in saving a rare alpine fish in danger of extinction.

Parks Victoria, the Department of Environment and Primary Industries' Arthur Rylah Institute (ARI), West Gippsland Catchment Management Authority, VRfish and the Australian Trout Foundation co-operated on a project to protect the tiny Shaw Galaxias.

It is estimated that just over 100 Shaw Galaxias remain in the wild, in only a short section of a single small creek in the upper reaches of the Macalister River catchment in the Alpine National Park. Their habitat was previously protected from introduced trout by several natural barriers (for example, rocks and waterfalls).

Severe storms and floods in 2010 and 2011 allowed trout to move upstream into the Shaw Galaxias' habitat, quickly limiting them to a 300-metre reach of a 30-centimetre-wide creek. Surveys in May 2012 showed a dramatic decline in the numbers of Shaw Galaxias as a result of the trout moving into their habitat.

To protect the species, several temporary and permanent barriers were installed to stop trout moving further upstream into the remaining habitat of the Shaw Galaxias. "Electro-fishing" was then used to catch more than 700 trout in the creek above the barriers and move them safely downstream.

This series of simple onground activities, undertaken as a partnership between key agencies and interest groups, provides a vital step towards securing the future of the Shaw Galaxias.



The rare Shaw Galaxias. Photographer: Rudie Kuiter



Artificial barrier installed to protect the Shaw Galaxias from introduced trout. Photographer: Michael Nicol

7.3 Recreational duck hunting

Recreational duck hunting is an important social activity in regional Victoria for both local communities and interstate or overseas visitors.

Recreational duck hunting is a popular water-based recreational activity that contributes to local economies through expenditure on licences, equipment, accommodation and travel. It also provides an opportunity to obtain wild game for food. Duck hunting is allowed in wetlands on private land with the owner's permission, in State Game Reserves and some other types of public land.

There are approximately 25,000 licensed duck hunters in Victoria and most are aware of the need to protect native biodiversity and preserve habitat for native wildlife. Opportunities for recreational duck hunting rely on the good environmental condition of waterways. Without appropriate habitat or water quality, these game species may not occur or only be present in low numbers that do not provide hunting opportunities. However, there are many different opinions about duck hunting in wetlands, with some groups opposed to any hunting in wetlands. Other groups are supportive of sustainable levels of duck hunting.



Dowds Morass State Game Reserve provides habitat for many game and non-game bird species. Courtesy West Gippsland CMA

7.3.1 Ensuring recreational duck hunting is sustainable

Regulation of hunting under the *Wildlife Act 1975* aims to ensure that game hunting is sustainably and ethically managed and has minimal impact on non-game species. Regulations allow for the declaration of an open season, restrictions on hunting times, bag limits and hunting methods and the prohibition of the use of lead shot. Provisions exist for the closure of wetlands to duck hunting to protect non-game species. Many initiatives have been put in place over the last two decades to improve the management of duck hunting. These include hunter education programs to improve waterfowl identification skills and encourage ethical hunting. Duck hunters must also be licensed and pass a Waterfowl Identification Test. An independent Game Management Authority is being established to improve the effectiveness of game management and promote responsible game hunting.

Waterfowl surveys and scientific information on waterfowl populations are important in the management of each duck hunting season to ensure that harvesting levels are sustainable, taking into account the prevailing environmental conditions. In 2009, the Victorian Government, Field and Game Australia and the Sporting Shooters' Association of Australia (SSAA) funded a panel of scientific experts to develop a framework for the sustainable harvest of waterfowl in Victoria.

Following the recent floods across Victoria, wetland availability and waterfowl numbers across Victoria increased dramatically and provided excellent hunting conditions for the 2011 duck hunting season. Over 130 (then) Department of Sustainability and Environment, Parks Victoria and Victoria Police officers actively monitored and enforced duck hunting on more than 20 major wetlands across the state on opening weekend of the 2011 season. The vast majority of hunters on monitored wetlands were compliant with regulations.

Policy 7.3

The Victorian Government will continue to support sustainable levels of duck hunting in wetlands. These activities will be managed and monitored in accordance with the *Wildlife Act 1975* and the *Managing duck hunting in Victoria* manual (2011).

7.3.2 Habitat conservation and game management

Many game hunting organisations have a long history of working to conserve habitat and restore wetlands. Hunting groups can assist with the management and conservation of waterbird species in Victoria by erecting nest boxes, restoring degraded wetlands, controlling invasive species and working with State wildlife authorities and other groups on monitoring and survey projects. Field and Game Australia has been active in the restoration of wetlands, such as the Heart Morass in Gippsland and has provided input to the management of wetlands and environmental watering. There is scope to strengthen the role of game hunters in game management by improving co-ordination of conservation and game management efforts.

On private land, Property Based Game Management (PBGM) programs encourage landholders to increase habitat for game species on their properties.

The programs aim to:

- increase biodiversity across the Victorian landscape
- provide opportunity for the Victorian farming community to manage game species on their property
- provide hunting opportunities for licensed hunters across Victoria through the enhancement of game species.

Through PBGM, landholders will have access to expert information and advice on management practices that will enhance game species and increase biodiversity on their properties. Landholders are connected to responsible hunters to assist them with activities such as feral animal control, population management and onground conservation works.

Policy 7.4

Co-operative management arrangements with hunting organisations for game and habitat management on State Wildlife Reserves and other appropriate land categories will be encouraged and supported.

Property Based Game Management programs on private land will continue to be supported.

The Victorian Government will continue to work with recreational game hunting organisations to improve opportunities for access and input into habitat management, where appropriate.



Nesting boxes at Macleod Morass, erected with the assistance of hunting groups, as part of wetland conservation projects. Courtesy DEPI

7.4 Recreational use of lakes and reservoirs

7.4.1 Managing storage levels

Water storages in open catchments (that is, accessible to the public) often provide important recreational opportunities for local communities, in addition to their primary function of storing water for irrigation, stock and domestic purposes. Local, interstate and international visitors to Victoria enjoy experiences on and in the water (such as motor boating, sailing, swimming and rowing) and beside the water (such as picnicking, camping and walking). These recreational opportunities provide flow-on economic benefits to regional communities but require ongoing management to ensure that the values of these areas are protected into the future.

Lakes and reservoirs that are used for recreational purposes are generally managed by water corporations and/or by voluntary committees of management (where they are Crown land reserves). In some cases, water corporations may develop specific management plans for individual lakes. It is important for recreational users to understand that these areas are often primarily managed for water storage and/or supply and that recreational opportunities are opportunistic and must not affect public health issues, such as maintaining the quality of domestic water supplies. However, there may be opportunities for recreational users to participate in decision making to try to ensure recreational opportunities are maximised where possible.

Although many lakes across regional Victoria have a long history of recreational use, infrastructure upgrades across Victoria have made some water storages redundant for their original purpose of water supply. These storages are often the focus of intense community lobbying to maintain water levels for recreational purposes. In limited cases, a specific entitlement for recreational water is available. However, in the majority of cases there is no water entitlement for recreational purposes. Environmental water entitlements may be used to provide secondary social benefits. However, their primary purpose is to maintain environmental values (see Section 8.4.4 for specific policy on this issue).

7.4.2 Agency roles and responsibilities for drying lakes

Until recently, Victoria faced prolonged drought conditions that saw many lakes across Victoria become partially or completely dry. In regional Victoria, these lakes are often the social and economic hub of small towns and their reduction or loss can be felt very deeply by local communities (see Case study 7.2). As a lake dries, some natural events and processes may pose risks to human health and the environment, or have social and economic impacts. Common occurrences during periods of lake drying include fish deaths, blue-green algae blooms, growth of weed species, loss of recreational opportunities, development of insect swarms and illegal access by stock or vehicles.

The drying of lakes can therefore cause strong emotional responses from individuals and communities. There are often significant differences in opinion as to what actions should be undertaken and how lakes should be managed now and into the future. Although the pressure eased with the high rainfall events of 2010–2011, it is important to be prepared for the next dry period. Therefore, the need to accurately identify responsible agencies for issues associated with drying lakes remains a management issue. It is also important for waterway managers to raise awareness within communities that dry periods are a natural occurrence for many lakes in Victoria.

Many different agencies have responsibility for various aspects of lake management and these roles and responsibilities have often been unclear to communities in the past. In response to this issue, and the prolonged drought conditions across Victoria over much of the past decade, the (then) DSE initiated the Drying Lakes project in 2008. This project brought together a range of agency experts and lake community members to form an agreed approach to future planning for lakes on Crown land that have the potential to remain dry in the long term.

The outcome of the Drying Lakes project was a tool that assists with the way drying lake queries are handled by the different management agencies and provides clarity around the agencies' roles and responsibilities. The *Guide to agency management of drying lakes in Victoria* (2010) lists a range of issues associated with drying lakes, agency and private landholder responsibilities, the legislative basis for those responsibilities and potential management responses and treatment options.

Policy 7.5

The Victorian Government will manage drying lakes in accordance with the *Guide to agency management of drying lakes in Victoria* (2010).

The preferred management approach is to allow lakes to adjust to drying conditions with no or minimal intervention. Actions to deal with social, economic or environmental issues that may arise as a consequence of lakes drying will require the consent of designated land managers and appropriate authorities.

Case study 7.2: Drying of Lake Colac: community and agency responses

Lake Colac is the largest freshwater lake in Victoria and one of the defining geographic features of the Colac Otway Shire. The lake is valued for the recreational, environmental and economic opportunities that it provides. It is home to the Colac Yacht and Rowing Clubs. Provision of parking and camping areas, picnic tables, barbecues and boat ramps make the foreshore publicly accessible for a number of uses. However, a period of drought conditions between 1997 and 2009 saw water levels decline so dramatically that all water-based activities on Lake Colac ceased.

As the condition of the lake deteriorated during this dry period, many of the values associated with the lake were lost. Environmental stress became severe and had flow-on economic and social effects that were widely felt throughout the region. Over the summer of 2008-2009, Lake Colac dried out completely. The yacht club abandoned its regattas, losing its major source of income, fewer visitors used camping facilities and recreational and commercial fishing ceased. The mass death of over 300 tonnes of carp caused major concerns for the local community and severely affected on the amenity of the area.

Community concern about the perceived threat of increased fire hazard from native Fairy Grass invading the dry lake bed was also high. Many individuals and

groups saw the dry lake as an opportunity to address some of the long-standing problems contributing to the lake's generally poor environmental condition and to restore and enhance the values of the lake.

As one of the numerous agencies having responsibility for the management of the lake, the local government took the lead to address and reduce the significant impacts on the local community. A Dry Lake Working Group was developed with representation by local residents, Councillors and numerous expert agencies. This group took a collaborative approach to determining appropriate and feasible actions to reduce immediate risk to human safety and improve environmental condition and opportunities for recreation. They also planned for future responses and responsibilities for managing Lake Colac through periods of low water levels.

With increased rainfalls the lake has partially refilled, alleviating many of the concerns held by the community and lake and land management groups. With rising water levels, the lake is beginning to see the return of some boating and fishing activities. There have been many other benefits from the partially full lake, such as growth of extensive grassy areas along the lake shores that have provided a haven for breeding water birds.



Recreation on Lake Colac stopped when water levels dramatically declined. Photographer: Alison Pouliot

7.5 Recreational boating

Victoria's waterways (particularly lakes and reservoirs) provide opportunities for canoeing, kayaking, rowing, sailing, motor boating and associated activities such as water skiing. Recreational and commercial vessels operate on many of Victoria's waterways and their use is regulated under the *Marine Safety Act 2010*.

Marine Safety Act (MSA) waterway managers (see definition in Chapter 1, Box 1.2) can make rules regulating the operation of vessels and persons using the waterways. Regulations may include permanent waterway rules regarding speed, special activity areas and prohibited activities. MSA waterway managers can also regulate events occurring on waterways

In many locations across Victoria, boating activities are an important economic driver for local towns and communities. These recreational opportunities can be compromised when water levels drop during dry periods and hazards such as logs and branches are exposed. Conversely, increased water levels from floods can wash additional timber into waterways that may pose a threat to boating activities. Recreational boating on waterways can have negative effects on the condition of waterways, for example, waves caused

Policy 7.6

Large woody habitat will not be removed from waterways unless it is demonstrated to be a serious threat to human health or safety because it occurs in a high use area. Where this has been demonstrated, the option of realigning the large woody habitat will be investigated to retain the environmental benefits within the waterway.

Marine Safety Act waterway managers will work with Transport Safety Victoria to identify risks to safety for recreational boating that may arise from instream works, where required.

by powered boats may contribute to bank erosion and the removal of large woody habitat from waterways, to reduce hazards for recreational boating, can be detrimental for native fish populations. These effects need to be carefully managed to ensure that the environmental condition of waterways is maintained and that the multiple values of waterways are not compromised. Some management activities may be mutually beneficial for waterway condition and recreational boating, for example removing invasive aquatic weeds or works to improve water quality.



Boating on Barmah Lake. Photographer: Keith Ward

7.6 Managing the impacts of recreational activities

The *My Victorian Waterway* survey (see Chapter 2, Box 2.1) found that the most frequently mentioned use of waterways was simply for ‘enjoying the scenery’, followed by enjoyment of native plants and animals and activities such as walking, hiking, cycling, picnics and barbeques.

However, there can be risks to waterways that are associated with these and other recreational activities. Impacts associated with recreational activities can include trampling of vegetation, dispersal of weeds, impacts on species habitat and bank erosion. These risks may be intensified for waterways in urban areas where population density is higher and people regularly use and enjoy waterways for recreational and social purposes (see Section 14.1.1). Managing access to waterways is a critical component to reducing the impact from recreational activities, particularly for sensitive ecosystems such as wetlands.

For example, the construction of raised boardwalks in wetland areas can minimise vegetation trampling and erosion and also ensure that visitors and their pets are kept at a suitable distance from bird breeding sites. In some catchments, community access may be restricted to ensure that the quality of drinking water supplies is protected. Management of waterway access also provides opportunities for connecting with the community and providing information about the functioning of waterways, or the importance of local onground works through the use of interpretive signage.

Policy 7.7

Where recreational activities occur that may affect waterway condition, the relevant waterway manager or land manager will identify and work with recreational users to manage those risks.



Boardwalks help manage impacts of recreational activities at Kinnairds Swamp. Photographer: Keith Ward



8

Environmental water management

Budgee Creek. Photographer: Shar Ramamurthy

Environmental water management

Guide to the chapter

8.1 Overview – managing Victoria’s environmental water

- Securing water for the environment
- Guiding principles for environmental water management
- Roles and responsibilities for environmental water management
- Interactions with the Australian Government and Murray-Darling Basin Authority

8.2 Adaptive and integrated management of environmental water

8.3 Providing water for the environment

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- Recovering water for the environment

8.4 Managing environmental water entitlements

- Planning processes for the use of environmental water
- Integration of Commonwealth and State planning processes and environmental watering in Victoria
- Criteria for prioritising use of environmental water
- Considering social and cultural values in the use of environmental water entitlements
- Costs of managing environmental entitlements

8.5 Efficient and effective use of environmental water

- Tools for achieving efficient and effective use of environmental water
- Use of alternative sources of water for environmental purposes

8.6 Managing risks associated with environmental watering

- Management of risks relating to delivery of large volumes of environmental water
- Management of risks relating to water quality

8.7 Maintaining environmental water availability

- Maintaining other types of environmental water
- Management of unregulated systems
- Better defining environmental water needs of groundwater-dependent ecosystems

8.8 Continual improvement of environmental water management

- Research to support environmental water management
- Monitoring and reporting

What are the issues with existing arrangements?

Planning arrangements for environmental water management need to be clearly outlined, including roles and responsibilities for the Victorian Environmental Water Holder, waterway managers, the Murray-Darling Basin Authority and the Commonwealth Environmental Water Holder.

Major water recovery initiatives in Victoria are completed or well underway and the focus is now on efficient and effective use of existing environmental water.

More work is required to ensure better management of groundwater-dependent ecosystems.

What improvements does the Strategy make?

For environmental water management the Strategy will:

- reaffirm Victoria’s approach to managing environmental water, in recognition of the advances that have been made in recovering water for the environment and establishing robust frameworks for its management
- clarify the roles, responsibilities and relationships between waterway managers, the Victorian Government, the Victorian Environmental Water Holder and the Commonwealth Environmental Water Holder, as well as Victoria’s interaction with the Murray-Darling Basin Authority and Murray-Darling Basin Plan
- provide policy direction to address complex environmental water management issues, such as considering social and cultural benefits that are supported by environmental water
- describe tools to achieve more efficient and effective use of existing environmental water
- outline actions to reduce risks to environmental water availability
- identify and manage groundwater-dependent ecosystems
- support research and monitoring to improve knowledge about the ecological outcomes of environmental water use.

8.1 Overview – managing Victoria's environmental water

Water in Victoria's rivers, estuaries and wetlands is vital to support environmental values and as a resource for people, agriculture and industry.

Historically, high levels of water extraction for people, agriculture and industry (consumptive uses) often resulted in changes to natural water regimes and insufficient water available to maintain the condition and environmental values of waterways. Considerable effort has been made to achieve a better balance between water for consumptive uses and water for the environment. Victoria has undertaken significant work since 2005 to set aside water specifically for the environment, referred to as the Environmental Water Reserve (EWR) (see Section 8.1.1). The focus for the next eight years is on innovative ways to improve how that environmental water is managed.

The efficient and effective management of Victoria's environmental water is crucial to protect and improve waterway condition. Environmental water management has evolved rapidly in the past decade with the following key developments:

- a shift from environmental water with limited management opportunities to large-scale management of an increased number of specific environmental water entitlements
- innovative solutions for managing environmental water more efficiently, developed during the severe drought period, which has added to the complexity of environmental water management decisions
- emergence of environmental water management as an issue of national importance, with the Australian Government taking on a significant role in managing environmental water
- improvements to the transparency and efficiency of the institutional framework for environmental water management, notably, the establishment of the Victorian Environmental Water Holder (VEWH).

Making the most efficient and effective use of environmental water is also important because it will reduce the need to recover more water for the environment now and into the future.

Values of environmental water

Environmental water supports many values such as native plants and animals, habitat features such as drought refuges and is also vital to maintain the condition of important waterways with formally recognised significance, such as Ramsar wetlands.

Environmental water is important to:

- stimulate animals such as native fish to feed and breed (for example, Murray Cod and Golden Perch need to be able to move onto floodplains to feed)
- trigger plants to seed or germinate (for example, River Red Gums need flooding for seeds to germinate)
- move carbon between rivers, floodplains and estuaries
- allow fish and plants to move throughout river systems and colonise new areas
- help restore groundwater supplies
- stabilise river banks through better vegetation growth reducing erosion into the river
- flush out the salt along river banks and floodplains.

While being described as 'environmental' water, maintaining or improving water regimes in rivers, estuaries and wetlands also provides for other benefits including recreation and tourism, protection of cultural heritage, and regional economic values (for example, water quality benefits).

Flows in Victorian rivers and estuaries are naturally variable reflecting the rainfall and runoff within their catchments. They generally comprise low flows in summer with occasional small peaks in flow after rain (fresches), which help to maintain or improve water quality. Higher winter and spring flows, including overbank flooding, re-connect isolated pool habitats, provide soil and nutrients for floodplains, as well as being vital for the breeding success of water birds, native fish, turtles and frogs.

Wetlands and floodplains typically have wetting and drying phases, both of which are important for different plants and animals. For example, wetting phases are important in sustaining the health of River Red Gum forests and providing breeding habitats for waterbirds. Drying phases help to maintain an appropriate balance of aquatic and terrestrial plants.

The key values, threats and management activities for environmental water are shown in Figure 8.1.

Threats to environmental water

Victoria's history of water extraction from rivers (via dams and other regulating structures, diversions from streams, groundwater bores and small catchment dams), and in some cases over allocation to consumptive uses, has altered the natural hydrology of our rivers, wetlands and estuaries. Water extraction, combined with the severe drought in the period 1997–2009, led to a decline in the environmental condition of many waterways, affecting environmental values such as River Red Gums along the Murray River and many native fish species.

Land use change within catchments, such as land clearing and urbanisation, has also modified the water regimes of many waterways. The potential impacts of climate change may affect future water availability and may have further effects on the environmental condition of waterways.

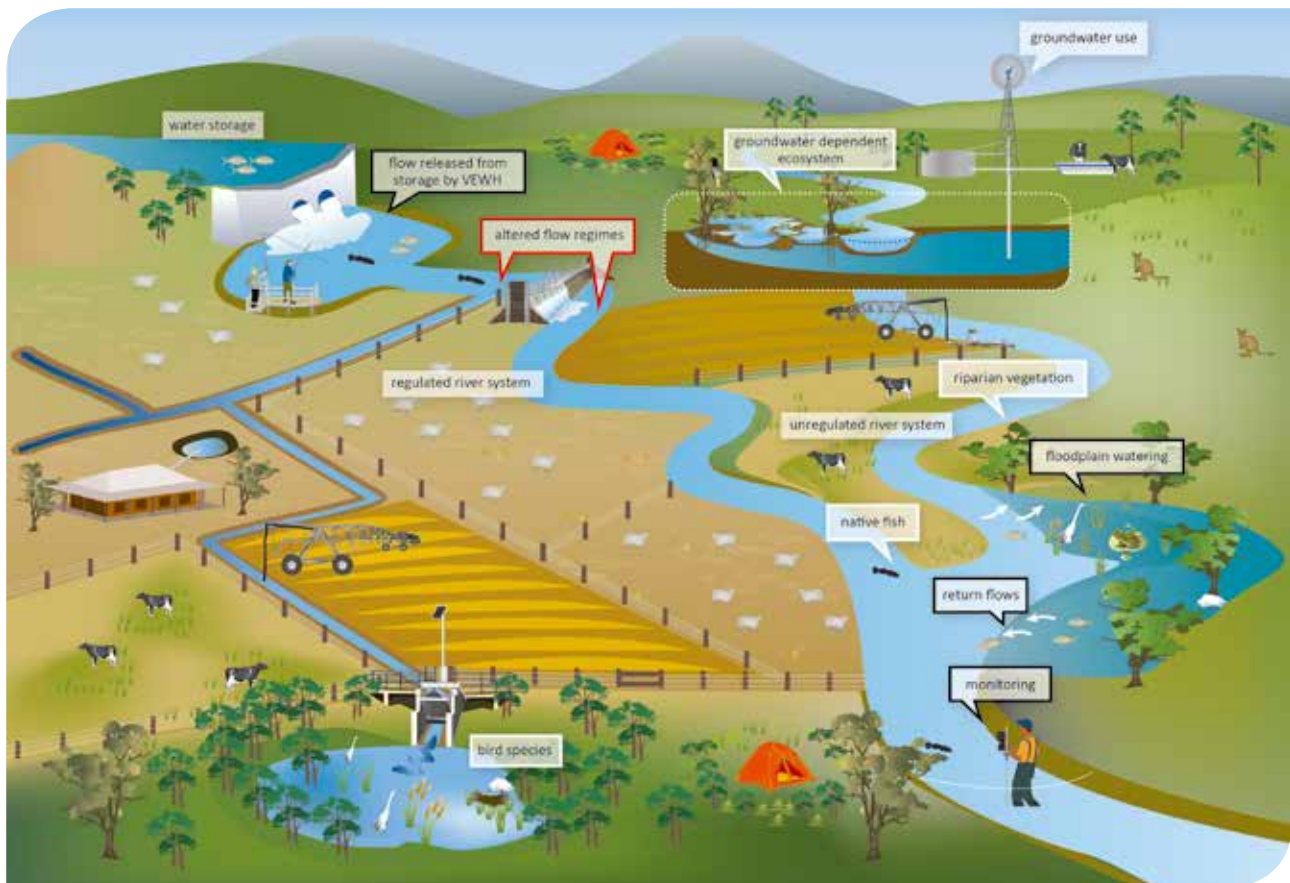


Figure 8.1: Values (white), threats (red) and management activities (black) for environmental water

8.1.1 Securing water for the environment

Environmental water in the EWR is provided in three ways:

1. **Environmental water entitlements:** a volume of water held by the environment in perpetuity. In general, the entitlements are a share of the available resource (inflows) in storages that can be released to meet specific environmental needs.
2. **Obligations on consumptive entitlements (passing flows):** the volume of water that water corporations or licensed diverters are obliged to provide out of storage or past a diversion point before water can be taken for consumptive use.
3. **'Above cap' water:** the water available above limits on consumptive volumes of surface water and groundwater. Most water available to the environment is 'above cap' water, which can be a very unreliable source of water.

In regulated systems, environmental water is set aside mainly through environmental water entitlements.

In unregulated rivers, environmental water is provided primarily through management of existing diversions via licence conditions, rostering and restriction rules.



The Messengers pumping station aims to water Hattah Lakes efficiently and maximise ecological outcomes. The Living Murray is a joint initiative funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Commonwealth governments, coordinated by the Murray–Darling Basin Authority. Courtesy Mallee CMA

Box 8.1: The Murray-Darling Basin Plan

Victoria's share of the 77,000 kilometres of rivers in the Murray-Darling Basin includes part of the Murray River and its Victorian tributaries including the Kiewa, Ovens, Broken, Goulburn, Campaspe and Loddon river systems. The Murray-Darling Basin Plan provides for the integrated management of water resources across the Basin (see Section 1.2.3) and as such forms a significant part of the framework within which waterway management in northern Victoria takes place.

The Basin Plan sets requirements for a range of issues regarding management of water across the Basin for environmental, social, cultural or economic outcomes.

Key components of the Basin Plan are:

- establishment of legal Sustainable Diversion Limits (SDLs) on surface water and groundwater diversions from 1 July 2019 onwards
- establishment of Basin-wide environmental objectives for water-dependent ecosystems and water quality and salinity objectives
- an environmental watering plan
- a water quality and salinity management plan
- requirements regarding water trade and protection of water for critical human needs
- requirements for development of water resource plans
- a monitoring and evaluation program.

The Basin Plan sets legal limits on the amount of surface water and groundwater that can be taken from the Basin from 1 July 2019 onwards. The Plan requires the recovery of sufficient water to provide environmental outcomes equivalent to those that would be achieved through recovery of 2,750 gigalitres per year.

Recognising that it may be possible to achieve the environmental benefits more efficiently, the Basin Plan allows for consideration of environmental works and measures and improvements to river operations that can secure environmental outcomes equal to those in the Basin Plan, but using less than 2750 gigalitres of held environmental water (see Section 8.3.2).

A key element of the Basin Plan is an Environmental Water Plan, which institutes a planning framework for use of environmental water across the Basin, including principles and methods for establishing priorities and making watering decisions. Decisions for the use of environmental water under the Basin Plan are made through the planning frameworks of each water holder to meet the Basin Plan's ecological objectives (see Section 8.4.2)

Victoria will work closely with the Murray-Darling Basin Authority and the Commonwealth Environmental Water Holder to implement the Basin Plan and establish arrangements and priorities for use of Commonwealth-held water in Victoria. Victoria is party to the Basin Plan Implementation Agreement, which clarifies Victoria's obligations including those related to long-term environmental water management, monitoring and reporting. Consistent with this, Victoria will be seeking to use existing state statutory frameworks to meet all related requirements under the Basin Plan.

8.1.2 Guiding principles for environmental water management

The objective of the EWR is to preserve the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and quality of water and other uses that depend on environmental condition. It is the responsibility of the holder of an environmental entitlement to manage it accordingly.

The management of environmental water in Victoria is guided by the following principles:

Integrated waterway management

- priority rivers, estuaries, wetlands and groundwater-dependent ecosystems for environmental water management will be identified through regional waterway planning processes, in consultation with the community
- environmental water management will be comprehensively integrated with complementary onground works programs for rivers, estuaries and wetlands

Maximising efficiency and seeking multiple benefits

- management will be efficient and maximise the environmental benefit achieved from the available water resources and funding; to minimise the economic and regional impacts associated with water recovery for the environment
- adverse social, cultural and economic and environmental effects will be managed and, where possible, minimised
- social and cultural benefits will be provided if possible, where this does not adversely affect environmental outcomes
- consumptive water and/or recycled water should be used to provide environmental benefits where this does not adversely affect existing users of water for non-environmental purposes

Transparent and sound decision-making

- management will be accountable and transparent, with clear roles and responsibilities for agencies and clear communication of decisions and outcomes achieved
- key stakeholders will be engaged at appropriate stages of environmental water management
- management will be based on the best available knowledge

Being prepared for future conditions

- planning will consider the full range of climate scenarios
- management will aim to address the risks of severe droughts, floods and the potential impacts of climate change, while avoiding unacceptable costs if these events do occur
- ongoing monitoring, evaluation and reporting will be used to facilitate adaptive management and continuous improvement.

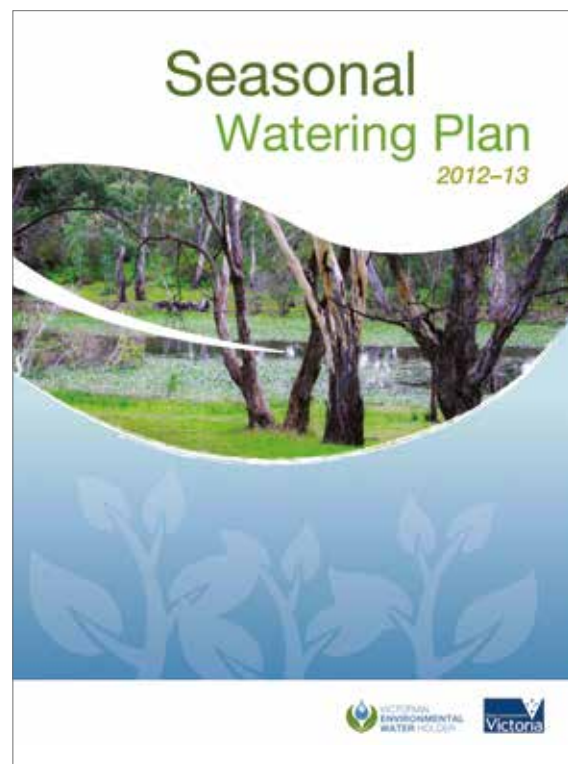
8.1.3 Roles and responsibilities for environmental water management

There are several agencies directly involved in environmental water management in Victoria (Table 8.1). Other important agencies, such as public land managers, play an important role in facilitating the delivery of environmental watering outcomes.

In 2010, the Victorian Parliament passed an amendment to the *Water Act 1989* to establish the independent Victorian Environmental Water Holder (VEWH). The VEWH took over responsibility for holding and managing Victoria's environmental water entitlements (the Water Holdings) from the Minister for Environment and Climate Change in July 2011.



Victorian Environmental Water Holder (VEWH) logo.



The VEWH annual Seasonal Watering Plan provides the blueprint for the Victorian environmental watering program each year.

Table 8.1: Roles and responsibilities for environmental water management in Victoria

Minister/Agency	Responsibilities
Minister for Environment and Climate Change	- oversee Victoria's environmental water management policy framework - oversee the VEWH, including appointment and removal of commissioners and creation of rules ensuring VEWH manages the Water Holdings in line with environmental water management policy
Minister for Water	administer the broader water allocation and entitlements framework and the <i>Water Act 1989</i>
Department of Environment and Primary Industries	- manage the water allocation and entitlements framework - develop state policy on water resource management and waterway management approved by the Minister for Water and Minister for Environment and Climate Change - develop state policy for the management of environmental water in regulated and unregulated systems - act on behalf of the Minister for Environment and Climate Change to maintain oversight of the VEWH and waterway managers (in their role as environmental water managers)
Victorian Environmental Water Holder	- make decisions about the most effective use of the Water Holdings, including use, trade and carryover - authorise waterway managers to implement watering decisions - liaise with other water holders to ensure co-ordinated use of all sources of environmental water - publicly communicate environmental watering decisions and outcomes - commission targeted projects to demonstrate ecological outcomes of environmental watering at key sites - report on management of the Water Holdings
Waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region)	- identify regional priorities for environmental water management in regional Waterway Strategies, in consultation with the community - assess water regime requirements of priority rivers, estuaries and wetlands to identify environmental watering needs to meet agreed objectives - identify opportunities for, and implement, environmental works to use environmental water more efficiently - propose annual environmental watering actions to the VEWH and implement the VEWH environmental watering decisions - provide critical input to management of other types of environmental water (passing flows management, above cap water) - report on environmental water management activities undertaken
Commonwealth Environmental Water Holder	- make decisions about the use of Commonwealth water holdings, including providing water to the VEWH for use in Victoria - liaise with the VEWH to ensure co-ordinated use of environmental water in Victoria - report on management of Commonwealth water holdings
Water corporations	- work with the VEWH and waterway managers in planning for the delivery of environmental water to maximise environmental outcomes - operate water supply infrastructure such as dams and irrigation distribution systems to deliver environmental water - ensure the provision of passing flows and compliance with management of diversion limits in unregulated and groundwater systems

Effective collaboration and communication among key agencies is essential to the success of environmental water management programs. The VEWH engages directly with waterway managers through the development of seasonal watering proposals and the development and implementation of the seasonal watering plan. The proposals and plan are provided to other water holders to ensure planning is aligned and co-ordinated. Additionally, the VEWH is involved in the Murray-Darling Basin Authority's Environmental Watering Group which is responsible for planning the delivery of The Living Murray program environmental water (see Section 1.2.3).

Community engagement is also a critical part of the environmental water management framework. It provides an understanding of what the community values about waterways and supports the planning for, and delivery of, environmental water management programs. Waterway managers also engage public land managers and storage operators to ensure that appropriate delivery arrangements are possible or in place to enable environmental watering.

Other stakeholders with an interest in environmental watering include Traditional Owners, environmental groups, recreational users, local government, other water entitlement holders, landholders and local communities. It is important that the interests and values of these groups are incorporated in planning for, and management of, environmental water.

Policy 8.1

The Victorian Environmental Water Holder will proactively seek opportunities to communicate with delivery partners and key stakeholders in the development and implementation of its environmental water management policies and plans.

Action 8.1: The Victorian Environmental Water Holder will identify and create engagement opportunities for stakeholders who have an interest in environmental watering.

Who: Victorian Environmental Water Holder.

Timeframe: 2014

8.1.4 Interactions with the Australian Government and Murray-Darling Basin Authority

As part of its role as statewide co-ordinator of environmental watering activities in Victoria, the VEWH liaises with other environmental water holders to co-ordinate delivery of their water with the delivery of Victorian Water Holdings. The key relationships for the VEWH are with the Murray-Darling Basin Authority (MDBA) and the Commonwealth Environmental Water Holder (CEWH).

The CEWH is responsible for managing the Commonwealth's environmental water holdings to protect the environmental assets of the Murray-Darling Basin. The CEWH holds the water recovered to meet the Basin Plan's environmental water recovery target. A substantial proportion of this water is held in Victorian storages. Victorian waterways benefit from its use either directly for Victorian sites, or from its delivery en route to downstream locations – such as in South Australia.

The MDBA coordinates The Living Murray (TLM) program, through which decisions are made about use of approximately 500 gigalitres of environmental water across TLM Icon sites. These include four large Victorian Murray floodplains.

Further detail on how planning and management of environmental water in Victoria is integrated across the VEWH, CEWH and MDBA is outlined in Section 8.4.

Policy 8.2

The Victorian Environmental Water Holder will co-ordinate the use of The Living Murray and Commonwealth Environmental Water Holder water entitlements in Victoria to maximise environmental outcomes.

Delivery of Commonwealth environmental water that is allocated to Victorian sites will be co-ordinated by waterway managers through the Victorian Environmental Water Holder processes under Victoria's water entitlement framework.

Each government will fund (through appropriate mechanisms) the delivery, monitoring and management of its own environmental water.



Hattah Lakes Wetlands. Environmental watering regulator gate. Courtesy Mallee CMA

8.2 Adaptive and integrated management of environmental water

Adaptive management involves learning from management activities to improve the next stage of management (see Chapter 17). It is an iterative process that requires ongoing monitoring, evaluation and reporting.

Adaptive management allows environmental managers to continuously improve knowledge and make more informed future management decisions. It can also provide the information required to periodically assess objectives and environmental values at sites.

The current adaptive management approach for environmental water will be refined by:

- adapting watering decisions to prevailing climate conditions in any year (using the seasonally adaptive approach, see Section 4.2.5)
- identifying a clear and transparent process to change environmental objectives if current objectives are no longer feasible (see Section 4.2.7).

Integrated management focuses on achieving environmental outcomes through an appropriate mix of environmental water, complementary (non-water related) onground works, and environmental works such as regulators and pumps.

This adaptive and integrated approach to environmental water management involves seven steps, which are reflected in planning documents (see Figure 8.3) within the environmental water management framework.

1. Identification of environmental (and other) values and regional priorities for environmental water management to determine river, estuary and wetland health objectives through regional Waterway Strategies (see Section 4.2).
2. Determination of the water regime required to maintain those environmental values using best-practice, scientifically-based methods and identification of shortfalls in water required to maintain environmental values (see Section 8.3.1).
3. Identification of targets for water recovery to address shortfalls in environmental water (where required) through regional Sustainable Water Strategies (see Section 8.3.2).
4. Effective and efficient planning and use of water available to the environment (see Sections 8.4 and 8.5)
5. Consideration and implementation of environmental works and measures to address shortfalls in water, assessing benefits against feasibility and cost-effectiveness (see Section 8.5.1).
6. Maximise environmental outcomes through complementary (non-water related) measures such as riparian revegetation and fencing (see Chapter 9), and the provision of fish passage (see Section 11.4.4).
7. Monitor, report and evaluate effectiveness of environmental water use.

Environmental values of waterways are reassessed periodically, informed by ongoing monitoring (see Section 8.8.2) and take into account outcomes that have already been achieved. This may result in repeating some or all of the seven steps.



Wallawalla Wetlands after receiving environmental water in 2010. Photographer: Shar Ramamurthy

8.3 Providing water for the environment

Balancing the needs of the environment and other water users continues to present challenges for environmental water management. It requires a transparent approach to identify environmental water needs to ensure any efforts for future water recovery are well-considered.

8.3.1 Identifying the required water regime

The Victorian Government's environmental flow assessment methodology (the FLOWS method) determines the water regime required to support environmental values identified for river systems. The water regime requirements are used to inform water allocation decisions. Environmental flow studies using the FLOWS method have been completed for 42 rivers across Victoria and can be found at www.ourwater.vic.gov.au/environment/rivers/flows/environmental-flow-studies

For wetland systems, similar principles will be applied to determine their required water regime. This will be captured as part of the planning and management of environmental water (see Section 8.4.1).

Less information is available about the freshwater requirements of estuaries compared to rivers and wetlands. However, it is known that the inflow of freshwater from rivers or groundwater is important for maintaining the environmental condition of estuaries. Freshwater inflows can trigger fish breeding, help to maintain an entrance to the sea, can improve water quality and maintain associated floodplains and vegetation communities. To support management decisions the Victorian Government developed the Estuary Environmental Flows Assessment Method (EEFAM), a consistent and systematic approach to determine the required water regime for estuaries. The Estuary Environmental Flow Assessment Method will be used to determine the water regime requirements of priority Victorian estuaries and to inform water allocation decisions that may affect the environmental condition of estuaries.

8.3.2 Recovering water for the environment

Increasing the share of water to the environment can affect existing water users and important economic activities, such as irrigated agriculture. In Victoria, decisions to recover additional water for the environment have been made through regional Sustainable Water Strategies (SWS's, see Section 1.2.2), which undergo a comprehensive consultation process with regional communities, water users and environmental managers. In doing so, it is also important to minimise economic and regional impacts by looking for opportunities to maximise environmental outcomes from held water.

Where it has been deemed necessary to recover water for the environment (for example, as part of the Basin Plan), the Victorian Government's strong preference has been that it occurs through water saving infrastructure projects. Upgrades to irrigation infrastructure to reduce evaporation or seepage and leakage mean that less water is lost en route through water delivery and the resulting water savings can be used to meet environmental objectives.

Water obtained through savings has been set aside in environmental entitlements. Since the creation of the EWR in 2005, the number of environmental entitlements has increased from 1 to over 20 and the volume of water provided under these entitlements will increase from 27 gigalitres to over 620 gigalitres per year.

Policy 8.3

Best practice, scientifically-based methods will be used to determine the required water regime for priority river, wetland and estuarine systems. This will include the use of quantitative data, multi-disciplinary expert panels and community-based consultative committees to identify environmental values, set environmental water objectives and specify a water regime (including wet and dry cycles where appropriate to support environmental values).

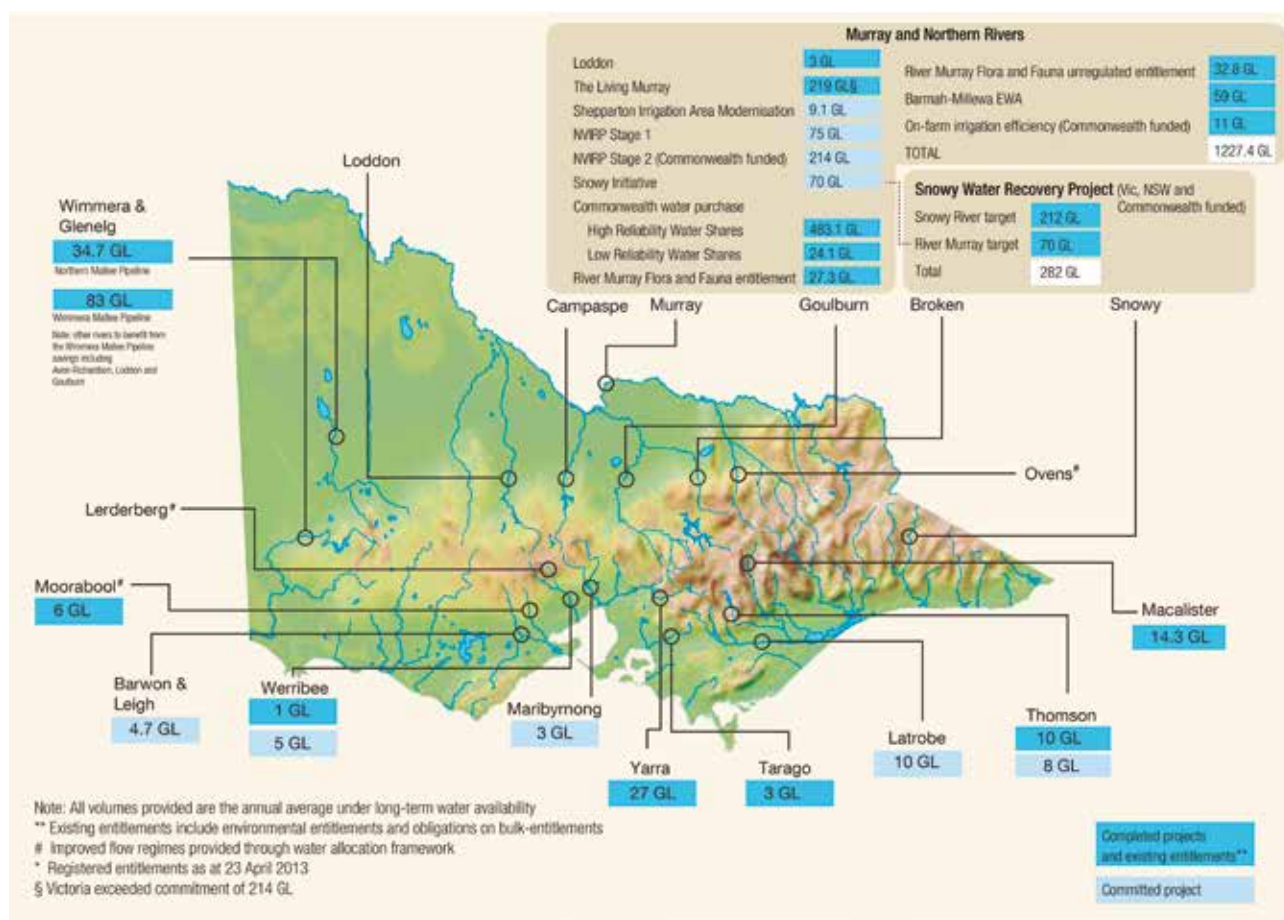


Figure 8.2: Victoria's water recovery projects (including jointly funded projects) up to April 2013.

Over the past decade, there has been significant investment by several state governments and the Australian Government to return water to the environment. Key Victorian water recovery projects are shown in Figure 8.2. Projects include TLM, Snowy River initiatives, Goulburn-Murray Water Connections Program (formerly the Northern Victoria Irrigation Renewal Project), Wimmera-Mallee Pipeline project and, more recently, water recovery by the Australian Government to meet the Basin Plan targets. The recovered water is held by jurisdictionally based agencies, such as the VEWB or the CEWH.

In Victoria, the major water recovery projects are largely complete or well underway, and no further water recovery is expected, other than to meet the requirements of the Basin Plan.

Beyond the projects outlined in Figure 8.2, the Basin Plan will recover sufficient water to provide environmental benefits equivalent to those that would be achieved through recovery of 2,750 gigalitres per year. If the full volume of water needs to be recovered, Victoria's share of this is 1,075.3 gigalitres. The focus of future investment will be to maximise the efficiencies in using environmental water.

The Basin Plan includes a mechanism to adjust the SDLs, in recognition that it may be possible to achieve the environmental outcomes more efficiently using works and measures or changed river operations.

This could reduce the amount of water needed to be taken out of productive use to secure these outcomes by up to 650 gigalitres.

The majority of Victoria's water recovery obligations have already been met through purchase of water entitlements or are contracted to be recovered through infrastructure efficiency projects, such as the Goulburn-Murray Water Connections Program (over 700 gigalitres). The remaining obligations won't be clear until 2016, following assessment of proposals for water efficiency measures to offset water recovery. If offsets total 650 gigalitres, no further Commonwealth general buyback tenders for high reliability water shares will be needed in northern Victoria. If offsets are less than the expected 650 gigalitres and additional water purchase is required, it is expected to include a proportionate mix of low reliability shares. Previously the purchase program in Victoria focussed almost solely on high reliability shares.

Policy 8.4

Victorian environmental water management will focus on making the most efficient and effective use of water available.

Victoria will continue to encourage the Australian Government to achieve water recovery through water saving infrastructure projects and reinforce that this should be done in a way that recognises that water recovery obligations for each jurisdiction have now been fully apportioned under the Basin Plan and associated intergovernmental agreements.

8.4 Managing environmental water entitlements

Most water recovery for the environment has occurred in regulated river systems and has been converted to environmental water entitlements.

Entitlements are the most reliable type of environmental water and can be managed to meet specific environmental objectives (that is, by delivering water to specific sites at

a chosen time by arranging for the release of water from storages). Environmental entitlements represent about four per cent of water available to the environment in Victoria.

In order to achieve the best environmental outcomes with the available environmental water, efficient and effective management of environmental water entitlements is required. This management is planned and implemented through a framework of key documents (see Figure 8.3).

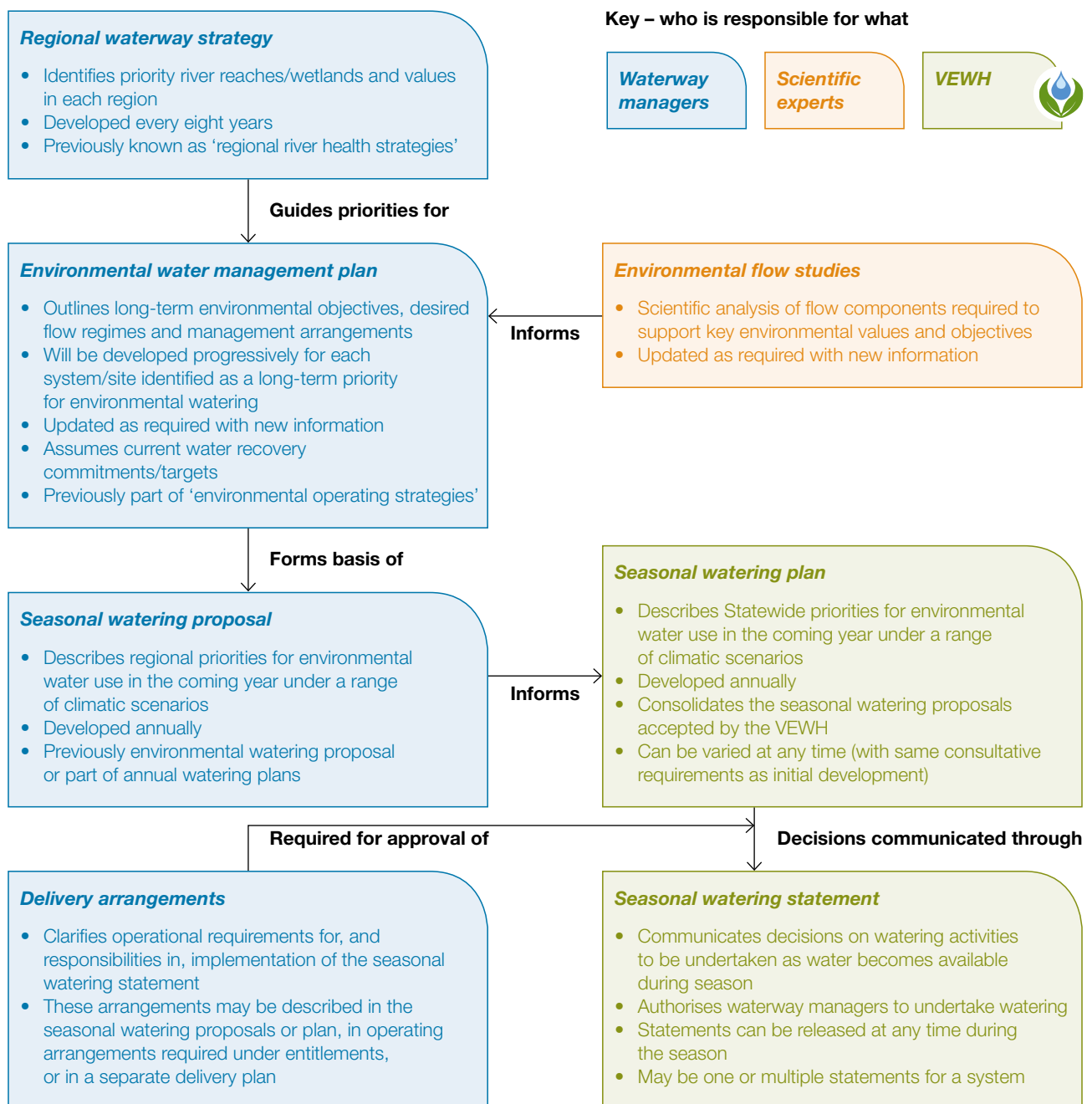


Figure 8.3: Planning framework for decisions about environmental water management in Victoria.

8.4.1 Planning processes for the use of environmental water

Regional Waterway Strategies (RWSs) identify priority waterways where environmental values are at risk from altered water regimes (see Section 4.2) and identify high level management objectives. These management objectives take into account the other values of the waterway, including social, cultural and economic values.

To develop detailed environmental objectives for regional priority waterways where environmental water can be delivered, environmental water management plans (EWMPs) are developed for particular sites. EWMPs outline longer-term management objectives for a site and detailed operational planning for use of environmental water. They are developed in consultation with regional communities (and, where possible, identify opportunities for social and cultural benefits) and include environmental watering objectives, water regime targets and ecological tolerances for the site. The EWMPs provide additional information such as management arrangements and delivery constraints. EWMPs will initially focus on individual sites but, as knowledge increases, they may extend to planning at the broader system scale.

Informed by their RWSs and EWMPs, waterway managers prepare seasonal watering proposals each year to identify annual priorities for environmental water use in their region. The Basin Plan also includes requirements for Long Term Environmental Watering Plans for environmental assets, which will be similar to Victoria's EWMPs. Victoria's EWMPs will need to be consistent with the Long Term Environmental Watering Plans.

Policy 8.5

Environmental water management plans will be prepared for priority waterways that have environmental values at risk from altered water regimes (identified in regional Waterway Strategies) and are able to receive environmental water allocations.

8.4.2 Integration of Commonwealth and State planning processes and environmental watering in Victoria

The VEWH, CEWH and MDBA are each responsible for different portions of the environmental water available for use in Victoria's Murray-Darling Basin waterways. Planning for the use of this water requires an approach that recognises the objectives and planning frameworks under which each of these bodies operates, and integrates these to achieve delivery through the VEWH's operational framework.

The Basin Plan sets objectives and targets to guide the use of water recovered for the environment. This then relies on the planning framework of each water holder to guide water management to meet the Basin Plan's ecological objectives. The Basin Plan includes a planning framework for environmental water that aligns with Victoria's framework (see Figure 8.4).

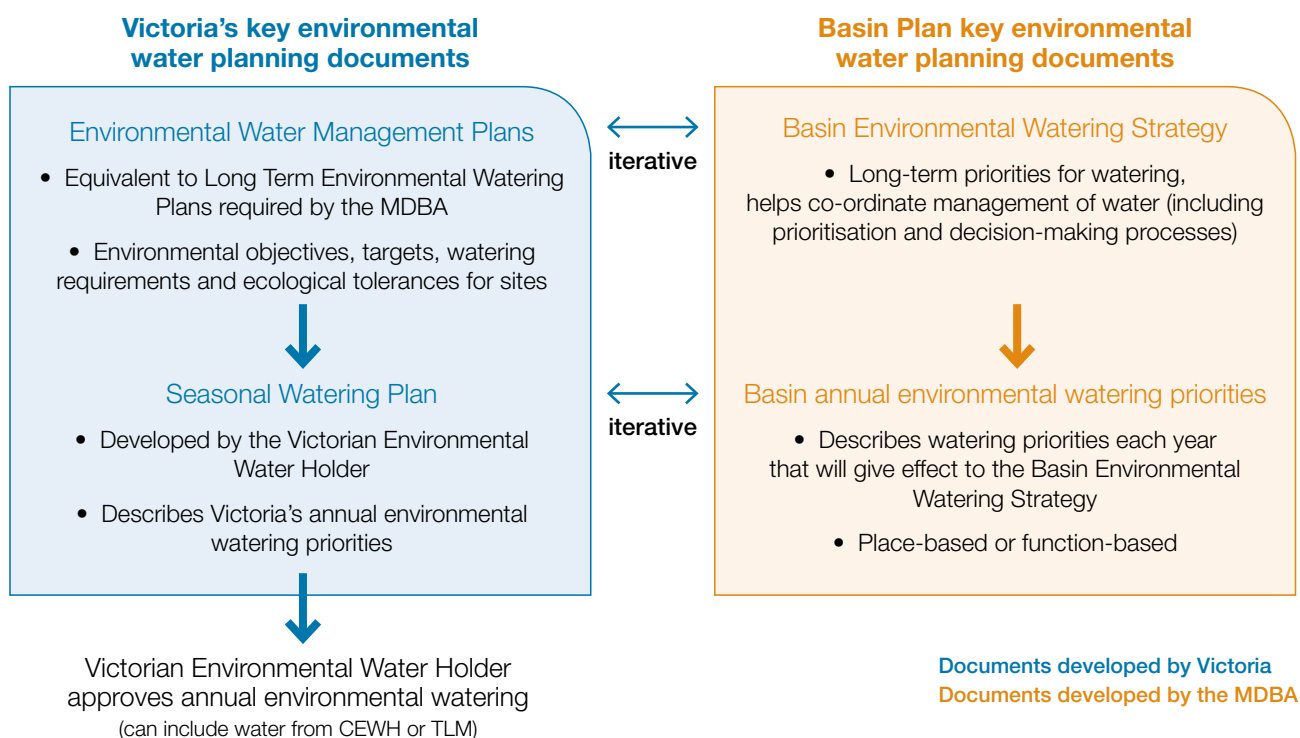


Figure 8.4: Alignment of key Victorian environmental water planning documents with the Basin Plan environmental watering framework

8.4.3 Criteria for prioritising use of environmental water

The VEWH is the key decision-maker for prioritising the use of environmental water entitlements across Victoria. Decisions are based on an analysis of seasonal watering proposals prepared by waterway managers. The VEWH makes decisions about the way available environmental water will be used each year and communicates these decisions through its seasonal watering plan and seasonal watering statements (see Figure 8.3).

Decisions on how and where to use environmental water are made in line with the principle of *'maximising environmental outcomes with the available resources'*. Criteria specific to regulated systems have been developed to guide the prioritisation of environmental watering activities between sites with differing values and in varying condition. These criteria were tested through the extended dry period from 1997–2009 (see Policy 8.6 and Figure 8.5).



Barmah Forest receives environmental water in 2010/11 to sustain bird breeding. Photographer: Keith Ward

Policy 8.6

In considering the seasonal watering proposals, developing the seasonal watering plan and prioritising the use of the Water Holdings, the Victorian Environmental Water Holder will make decisions on the basis of balanced and evidence-based consideration of all criteria listed below:

Criteria to prioritise water use to 'maximise environmental outcomes with the available resources'

Criteria	Examples
Extent and significance of the environmental benefit expected from the watering	The area watered, size of the breeding event to be triggered, conservation status of species that will benefit
Certainty of achieving the environmental benefit and capacity to manage other threats	Water has been provided before with demonstrated benefits, relevant complementary works are being undertaken to manage other threats
Capacity to provide ongoing benefits at the site	Ongoing arrangements with managers or private landholders rather than one-off or short-term agreements
Watering history and implications of not watering the site	An upper threshold is being reached and there is the potential for critical or irreversible loss
Risks associated with the watering	Risks to third parties (such as adjacent landholders) or for negative environmental outcomes (such as salinity or blackwater)
Feasibility of the watering	Whether operational arrangements (including equipment) are finalised, flexibility in timing of delivery
Cost effectiveness of the watering	Amount of benefit for the volume of water, amount of benefit for the cost of delivery, opportunities for return flows to provide downstream benefits
Opportunity to provide social and cultural benefits	After consideration of other criteria, the Victorian Environmental Water Holder will consider whether it can contribute to social and cultural benefits through environmental watering (see Section 8.4.4)
Long-term condition of one system should not be jeopardised in order to provide optimum short-term condition in another priority system	Other than in drought, critical flows ¹ should be provided at all priority sites before decisions are made on allocation of any remaining water

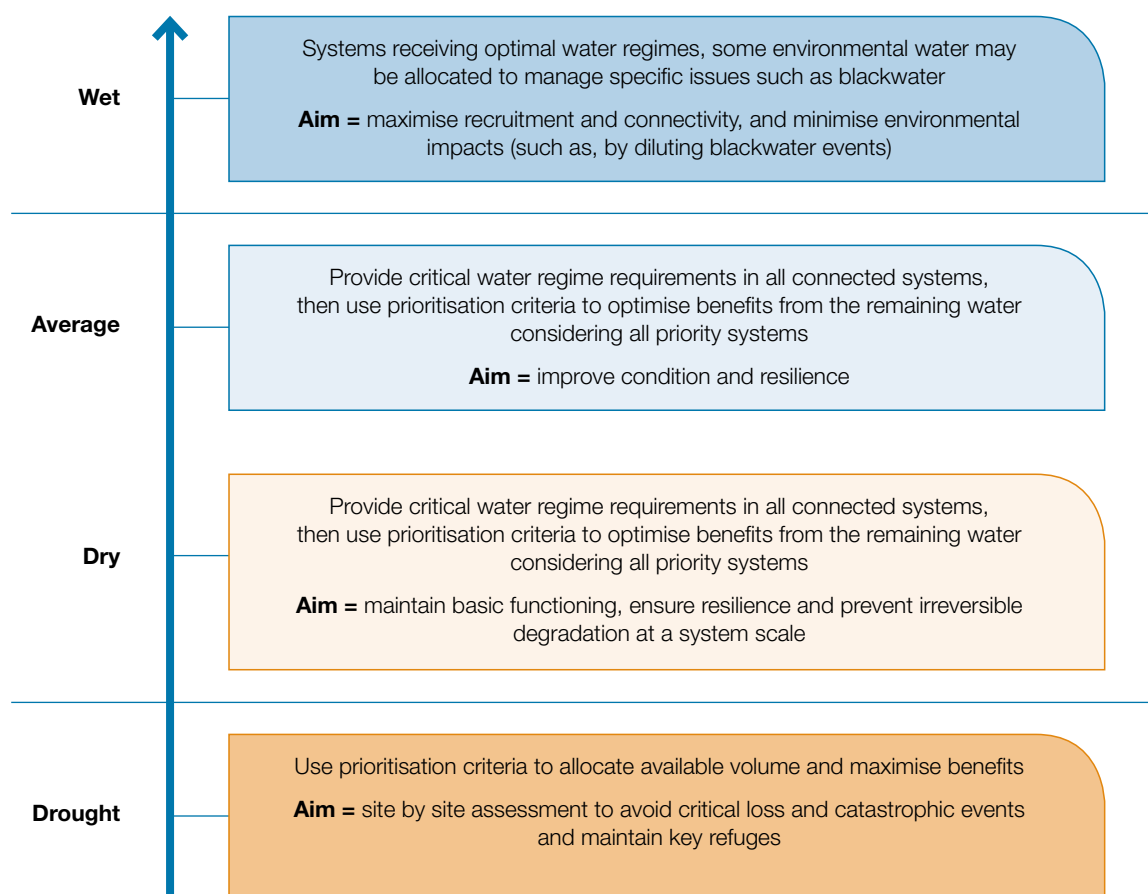


Figure 8.5: Prioritising environmental watering actions in different climatic conditions

8.4.4 Considering social and cultural values in the use of environmental water entitlements

The primary purpose of environmental water entitlements is to achieve environmental benefits. However, the delivery of environmental water for this purpose is likely to provide other benefits that depend on the condition of our waterways (see Figure 3.3), such as supporting social and cultural values.

Waterway managers identify the environmental, social, cultural and regional economic values of waterways as part of regional waterway planning processes (see Section 4.2). They also prepare EWMPs for priority sites where environmental water can be delivered (see Section 8.4.1). EWMPs are developed in consultation with regional communities, including recreational interest groups and Traditional Owner groups and, where possible, identify opportunities for social and cultural benefits. Through this consultative process, social and cultural values that are dependent on water can be captured to enable the VEWH to consider the other benefits of its decisions.

In most situations, social and cultural values (such as fishing, camping, cultural heritage protection and visual amenity) are compatible with environmental watering objectives.

Access to water by Victorian Traditional owners is outlined in Section 6.2.3.

Policy 8.7

Waterway managers will engage regional communities, including recreational interest groups and Traditional Owner groups, to capture social and cultural values of waterways through regional waterway planning processes, environmental water management plans and seasonal watering proposals.

In planning for and making discretionary environmental watering decisions, the primary purpose is to maximise environmental benefit. Where consistent with this objective, environmental water managers must also consider whether social and cultural benefits can be achieved.

Detail of Victorian Environmental Water Holder environmental watering actions that incorporate social and cultural values will be included in the Victorian Environmental Water Holder's annual environmental watering booklet.

The statutory objective of the VEWH² also allows for this to occur, however, the use of environmental water to provide specific social or cultural benefits cannot be prioritised at the expense of achieving environmental objectives. In a few instances where water has historically been used at environmental sites specifically for social purposes, there may be a case to consider options to manage the water in a way that clearly reflects these historic uses.

8.4.5 Costs of managing environmental entitlements

Water corporations that act as storage or system operators provide services to water customers, including environmental water holders, and recover the costs of providing those services from the customers that use them. There are several costs applicable to the management and operation of water entitlements used in Victoria, in addition there are costs specific to environmental water management. These include costs for:

- headworks (also called storage operator and bulk water services), carryover and delivery services
- resource management, metering and reporting
- environmental water planning and intervention monitoring.

Headworks and resource management charges

Historically, where environmental entitlements share the same properties as other entitlements, environmental water holders pay the costs of these services provided by water corporations just as other water users do. However, some of the charges attached to environmental water entitlements have been varied in relation to the following:

- the nature of the product – where the entitlement (or related right allocated to the environment) – is less reliable or certain than other consumptive entitlements
- recognition of Government investment in water savings projects to recover water for the environment where there have also been significant benefits to irrigators and other users.

Additionally, headworks and resource management charges have been historically varied to take into account the marginal use of storages and services by environmental water holders at the time. However, in recent years the number of environmental entitlements has increased substantially and the environment may no longer be considered a marginal water holder in some systems. For example, in northern Victoria the CEWH now owns a significant amount of entitlements held in the Victorian storages, as a result of the Australian Government environmental water recovery initiatives. In these situations, it is not appropriate that an environmental water holder pays different headworks and resource management charges to other water users.

Environmental water delivery charges

The increased volume of environmental water entitlements can also add to costs borne by storage/system operators through more sophisticated planning and scheduling of environmental water (for example through the delivery of freshes or accounting for return flows). In addition, where this activity has not historically been undertaken by storage/system operators, there will also be initial establishment and some new ongoing costs in performing these services. The nature of these increased costs needs to be better understood to ensure the VEWH and other environmental water holders are paying appropriate charges.

In the vast majority of cases, the delivery of environmental water entitlements will utilise river channels to meet environmental objectives (for example, for instream, overbank and wetland requirements). In a few systems where these natural distribution pathways have been interrupted or modified due to irrigation or other infrastructure, access to irrigation distribution systems may be required to deliver environmental water to priority sites.

This access to irrigation distribution systems might arise where there is a critical need to deliver water to a site at the same time as irrigation demands are high and there would otherwise be no spare channel capacity. For example, access to the delivery system is required in the Gunbower Creek (which is also used to supply irrigators) to ensure that water can be delivered to the Gunbower Forest to prevent water birds abandoning their nests after a breeding event. It is proposed that delivery shares will be acquired in this instance by environmental water holders, ensuring that there is equitable use of the channel capacity and that the environmental water holders are contributing to the ongoing maintenance of the irrigation distribution system they use.

At other times, watering of Gunbower Forest can be undertaken outside of the irrigation season or in non-peak periods during the irrigation season as a casual user. This means that the delivery of environmental water does not need to 'compete' with irrigation demands in peak periods in Gunbower Creek.

Delivery charges should reflect the principle that charges for environmental water services should be reflective of equivalent levels of service provided to water users, ensuring that there is a fair and reasonable contribution towards the upkeep of the irrigation distribution system.

However, there are concerns that the charges associated with current supply arrangements do not make an adequate contribution to the upkeep of the irrigation infrastructure used by environmental water holders. In the future, environmental water holders will be required to pay equivalent charges for access to the irrigation distribution system and be provided with the same level of service as the other customers.

Policy 8.8

Environmental water holders will be required to pay applicable charges for the costs incurred by storage/system operators to store and deliver environmental water.

Action 8.2: All environmental water holdings will be reviewed, to ensure that they incur applicable headworks, delivery and resource management charges. Ministerial guidance will be provided to clarify the nature of charges that are applicable for environmental water holdings. With regard to the costs incurred by the Victorian Environmental Water Holder, funding will be subject to standard budgetary processes.

Who: Department of Environment and Primary Industries, waterway corporations, Victorian Environmental Water Holder. **Timeframe:** 2014

Environmental water planning

The use of environmental water for TLM and CEWH is co-ordinated for use across northern Victoria by the VEWH and implemented by waterway managers on behalf of the entitlement holders (see Section 8.1.4). As more of the water available to TLM and the CEWH becomes increasingly available for use across northern Victoria, costs to the VEWH and waterway managers will increase.

As all costs incurred through environmental water management are based on full cost recovery, it is important that where the VEWH manages environmental water on behalf of other environmental entitlement holders, these costs are passed on to the relevant entitlement holders.

Similarly, where waterway managers are required to undertake intervention monitoring and report on the benefits of water for environmental waterholders, it is important that they are provided with the appropriate level of funding (from environmental water holders) to undertake these activities.

Action 8.3: The costs associated with environmental entitlements managed by the Victorian Environmental Water Holder and delivered by waterway managers on behalf of other entitlement holders will be identified to ensure these costs are passed on to the appropriate entitlement holders.

Who: Department of Environment and Primary Industries, Victorian Environmental Water Holder, waterway managers. **Timeframe:** 2014

8.5 Efficient and effective use of environmental water

Environmental water managers have learnt valuable lessons about managing limited water resources for maximum outcomes during periods of drought.

Management is now more targeted, efficient and effective with new tools that reduce the need to recover more water for the environment. Sometimes more cost-effective environmental benefits can be achieved through small scale changes to river management with reduced economic and regional impacts when compared with large scale water recovery programs.

8.5.1 Tools for achieving efficient and effective use of environmental water

Tools for achieving efficiencies and overcoming constraints for effective use of environmental water have been developed and implemented through the regional SWSs. These management tools are set out in Table 8.2. Using available environmental water efficiently can reduce the need to recover water for the environment, thereby avoiding associated impacts on regional communities. Efficiency tools can also be used alongside water recovery to maximise environmental outcomes.

To achieve the most effective use of environmental water and maximise environmental outcomes, it is also necessary to consider how to overcome physical and operational constraints (such as flooding of private land).

In some instances, environmental works such as pumps and regulators can be used to deliver environmental water and achieve environmental outcomes with much less water. This is particularly true for wetlands and floodplains, that have become disconnected from the main river channels or where overbank flow frequency is inadequate to meet environmental objectives. This can be an effective alternative with less economic impact than recovering additional water to meet environmental objectives.

While environmental works for flooding high value floodplains and wetlands have benefits, they can also have negative effects (such as disconnection of the river and floodplain and acting as a barrier to fish movement and migration). This can reduce carbon and nutrient exchanges with the river, which are important to maintain ecological function. As such, the decision to use environmental works requires careful consideration and planning, as is the case for other types of public infrastructure in or around waterways (see Section 18.6).

Policy 8.9

Efficiency tools and environmental works to maximise the benefits of environmental water delivery will be explored to ensure available environmental water is used as effectively as possible.

Options to maximise the benefits of environmental water delivery will be assessed on a case by case basis; considering the potential benefits, risks, feasibility and cost effectiveness.

Table 8.2: Efficiency tools for managing environmental water

Efficiency tools	Description	Benefits
Carryover	Allows entitlement holders to hold unused water allocations for use in subsequent seasons. Carryover rights were historically provided to the environment to avoid greater water recovery being necessary.	Provide greater flexibility to manage water availability among seasons, for example, by trading water where better outcomes can be achieved from the funds generated by trade compared to outcomes that could be achieved from surplus water.
Trade	Environmental water entitlements and allocations can be bought and sold by the VEWH where consistent with the VEWHs objectives.	
Reuse of return flows	Return flows are the portion of water that 'returns' to the river (or water supply) system after a watering event. This water can be reused for floods and other environmental watering downstream.	Can significantly reduce the amount of environmental water required to meet environmental objectives. Can be an effective alternative with less economic impact than recovering additional water to meet environmental flow objectives.
Using consumptive water en route	Use of consumptive water or 'piggyback' environmental water on consumptive water on its way to being delivered to water users via rivers, creeks and wetlands.	

8.5.2 Use of alternative sources of water for environmental purposes

Using alternative sources of water that are ‘fit for purpose’, that is, of an appropriate quality for its intended use, can help reduce reliance on water from our waterways. Examples of alternative water supplies include recycled water (treated wastewater from sewage treatment plants) and urban stormwater.

Treated recycled water is released into waterways for a range of reasons. In some cases, this may provide environmental benefits. There are two ways that recycled water can be used as environmental water in waterways:

- a proportion of existing releases from sewerage treatment plants, which can be shown to provide net benefits and can be maintained into the future
- sewerage treatment plant discharges can be diverted to new locations (that is, other waterways) that are in greater need of additional flow.

However, in some cases the negative effects resulting from recycled water discharges counteract or outweigh any benefits provided. Therefore proposals for using recycled water for environmental purposes must be carefully assessed on a ‘case by case’ basis and only supported where they provide overall net benefits to the community.

Case by case consideration will also allow assessment to take appropriate account of characteristics unique to particular sites. For example, increasing flows by discharging recycled water to a flow-stressed waterway may provide benefits. However, discharges from recycled water treatment plants may not contain the right level of nutrients or be so cold that organisms in the waterway cannot survive. Therefore the benefits of an increased flow may be reduced if those discharged flows are not the appropriate quality for that particular waterway, resulting in a small or negative net environmental benefit.

Stormwater is another alternative water source that could improve water supply reliability, broaden the supply base and improve local amenity and waterway health for communities (see Chapter 14). Approaches to use of stormwater will be considered as part of the Victorian Government’s *Living Victoria* initiative (see Section 14.2.3).

Policy 8.10

The use of recycled water for environmental purposes will be considered on a case by case basis and will only take place where:

- it is consistent with existing Government guidelines, regulation and policy (for example, streamflow management plans, environmental protection requirements and health requirements)
- there is a net benefit to the environment
- any impacts on existing water users such as licence holders are identified and managed.

The existence of a net benefit to the environment of the recycled water use will be assessed by identifying:

- existing water regime and water quality requirements of the site
- the values of the site likely to be affected by the changes in water regime and water quality from the recycled water discharge
- the consequences and likelihood of any changes due to recycled water discharge
- the ecological risks associated with the recycled water discharge
- the capital and ongoing costs of using the recycled water as an environmental water source
- the extent to which the use of the recycled water can be integrated with other activities for the improvement of environmental condition of waterways.

Where the use of recycled water as a source of environmental water is considered appropriate, the water may be used as such and potentially formalised as a right or entitlement.



Stormwater can be a valuable resource. Photographer: Rob Steel

8.6 Managing risks associated with environmental watering

Environmental watering can occasionally pose risks to communities, properties and the environment. Effective management of environmental watering activities requires identification and management of any risks that may be involved.

Several agencies have a role that can contribute to, or help manage, risks in environmental watering including; the VEWH, waterway managers, storage operators and occasionally land managers. As a result, a co-ordinated approach to risk management is necessary.

Policy 8.11

Risk strategies will be included in waterway managers' seasonal watering proposals and the Victorian Environmental Water Holder's seasonal watering plan.

Principles for managing risk associated with environmental watering

The management of risk associated with environmental watering in Victoria will be guided by the following principles:

- risks involved with environmental watering will be identified and managed commensurate with the level of risk and the environmental outcome sought
- risk management in environmental watering will consider the range of scenarios in which risks may arise
- the role of each relevant body involved in planning, delivery and facilitating delivery of environmental water will be clearly specified and verified to ensure due diligence and use of best available information to manage any risks to third parties.

Action 8.4: Clearly specify and verify the role of each relevant body involved in planning, delivery and facilitating the delivery of environmental water to manage any risks to third parties.

Who: Victorian Environmental Water Holder, waterway managers, Department of Environment and Primary Industries, water corporations.

Timeframe: 2014

8.6.1 Management of risks relating to delivery of large volumes of environmental water

Victorian and Australian Government investment in water recovery for the environment has enabled the delivery of large volumes of water to improve waterway condition. While this provides the opportunity for greater environmental benefit, it can also mean increased risk to communities and property from high flows in waterways and overbank flows on public or private property.

On floodplains, achieving an optimum water regime can mean delivering water in a way that simulates a flood event. This has environmental benefits and can also benefit surrounding landholders, for example, by increasing land fertility. In these circumstances, it is desirable to proactively plan for and create these flood events. However, where there is likely to be a flow of environmental water onto private land, the consent of the landholder needs to be obtained.

The MDBA will complete a constraints management strategy by November 2013, which will consider constraints that may affect delivery of environmental water and assess the options, risks and opportunities associated with addressing those constraints. Victoria will be involved in this process in addition to having its own risk management processes with Victorian environmental water delivery partners – the VEWH, water corporations and waterway managers.

Policy 8.12

Deliberate inundation of private property will only be undertaken with the landholder's consent (for example, in the form of an agreement or easement arrangement).

Action 8.5: Engage with the Murray-Darling Basin Authority for the development of its constraints management strategy for environmental watering.

Who: Department of Environment and Primary Industries, Victorian Environmental Water Holder, water corporations, waterway managers.

Timeframe: late 2013

8.6.2 Management of risks relating to water quality

In some cases, environmental return flows³ may cause water quality issues such as increased salinity, increased nutrients, blackwater events and acid sulfate conditions.

The volume of return flows from environmental entitlements will generally be small compared to return flows from natural floods. Nevertheless, it is important to manage the risks. Existing environmental water delivery programs analyse the potential for negative impacts and a risk mitigation program is then developed.

In the longer-term, water quality risks could be managed by reinstating a more natural flooding regime to improve the condition of floodplains and wetlands, reducing the occurrence of conditions that favour poor water quality (such as long-term build-up of organic matter of floodplains).

Policy 8.13

In relation to return flows, waterway managers will continue to:

- identify water quality risks associated with environmental watering
- identify risks to downstream drinking water supplies and determine mitigating actions
- identify and manage salinity risks of environmental watering
- ensure good communication of risks with potentially affected parties and water corporations.

Existing policies and regulatory requirements relating to return flows will continue to apply.

8.7 Maintaining environmental water availability

Maintaining environmental water availability is critical to ensure that current gains made through improved environmental water management are secured for the benefit of future generations.

8.7.1 Maintaining other types of environmental water

Under the Victorian water allocation framework there are several mechanisms (other than setting water aside in environmental entitlements) to ensure sustainable water use and to prevent unacceptable impacts to the availability of water for the environment that could otherwise result from river regulation and water extraction, including:

- Murray-Darling Basin limits on the taking of surface water and groundwater for consumptive use
- permissible consumptive volumes that set the total volume of water that may be taken for consumptive use in a system
- caps set in management plans

- licence management rules prohibiting summer diversions, setting rostering and restrictions to share summer low flows, restricting upstream and unregulated to regulated system trade
- Victorian policy-based diversion limits on consumptive use of water to limit extraction during periods of low flow and protect winter environmental flows
- rules in management plans and entitlements setting aside minimum or passing flows
- legislative requirements for consideration of impacts to the EWR as part of the allocation, amendment or transfer of entitlements.

The most secure form of water made available for the environment through the function of these mechanisms is in the form of passing flows. The rules for the provision of passing flows often require they must be provided for before other users. However, passing flows are small in volume.

By far the largest contributor (by volume) to environmental water is water left in the system due to the operation of the above mechanisms. However, this water may only be available in waterways in real terms in wet years where the water in the system is surplus to the water allocated to consumptive entitlements.

Action 8.6: Review and update subordinate instruments to the *Water Act 1989* as necessary to reflect policy for robust and transparent water allocation decision-making.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2015

For example, in regulated systems, a significant proportion of this water is made up of spills from storages available only in wet years. This means the available environmental water can vary widely from year to year and is particularly vulnerable to the potential impacts of climate change.

Additionally, water made available in these ways is not usually formally quantified and so is also vulnerable to pressure from non-environmental water-users for additional allocation of water for consumptive purposes. The review of the *Water Act 1989* (see Section 1.2.1) will investigate how the concept of the EWR has been implemented, including options to better clarify how the different components of the EWR are specified.

Efforts have been made to better track and understand expanding uses of water outside the entitlement framework that could affect the availability of water that contributes to the preservation of environmental values. For example, there are now requirements to register domestic and stock dams and efforts to estimate water intercepted by land use, such as plantation forestry.

Water resource decision-making processes relating to uses within the entitlement framework will continue to be sufficiently robust and transparent in considering the effect of these decisions on the availability of environmental water. As indicated above, the *Water Act 1989* and several policy-based instruments require that decision makers must have regard to the EWR when making water allocation decisions. However, the requirements are sometimes duplicated and the way in which this is applied and assessed is not clearly specified or consistent. The review of the *Water Act 1989* will also look at ways to streamline and clarify how impacts on the EWR will be considered in the future.

Policy 8.14

Water resource management decisions will follow a robust and transparent process that considers effects on existing users and environmental water by:

- using the best available evidence about the effects
- considering alternative sources of water and alternative mechanisms for obtaining water (for example, trade) where there is a likely adverse effect on existing users
- consulting with existing entitlement holders about the proposed action including the ability to have input into how the action is implemented
- seeking submissions on the proposed action where no formal consultation has occurred.

8.7.2 Management of unregulated systems

In unregulated rivers, the environmental water is provided primarily through management of existing diversions via licence conditions, rostering and restriction rules.

In systems that are not highly allocated, licences are only issued during the winter fill period (July to October). This is in response to the existing high number of annual licences which has led to over-extraction in many systems during the summer months when stream flows are typically low.

In priority unregulated systems that are flow-stressed in summer, formal management arrangements may be implemented. These arrangements provide for sustainably managing available water resources in an unregulated system to balance the needs of all users, including the environment. Types of existing management plans include:

- **Streamflow Management Plans** – statutory plans for managing water resources of priority unregulated waterways that are under stress, or where there is a demand for more development.
- **Integrated water management plans** – recognise the connections between groundwater and surface water in systems where these water resources are highly-connected.
- **Local management plans** – capture and formalise existing rules in unregulated systems where there is no statutory management plan.

Local management plans are an increasingly important instrument for capturing arrangements for management of unregulated systems and ensuring fair sharing of water resources in those systems between water users and the environment. Waterway managers have a critical role in contributing to the development of these plans and ensuring the needs of the environment are included.

Policy 8.15

In unregulated systems the focus is on maintaining and managing environmental water by strengthening existing processes relating to trade and allocation of water entitlements and conditions on water entitlements, to ensure the availability of environmental water is maintained.

Local management plans will be developed that consider environmental water requirements of waterways and surrounding land as appropriate.

Action 8.7: Develop guidelines to support the development of local management plans to ensure fair arrangements for water users and the environment.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2014

8.7.3 Better defining environmental water needs of groundwater-dependent ecosystems

Groundwater-dependent ecosystems (GDEs) are those that rely on groundwater for all or part of their water needs and may include rivers, estuaries, wetlands and terrestrial vegetation (see Figure 8.6). Historical management of groundwater has focused on the sustainability of the water resource, while ecosystems reliant on groundwater have been considered to a lesser extent.

Effective and sustainable management of GDEs in Victoria requires improved knowledge of the distribution, condition and environmental values of GDEs, including information about groundwater and surface water interactions.

The initial focus will be on GDEs of high environmental value and high risk and those that are most easily observed and monitored. Improved knowledge will enable managers to incorporate adequate consideration of those GDEs in groundwater management and allocation processes.

Policy 8.16

The groundwater allocation framework will adopt a risk-based approach to considering groundwater-dependent ecosystems. This approach will reflect the level of groundwater interaction and the level of risk posed by water use.

For groundwater-dependent ecosystems with high environmental values:

- those at risk of being affected by changes in groundwater levels will be considered in all groundwater management and allocation decisions, for example, by ensuring they are adequately considered when setting or adjusting permissible consumptive volumes
- those that rely on regional and intermediate scale groundwater systems will be considered in groundwater management planning
- those with high environmental values that rely on the surface expression of local scale groundwater systems will be assessed site by site in the licensing regime.

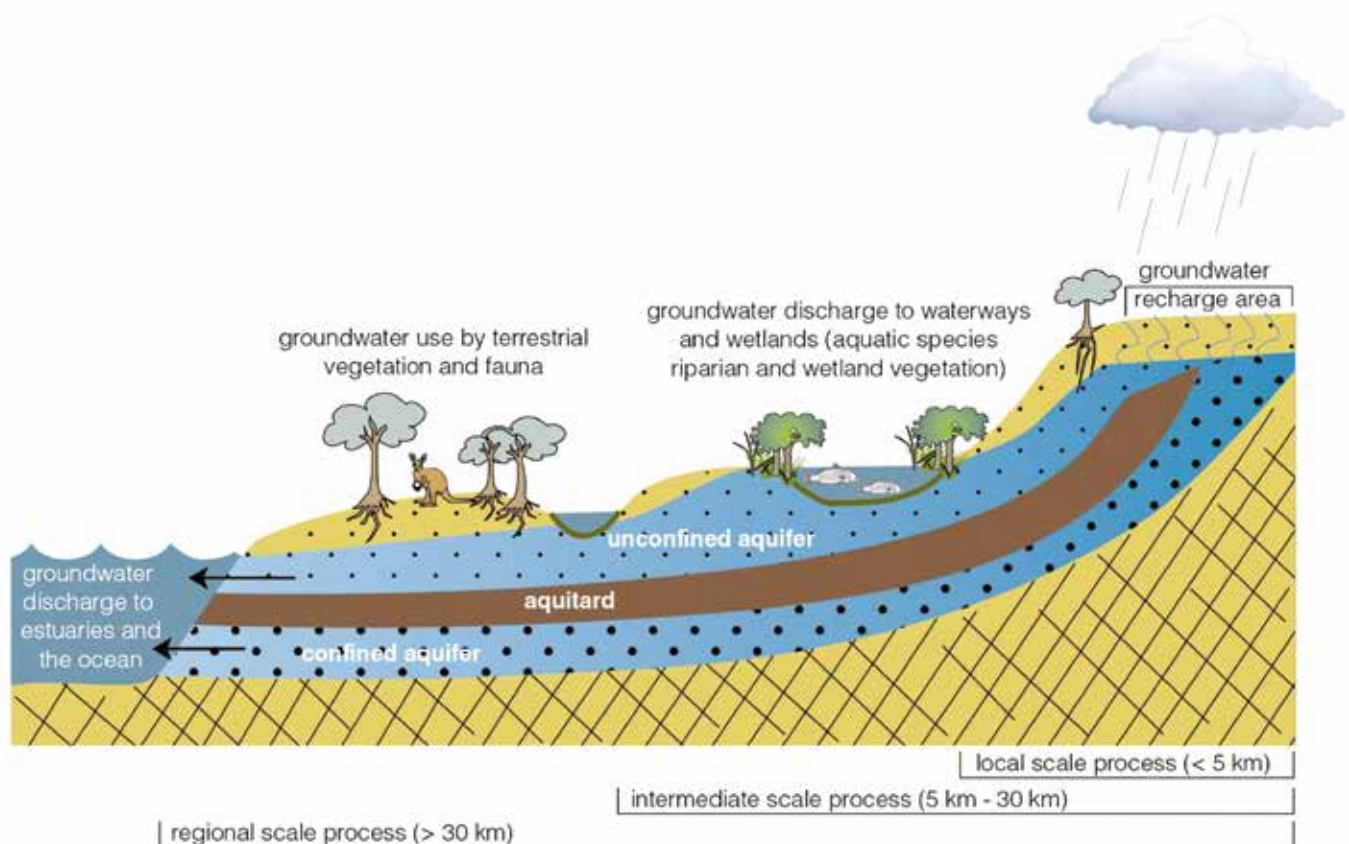


Figure 8.6: Locations of groundwater-dependent ecosystems in the landscape, and in relation to groundwater aquifers.

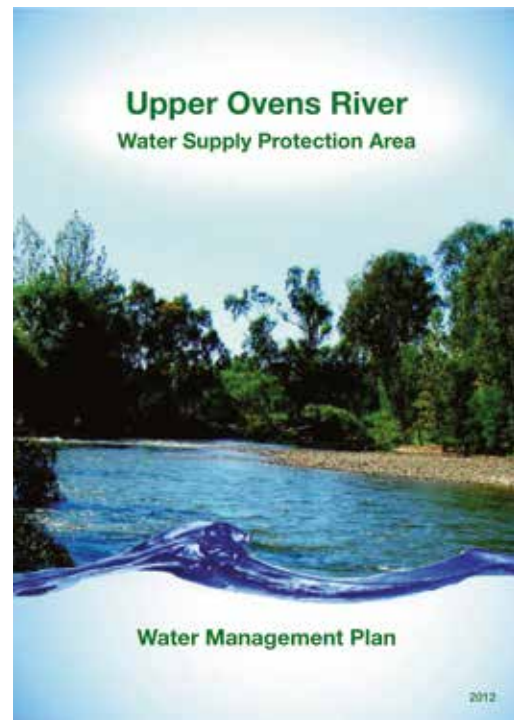
Some systems have a high level of interaction between surface water and groundwater. As a result, increased groundwater extraction can reduce streamflow and therefore affect GDEs and the reliability of water for existing surface water users.

Where a GDE relies on groundwater that is clearly connected to surface water, the management approach needs to be integrated, with recognition that an increased use of groundwater may reduce streamflow, and vice versa. An example of an integrated surface water-groundwater management plan is that created for the Upper Ovens River Water Supply Protection Area, the first such plan in Victoria.

Policy 8.17

Systems with high groundwater and surface water interaction will be:

- managed as an integrated resource
- considered as part of ongoing strategic groundwater resource assessments and local management plans or statutory management plans
- monitored to inform understanding of the condition of and impacts to high value and high risk groundwater-dependent ecosystems.



The first example of an integrated surface water-groundwater management plan.

Action 8.8: Identify and prioritise types of high value groundwater-dependent ecosystems to inform regional waterway planning processes and water allocation decisions.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2014

Action 8.9: Develop method(s) to assess the contribution of groundwater in supporting the priority types of groundwater-dependent ecosystems.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2015

Action 8.10: Develop guidelines to help licensing authorities consider the risk to groundwater-dependent ecosystems, including:

- management principles (for example, setting trigger levels)
- how to consider groundwater-dependent ecosystems in licensing decisions and groundwater-related management plans where appropriate.

Who: Department of Environment and Primary Industries, water corporations, waterway managers.

Timeframe: 2014

8.8 Continual improvement of environmental water management

Adaptive management of environmental water requires effective monitoring, reporting and evaluation, coupled with improved knowledge from targeted scientific research (see Chapter 17).

8.8.1 Research to support environmental water management

Effective environmental water policy and management needs to be supported by evidence, reflect current best practice and address priority knowledge gaps. The Department of Environment and Primary Industries currently supports research in several areas to support environmental watering activities and management approaches.

Focus areas for research to support environmental watering outcomes are:

- research to improve our understanding of ecological responses to environmental watering
- development of models to optimise the delivery of environmental water.

Further information on research and knowledge gaps in waterway management is outlined in Section 17.5.

8.8.2 Monitoring and reporting

Monitoring provides information about the linkages between environmental water delivery and ecological response and leads to continual improvement of environmental water management. Existing monitoring approaches address both long-term and short to medium term information needs and occur at different scales (see Table 8.3).

The Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP) is the program through which longer-term ecological response monitoring is undertaken. Waterway managers monitor environmental indicators such as fish numbers, water quality and vegetation growth in response to different flows.

VEFMAP is used in nine priority regulated rivers across Victoria, including the Goulburn, Broken, Campaspe, Loddon, Wimmera-MacKenzie, Glenelg, Thomson, Macalister and Yarra rivers. These priority rivers are the subject of VEFMAP due to the significant environmental water recovery undertaken within those systems.

In some rivers, environmental water can also provide benefits to estuaries. Where this is the case, monitoring of environmental outcomes in those estuaries may be valuable. To do this, existing monitoring of rivers through VEFMAP can be extended to priority estuaries receiving environmental flows.

Currently there is no systematic monitoring undertaken for the response of wetlands to environmental watering. In the same way as for rivers, it is important to test hypotheses about the ecological response of wetlands to environmental water delivery through monitoring.

A statewide report on environmental watering outcomes is produced each year that captures the volume, timing and frequency of water delivered and the environmental outcomes achieved (see Section 17.4.1 on reporting). The annual environmental watering booklets can be found at www.vewh.vic.gov.au.

Monitoring and reporting requirements to evaluate effectiveness of the Basin Plan will be negotiated through the Basin Plan Implementation Agreement. Victoria will be seeking to use existing state statutory frameworks to meet all related requirements under the Basin Plan.



Monitoring fish numbers in response to environmental water delivery. Courtesy Arthur Rylah Institute

Table 8.3. Different types of environmental water monitoring programs.

Monitoring	Purpose
Event-based compliance monitoring	Collects information about the volume and timing of environmental watering to assess if environmental water was delivered to specifications
Event-based ecological response monitoring	Collects information about short to medium-term ecological outcomes of specific environmental watering events
Ecological response monitoring	Collects information over the long-term to verify whether intended outcomes are being achieved by the program of environmental watering activities (for example, through the Victorian Environmental Flows Monitoring and Assessment Program)
Condition monitoring of rivers, estuaries and wetlands	Monitors long-term condition of waterways (for example, Index of Stream Condition, pilot Index of Estuary Condition and Index of Wetland Condition – see Section 17.3.4)

Action 8.11: Develop a program to monitor the ecological response of priority estuaries to environmental watering.

Who: Department of Environment and Primary Industries, Victorian Environmental Water Holder, waterway managers. **Timeframe:** 2015

Action 8.12: Develop a program to monitor the ecological response of priority wetlands to environmental watering.

Who: Department of Environment and Primary Industries, Victorian Environmental Water Holder, waterway managers. **Timeframe:** 2015



Lake Meran before and after watering. Photographer: Bridie Velik-Lord North Central CMA



9

Riparian management

*Vegetated riparian land along the Lower
Franklin River. Courtesy West Gippsland CMA*

Riparian management

Guide to the chapter

9.1 Context

- The value of riparian land
- Threats to riparian land
- Riparian land in Victoria
- The complexity of riparian land management
- Riparian land managers
- Riparian management activities

9.2 Improved approach to the management of riparian land

- Victorian Government investment in riparian management activities
- Landholder involvement in riparian management
 - Private land
 - Crown frontages
- Victorian Government role in the management of Crown frontages

9.3 Improved management of specific riparian issues

- Riparian land and bushfire
- Managing livestock grazing on riparian land
 - Controlled grazing
 - Stock access to waterways upstream of drinking water offtakes
- Management of fenced riparian land
- Access to water for stock when Crown frontages are fenced
- Carbon sequestration on riparian land
- Managing invasive species on riparian land
- Access to Crown frontages for recreational use

What are the issues with existing arrangements?

In Victoria, riparian land in cleared catchments has typically been used for agriculture, particularly grazing. However, the community is increasingly valuing the broader cultural, recreational and environmental values of riparian land. Consequently, there is a need to improve partnership arrangements, develop better onground management approaches and improve administrative, institutional and legislative arrangements to support broader management objectives for riparian land.

What improvements does the Strategy make?

For riparian management the Strategy will:

- establish a framework to progressively maintain and improve priority public and private riparian land through voluntary agreements for fencing, weed management, revegetation and long-term management of riparian land
- strengthen the partnership approach to managing riparian land, between private landholders, government and relevant agencies and clarify their roles in riparian management
- review and/or reform legislative and administrative arrangements to improve Crown frontage management
- provide clear management directions for difficult riparian management issues such as controlled grazing, long-term management of fences and fenced riparian land and access to water for stock.

9.1 Context

Land that adjoins rivers, creeks, estuaries, lakes and wetlands is known as riparian land (often called ‘frontage’). Riparian land can vary in width from a narrow strip to a wide corridor and is often the only remaining area of remnant vegetation in the landscape.

While much of the generic information in this chapter is relevant to all riparian land, most of the specific issues discussed and actions proposed relate to rivers and creeks in rural landscapes. Issues particularly relevant to wetlands, estuaries or rivers in urban areas are discussed in Chapters 12, 13 and 14 of the Strategy.

9.1.1 The value of riparian land

Riparian land has a range of important values. It is used by farmers for agriculture, particularly for grazing or providing access to water for stock. Riparian land is also valued for recreational use (for example, picnics, barbecues, walking and for access to waterways for swimming and fishing) and contributions to regional economies through tourism (for example, visitors to the River Red Gum forests along the Murray River). Riparian land also has cultural heritage values, especially sites of significance to Traditional Owners and other Aboriginal people. Finally, riparian land has many environmental values, such as providing habitat for rare or threatened species and as a network of habitat

that connects larger patches of remnant vegetation and provides a corridor for the movement of animals and native plants (known as a biolink). The key values, threats and management activities for riparian land are shown in Figure 9.1.

Healthy waterways depend on the condition of riparian land. Trees on riparian land provide a supply of organic matter to waterways, including large wood, which supports aquatic invertebrates and nutrient cycling. Vegetation on riparian land improves water quality in waterways. It filters out sediments, nutrients and pathogens from run-off from a range of land uses and catchment activities including agriculture, on-site domestic wastewater management and urban development. This protects public water supplies, improves water quality for fishing and recreation and helps reduce algal blooms downstream. Shade from riparian vegetation also helps regulate water temperature, which can be important to native fish species and helps reduce the likelihood of algal blooms. Riparian land is also important for the storage of carbon.

Riparian vegetation helps to stabilise stream banks and reduce erosion. High quality native riparian vegetation, in near natural waterways or established through revegetation programs such as those undertaken in Victoria over the last 10 to 20 years, reduces the occurrence and scale of flood related channel change¹. This channel change has led to nearly \$80 million of direct repair costs over 20 years and much larger costs to repair damaged assets such as bridges and roads.

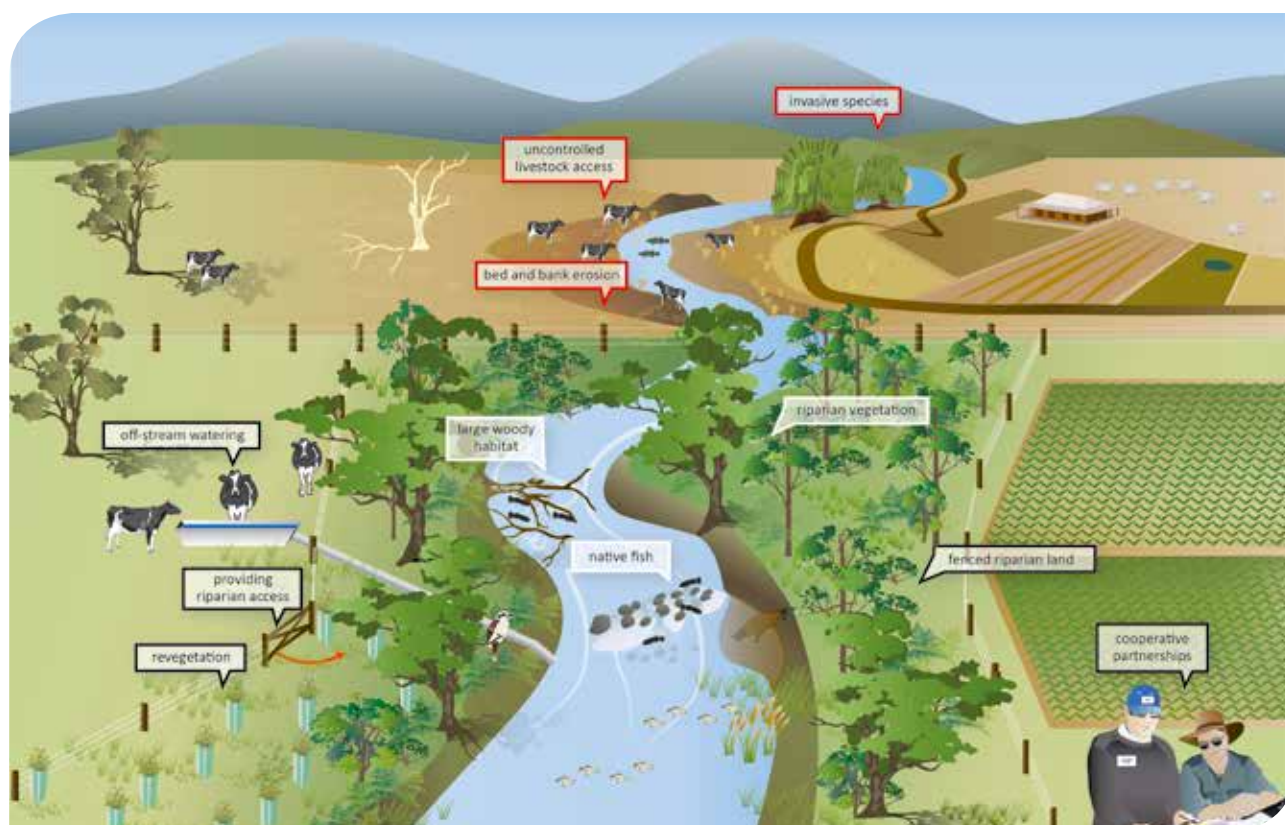


Figure 9.1: Values (white), threats (red) and management activities (black) for riparian land.

9.1.2 Threats to riparian land

The capacity of riparian land to provide a wide range of values relies upon its condition; particularly the width, connectivity and the quality, quantity and structure of the vegetation present. The major threats to riparian land are those that affect one or more of these key attributes.

One threat to the condition of riparian land is uncontrolled stock access to riparian land and the bed and banks of waterways². Stock can contaminate water and erode the banks by trampling. Other threats to the condition of riparian land include recreational pressure, weeds (especially willows), unmanaged vehicle access and stream crossings, rubbish dumping, urban development (see Chapter 14), the collection of firewood and some agricultural practices (such as cropping too close to riparian land).

These threats have all affected the condition of Victoria's riparian land.

The third statewide benchmarking of riparian land condition showed that 32 per cent was in good to excellent condition, around 40 per cent was in moderate condition and 28 per cent was in poor to very poor condition³.

9.1.3 Riparian land in Victoria

Victoria has a unique network of public riparian land known as Crown frontages (owned by the State), which were mostly established between the 1850s and the 1880s in recognition of their value as a public resource⁴. Crown frontages occur mostly on larger waterways. On smaller waterways in agricultural landscapes, riparian land is usually privately owned.

Of an estimated 85,000 km of rivers and creeks in Victoria⁵ (therefore about 170,000 km of frontage), there are about 30,000 km of Crown frontages. About 22,000 km of the Crown frontages are within cleared catchments (the other 8,000km are in larger public land blocks such as parks and State forests). Crown frontage can vary from a few metres wide to kilometres wide, with the average width being about 20 to 40 metres. The total area of Crown frontage in the state is about 100,000 ha, which is only 0.4% of the State and 1.1% of the total public land estate⁴.

At present, about 17,000 km of the 22,000 km of Crown frontages within cleared catchments are managed by the adjacent landholder under about 10,000 agricultural licences. Most of the licences are for grazing purposes, with a small and diminishing number for the cultivation of crops. These licences are typically renewed every five years, with the next renewal scheduled for October 2014. The average licence fee is \$85 for five years, calculated on productive value of the land but discounted based on weed management and other obligations on the licensee.



Uncontrolled stock access can be a threat to the condition of riparian land. Photographer: Rhonda Day

9.1.4 The complexity of riparian land management

The management of riparian land in Victoria is complicated by several factors including:

- the current administrative, management and licensing arrangements for riparian land are based on administrative definitions of a frontage, which do not recognise the wide range of values that riparian land can provide
- different types of riparian land are managed by differing statutory and management regimes, which can cause confusion about its management
- conflict between various uses and values of riparian land, particularly agricultural use and the broader recreational, cultural and environmental values of riparian land
- river movement, especially in flood, may make the location of Crown and private frontages difficult to determine without surveys.

9.1.5 Riparian land managers

Given the broad range of values and complex ownership and management of riparian land, there are many stakeholders with different roles in the management of riparian land.

The Department of Environment and Primary Industries (DEPI) has overall management responsibility for Crown frontages in Victoria. It is responsible for their administration, including their licensing for riparian management and for grazing and ensuring compliance with licence conditions. The DEPI also has a direct onground responsibility for unlicensed Crown frontages (see Section 9.2.2) and some other categories of frontage. Furthermore, the DEPI provides funding for riparian management programs through the catchment management authorities (see Section 9.2). Funding arrangements for Melbourne Water are outlined in Section 18.4.2.

Waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region) are primarily responsible for the maintenance and improvement of most riparian land through partnerships with adjoining landholders. However, waterway managers typically do not have any direct land management responsibilities for either private or Crown riparian land.

Landholders play a major role in the management of both private riparian land and licensed Crown frontages. In partnership with waterway managers, landholders typically contribute resources to the initial riparian management activities and undertake long-term management of the fenced riparian land. Even on frontages where there is no input from waterway managers, many landholders expend considerable resources on pest animal and weed management as required by their legislative obligations and licence conditions.

Some Crown riparian land is also managed by committees of management, Parks Victoria and other agencies. The typical focus for this management is the protection of high environmental and recreational values. Also, much riparian land in urban settings is managed by local councils, as committees of management, with the principal focus being on enhancing recreational values.

'Friends of' and Landcare groups can also play a role assisting other agencies in riparian management, for example, through weed management and revegetation activities. Landcare groups often form the link between individual landholders and agencies and may be able to offer additional resources, such as volunteers to help with revegetation.

Traditional Owners may play a role in riparian management on Crown land, particularly through joint and co-operative management agreements (see Section 6.4.1).

Other agencies also play a role and have an interest in riparian management, such as rural water corporations through the authorisation of the use of water for stock, local government through enforcing various local laws (for example, about vegetation clearance and heritage controls) and urban water corporations, which must provide safe drinking water to their customers.



Fencing and revegetation of riparian land. Courtesy West Gippsland CMA

9.1.6 Riparian management activities

Over the last 15 years, waterway managers have worked in voluntary partnerships with landholders to undertake riparian management activities. Management activities typically include fencing, revegetation, maintenance or improvement of existing indigenous vegetation, controlled grazing, provision of offstream stock watering infrastructure and weed management. These management activities provide many benefits to the community and landholders through improved water quality (with significant benefits to public health due to improved drinking water quality), better stock management and improved waterway condition⁶. Within a catchment context, riparian management activities provide beneficial carbon, biodiversity and water quality outcomes⁷.

Using this partnership approach, about 9,000 management agreements between waterway managers and landholders were put in place between 2002 to mid 2012 to improve the condition of riparian land.

This included over 8,400 km of waterways being fenced and over 33,000 ha of riparian land being protected. The scale of riparian work has meant that some waterways in the state are now almost entirely fenced and protected. For example, the floodplain section of the Snowy River in East Gippsland is almost entirely fenced and over 1,000 km of waterways have been fenced in the Glenelg Hopkins region (see Box 9.1).

An evaluation of riparian works undertaken by waterway managers in partnership with landholders, including a survey of the landholders' attitudes to riparian management, showed that generally, the riparian works have been successful and continue to be well maintained by landholders. Also, landholders overwhelmingly support the works and would recommend similar work to other landholders (see Box 9.2)⁸.

Box 9.1: One thousand kilometres of fencing – A Glenelg Hopkins success story

In mid 2011, the 1,000th km of riparian fencing in the Glenelg Hopkins CMA region was erected – the distance between Hamilton and Sydney – protecting a significant number of waterways.

This included parts of the Glenelg River – the largest and most significant waterway in the Glenelg Hopkins region. In partnership with landholders and community groups, such as Landcare, the CMA protected 400 km of the Glenelg River and its tributaries. As well as fencing, the funding provided landholders with stock crossings for improved stock management and over 100 offstream watering points.

The funding also provided economic benefits to the regional economy. The project injected \$7.4 million of State funding into the regional economy by providing funds directly to landholders and by the use of local businesses such as fencing contractors, nurseries and fencing material suppliers.

Ian Sutherland and his family purchased a rundown property near Balmoral. He said they had a 10-year vision for the land, which was virtually a dust bowl. They were keen to fence off all the waterways to improve farm management and waterway condition but didn't have the financial capability to do it alone. "The CMA grants have helped a lot. It will improve our stock management and we can still pump water out of the creeks if we need to. Just saving one calf from tumbling down a bank and drowning in a waterway will justify all the work done".

Box 9.2: Evaluating onground riparian works

An investigation was undertaken in 2011 to evaluate a sample of riparian sites in Victoria where onground works had been completed over the last decade⁸. It determined the condition of riparian works and landholder attitude to the works. For example:

- where fencing was erected to prevent stock access to riparian land the fencing was still functional at 86 per cent of sites
- on average, landholders gave 'willing to recommend riparian work to others' a score of 9/10 and most considered they would do more riparian work themselves
- 76 per cent of landholders indicated that there had been no loss of productivity across the property as a result of the riparian works
- 74 per cent of landholders indicated that they considered that the condition of the waterway had improved as a result of riparian works
- landholders have been involved in long-term management at 93 per cent of sites.

Comments from landholders included "I can't understand why more farmers don't do it. In the past we would lose one or two animals in the stream each year, but we haven't lost any for years. Property looks better with healthier streams and surrounds, and has increased in value" and "Thanks to CMA for a job well done".

9.2 Improved approach to the management of riparian land

Improvements to the current riparian management program in Victoria need to build on the strengths of the existing partnership approach, develop better onground management practices and improve administrative, institutional and legislative arrangements to support broader management objectives for riparian land. These objectives apply to all riparian land, both private and public land.

This section builds on the general approach to the management of riparian land outlined in Section 9.1.6. The approach taken for specific riparian management issues is described in Section 9.3.

9.2.1 Victorian Government investment in riparian management activities

Victorian Government investment in riparian land management needs to be targeted to priority activities that are determined through a regional priority setting process. Regional Waterway Strategies (RWSs) will identify high value waterways and establish priority riparian management activities over the eight-year planning period (see Section 4.2).

Long-term management and improvement of riparian land will only succeed if there is a clear partnership between landholders and Government. Consequently, Government will build on the existing approach and continue to invest in riparian management by supporting voluntary partnerships with landholders on both private and Crown frontage land.

The process of identifying priority riparian management activities does not discriminate between private or public land, but the subsequent management approach for undertaking the riparian management will vary somewhat according to the tenure of the land.

Management objective

The objective for the management of riparian land, particularly Crown frontages, is to maintain or improve its condition to support environmental, social, cultural and economic values. On Crown frontages, private benefits (such as the economic value of grazing stock) will be supported where they achieve positive environmental outcomes or where they do not significantly compromise the environmental, cultural and social values.

Policy 9.1

The Victorian Government's approach to achieve its objective for riparian management on both public and private land is to assist landholders (and other public land managers) to maintain or improve the condition of the riparian land. It does this by providing both information on riparian management and investment which contributes towards the cost of onground riparian management activities. These activities typically include fencing, revegetation and vegetation enhancement, weed management and the provision of offstream stock watering infrastructure.

The approach to riparian management will be achieved through voluntary and co-operative partnerships between landholders and Government, typically through waterway managers. The partnerships will involve voluntary riparian management agreements with landholders (for Crown and private land) in addition to licensing arrangements with adjoining landholders (for Crown frontages). It will also involve other land managers where appropriate (for example, Parks Victoria, committees of management, Traditional Owner Land Management Boards and local government).

Wherever possible, riparian management will deliver multiple benefits, including the provision of:

- agricultural values such as:
 - controlled grazing
 - access to water for stock
- environmental values such as:
 - the protection of biodiversity, especially significant plants and animals
 - providing biolinks of continuous and connected riparian vegetation, particularly along entire high value waterways and as lateral connections between riparian land and the surrounding landscape
- water quality benefits, particularly by considering areas upstream of drinking water offtakes or reservoirs
- public access and recreational use
- cultural heritage values
- carbon sequestration.

9.2.2 Landholder involvement in riparian management

Landholders are the key custodians of much riparian land in Victoria. As the occupier of the property or frontage, they generally have good local knowledge of their riparian land. They often undertake pest plant and animal management on riparian land. Voluntary partnerships between waterway managers and landholders form the key element of the Victorian Government's approach to riparian land management. In these partnerships, landholders typically invest at least as much as Government in riparian management.

The long-term management responsibilities of landholders and waterway managers for riparian land where works have been undertaken are not always adequately described in agreements or on the licence for Crown frontages. Therefore, there is a need for the management obligations of both the waterway manager and the landholder to be clearly articulated in formal binding management agreements between both parties. Further discussion of landholder roles in the management of fenced riparian land is included in Section 9.3.3. Many of the approaches to the management of riparian land apply equally to private and public land. However, there are some differences.

Private land

The benefits of onground riparian works and the defined role of the landholder in managing the works may be lost upon change of ownership of private riparian land or once a fixed-term agreement with the current landholder expires. An on-title agreement may be able to assist in securing the benefits of the riparian work in perpetuity by ensuring the long-term management obligations apply to current and new landholders and to the agency party to the agreement. On-title agreements, such as Trust for Nature covenants and Land Management Conservation Agreements, are not 'set and forget' but require all parties involved to commit to long-term management. Often, higher incentives are made available to landholders for riparian management activities if they are prepared to enter into on-title agreements.

Crown frontages

Licensed frontages

There are almost 10,000 agricultural licences on Crown frontage across the state. In 2010, the Victorian Government introduced 'riparian management licences'. By mid-2013 there were over 730 riparian management licences (and 152 conservation licences) covering over 7,000 ha of Crown frontage, of which over 5,600 ha is fenced and protected⁹.



Landholder shows riparian fencing achieved in partnership with North Central CMA on Tullaroop Creek. Photographer: Johanna Slijkerman

Landholders with either traditional agricultural licences or riparian management licences are responsible for managing weeds and pests and other issues related to the condition of the licensed frontage. However, there is a lack of clarity about what standards are expected of a landholder to comply with these obligations. Therefore, it is critical that these standards be defined for licensees.

The true costs and benefits to both landholders and to Government of the current framework, whereby landholders manage Crown frontages under licence (both traditional agricultural licences and riparian management licences), are not well understood. An improved understanding of these costs and benefits will help inform improved management, including both cost-sharing guidelines for undertaking and managing riparian management works and examining options for resourcing long-term management of fenced riparian land. These issues are further explored in Section 9.3.3.

Compliance by licensees with licence conditions and other statutory requirements on Crown frontages is also critical. Further information on this issue is provided in Section 9.2.3.

Unlicensed frontages

Many parcels of Crown frontage are unlicensed but still used by the adjoining landholder, typically for grazing (known as 'unlicensed occupations' or 'unauthorised occupations'). Often this occurs because the landholder is simply unaware that the riparian land is Crown frontage or the licence has not been transferred for a change in ownership. Appropriate management activities, such as fencing and revegetation, need to be undertaken for some of these occupied unlicensed frontages, particularly in priority areas. In other cases, it may be appropriate to issue an agricultural licence.

Policy 9.2

Minimum standards for management of riparian land are required by the conditions of an agricultural licence on Crown frontages and are a legislative requirement on private land.

When work is undertaken on private or Crown riparian land, partnerships between landholders and waterway managers will be documented in clear and effective, legally binding agreements that:

- articulate the responsibilities of each party to the agreement
- will be negotiated with landholders on a voluntary basis.

On private land, on-title agreements will be an option to secure the benefits of the riparian work in perpetuity.

When entering agreements with waterway managers involving currently licensed Crown frontages, landholders will need to convert their existing licences into riparian management licences issued by the Department of Environment and Primary Industries that:

- specify the landholder's long-term management responsibilities in the licence conditions
- waive the licence fee (for the managed area)

- provide for controlled grazing in certain circumstances
- provide for the issue of a take and use licence to water stock
- ensure long-term management responsibilities will pass to a new licensee when properties adjoining Crown frontages are sold and licences are transferred.

Where Crown frontages are in unauthorised occupation on a priority reach, and it is deemed appropriate to issue a licence by the public land manager (for example, DEPI or Parks Victoria), the landholder will be given the choice of:

- taking up a riparian management licence (which provides for the issue of a licence to take and use water for stock) and typically being eligible for fencing and offstream stock watering incentives or
- not taking up a licence which will require fencing the frontage off at the landholder's cost.

Where Crown frontages are in unauthorised occupation on a non-priority waterway, the landholder may be offered a standard agricultural licence. However, in circumstances where the unauthorised occupation is on a low priority waterway but the site-specific riparian values are high, a riparian management licence may be offered.

Action 9.1: Develop minimum standards for the management of licensed Crown frontages.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2014

Action 9.2: Investigate the costs and benefits to landholders and the Victorian Government of managing Crown frontages under licence.

Who: Department of Environment and Primary Industries.

Timeframe: 2015

9.2.3 Victorian Government role in the management of Crown frontages

There is a need to improve communication and formal processes between waterway managers, the DEPI and landholders regarding Crown frontages and their administration and management. In part, this will be achieved by reviewing the current roles and responsibilities of the DEPI and waterway managers for the management of Crown frontages.

Current legislation governing the management of Crown frontages, especially the *Land Act 1958*, is outdated and inflexible in its approach to licensing and administration and does not support the current approach to land management.

While collaboration and partnerships between landholders and agencies are the cornerstone of the riparian management program, compliance action may sometimes be required. This is particularly important given the new licensing regime for frontages (including riparian management licences) and the commitment to better defined minimum standards for Crown frontage licences. In 2012, the (then) Department of Sustainability and Environment commenced building capacity for riparian compliance activities on priority riparian land, which will be reflected in the current revision of the DEPI's Statewide Compliance Strategy and Regional Compliance Plans. The focus is on education and negotiation with landholders and licensees and using enforcement only when necessary as a 'last resort'. The DEPI's compliance role for Crown frontages needs to continue to be supported.

If private property adjoining a Crown frontage is sold, prospective purchasers need to be aware that the frontage is not private land. Real estate agents and others in the industry may also be unaware of the adjoining Crown land. Current legal mechanisms do not adequately inform prospective buyers about the status of the adjoining frontage, so they may assume it is private land.

Therefore, when properties adjoining Crown frontages are being sold, systems are required to articulate to the prospective purchaser that the land adjacent to the river is Crown and not part of the private land, that it is subject to a licence and that the landholder may be contacted by the waterway manager to discuss the priority of the frontage for riparian management activities.

When a riparian property with adjoining licensed Crown frontage has been sold or transferred, there are no systems in place to alert the DEPI about this change. The sale of property with an adjoining Crown frontage and the impending transfer of the frontage licence provide an important opportunity to communicate with the new owner, inspect the condition of the frontage being transferred and negotiate new management objectives to improve the management of that riparian land, if required.

Therefore, systems need to be developed to alert the DEPI, and waterway managers, about the sale or transfer of a property adjoining a Crown frontage.

The next Crown frontage licence renewal is scheduled for 2014. This presents an opportunity to introduce the minimum standards (referred to in Section 9.2.2) as part of guidelines explaining to licensees what is expected of them in the management of their frontage and to provide additional information to licensees about riparian land management. These will ensure greater clarity for landholders in meeting their responsibilities for managing their licensed Crown frontages.

Policy 9.3

Administrative, institutional and legislative arrangements relating to the management of Crown frontages will be reviewed and amended (if required) to:

- streamline and improve their administration, particularly the relationship between the Department of Environment and Primary Industries, waterway managers and Crown licensees
- ensure they align with the Victorian Government's objective for the reduction of 'red tape' and the management objective for riparian land.

The Department of Environment and Primary Industries will continue to foster improved understanding by Crown frontage licensees of their obligations for the management of frontages.

The Department of Environment and Primary Industries will continue to support and implement improved compliance approaches for Crown frontages, including stronger action against serious breaches of licence conditions and unauthorised occupations.

Action 9.3: Review the roles and responsibilities of the Department of Environment and Primary Industries and waterway managers for the management of Crown frontages.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

Action 9.4: Review and reform the legislation relating to the management of riparian land, particularly Crown land (focussing on the *Land Act 1958*), to streamline the administration and management of Crown frontages and to enable it to support the Victorian Government's objective for the management of riparian land.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2018

Action 9.5: Develop and distribute information to Crown frontage licensees (as part of the next Crown frontage licence renewal) explaining what is required to meet licence obligations and provide further information about riparian management.

Who: Department of Environment and Primary Industries.

Timeframe: 2014

Action 9.6: Develop and implement improved compliance approaches for Crown frontages, including stronger action against serious breaches of licence conditions and unauthorised occupations.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016

Action 9.7: Develop information for the real estate and legal industries to inform prospective riparian property buyers that land along rivers is often public land.

Who: Department of Environment and Primary Industries.

Timeframe: 2016

Action 9.8: Develop systems at the point of sale to alert prospective buyers of riparian property abutting Crown frontage that the land adjacent to the river is Crown and subject to a licence.

Who: Department of Environment and Primary Industries.

Timeframe: 2016

Action 9.9: Develop systems to alert the Department of Environment and Primary Industries and waterway managers when property adjoining a Crown frontage is sold or the title transferred.

Who: Department of Environment and Primary Industries.

Timeframe: 2014

9.3 Improved management of specific riparian issues

9.3.1 Riparian land and bushfire¹⁰

Many landholders are concerned that vegetated riparian land, including land revegetated through riparian management programs, poses a fire risk to their property. However, riparian land poses a lower fire threat to a landholder's property, including to crops, livestock and built assets (such as houses and farm buildings), than the threat posed by other parts of the landscape.

Any significant patch of vegetation situated close to assets may pose a fire threat. However, under low to moderate fire danger conditions, well-managed riparian vegetation, with limited grass and weed growth, is less likely than pasture or crops to contribute to the spread of fire across a property or the wider landscape. This is largely because:

- fire will spread more quickly in cured grass or crops compared with forest (provided there is only limited spotting)
- trees generally reduce wind speed and the rate and intensity of fire
- riparian land occupies a relatively small proportion of the broader landscape.

Fire is also much less likely to start in riparian land than other parts of the landscape, typically because it is not as prone to lightning strikes, is remote from access for arsonists, has fuel too moist to burn and is sheltered from the wind and sun.

Built assets would typically be under greater threat from cured pasture and nearby unmanaged wind breaks than from riparian land, which is often further away from farm assets. In addition, riparian land does not act as a 'wick' or 'fuse'. Fires will burn most rapidly in the direction of the wind. Consequently, riparian land poses a lower fire threat to a landholder's property, including to crops, livestock and built assets, than other parts of the landscape.

Extreme fire events, such as the February 2009 bushfires in Victoria, are rare. In such conditions of protracted drought and extreme fire weather all vegetation can burn.

In these situations, riparian land will have less influence on fire spread and impacts than the landscape level grass and forest fuels.

Increased communication between the DEPI, Country Fire Authority, waterway managers and landholders about fire behaviour in riparian land will assist all stakeholders to understand the relative contribution of riparian vegetation to fire risk compared with other aspects of landholders' properties and how best to manage any risk.

Fire management and planning need to be considered in riparian management activities including:

- weed and pasture grass management
- setbacks from the riparian land to built assets (such as houses and sheds)
- the establishment of access points at strategic locations within the riparian land for fire suppression agencies, particularly to access reliable watering supplies for fire fighting tankers.

Ongoing management of riparian land from a fire management perspective is the responsibility of landholders on both private land and licensed Crown frontage.

Policy 9.4

The Country Fire Authority, Department of Environment and Primary Industries and waterway managers will work to increase landholder and broader community understanding of the fire risks associated with riparian land.

Fire risk, especially to built assets, will be considered in riparian management planning through collaboration between waterway managers and fire agencies.

Action 9.10: Develop information for fire suppression agencies, waterway managers and landholders about fire behaviour in riparian land.

Who: Country Fire Authority, Department of Environment and Primary Industries, waterway managers.

Timeframe: 2014

9.3.2 Managing livestock grazing on riparian land

Controlled grazing

Grazing of stock is a major use of riparian land and can be a commercial benefit to farming enterprises. Complete exclusion of grazing can be a disincentive for landholders to be involved in improved management of riparian land, particularly due to concerns about the build up of weeds. Controlled grazing limits stocking rates and restricts the timing, duration and conditions under which grazing takes place. It can be a useful management tool in some circumstances, typically in:

- controlling palatable weeds, particularly pasture grasses
- maintaining or improving the vegetation condition of certain vegetation types, such as native grasses
- promoting natural regeneration of indigenous woody species.

A decision support tool and guidelines have been developed to determine the acceptability of grazing in different types of riparian land¹¹. The decisions about grazing management based on these guidelines will be included in riparian management agreements and in riparian management licence conditions on Crown frontages.

Management agreements and licence conditions allowing for controlled grazing need to be monitored by waterway managers and the DEPI to ensure landholder compliance.

The decision support tool is based on the best available science and management knowledge. However, there is very limited applied environmental research in south-eastern Australian on the interactions between grazing in riparian land and environmental condition and recovery. Research on the use of controlled grazing in riparian ecosystems and the circumstances where it is appropriate, is required for it to be improved as a management tool.

Policy 9.5

In general, controlled grazing will be allowed on Crown frontages and private riparian land subject to riparian management agreements if it:

- is environmentally beneficial
- is acceptable as a management tool and/or
- does not compromise:
 - environmental, social, cultural or economic values of the riparian land
 - downstream environmental, social, cultural or economic values.

A decision support tool and guidelines will be used to assist implementation of the policy on controlled grazing.

Grazing will continue to be permitted on lower priority Crown frontages that are not the subject of riparian management agreements, subject to licence conditions that minimise the adverse impacts of grazing on the value of the riparian land and the waterway.

Stock access to waterways upstream of drinking water offtakes

Grazing stock need access to water. Similarly, Victoria's waterways provide water for human use. One of the catchment-based risks that water corporations need to take into account is the potential risk from pathogens due to stock accessing waterways upstream of drinking water offtakes, especially juvenile and sick stock. Risk needs to be managed with a range of options including upgrading water treatment facilities, fencing streams to manage stock and educating landholders about the risk and how they can manage it (especially encouraging and educating landholders to separate juvenile stock from waterways)¹².

Currently, water corporations are legally obliged to consider health risks to their water supplies by identifying, documenting and assessing how they will be managed in their risk management plans. However, there is a need to provide water corporations with further guidance in determining the level of risk from stock upstream of their offtakes.

Also, in many cases, water corporations are working with waterway managers to fence off frontages where water corporations have identified that there is a risk to water supplies. For Crown frontages, this includes the practice of conversion from traditional agricultural licences to riparian management licences, with accompanying fencing and other management activities. However, the riparian work priorities of waterway managers and water corporations have not always been aligned.

Policy 9.6

Stock will not be banned catchment-wide from drinking water catchments. However, reducing stock access, especially juvenile stock, to priority waterways upstream of drinking water offtakes by fencing riparian land will be undertaken by agencies (including waterway managers and water corporations) as part of their onground management programs. For Crown frontages, this will be assisted by the conversion of traditional agricultural licences to riparian management licences.

Action 9.11: Prepare guidance material for water corporations for the management of risks to drinking water quality arising from stock in waterways upstream of drinking water offtakes.

Who: Department of Health, Department of Environment and Primary Industries, water corporations

Timeframe: 2014



Reducing stock access to priority waterways upstream of drinking water offtakes will be encouraged as part of riparian management programs. Courtesy DEPI

9.3.3 Management of fenced riparian land

Fencing to manage stock access is the major tool in riparian management programs. There are many practical issues faced by Government, waterway managers and landholders concerning riparian fencing and managing the fenced riparian land, including consideration of:

- when fences are and are not the appropriate management tool
- cost-sharing between landholders and Government to pay for the initial riparian management works and management of the fenced land, particularly taking account of the level of benefit received by each party
- long-term management responsibilities for fences and fenced riparian land, which must be clearly articulated and understood by all parties, including issues such as weed management, fence maintenance and ongoing access to the fenced land
- landholder capacity to resource long-term management of fenced riparian land^{8,13,14}
- the need for existing and future riparian work sites on both Crown and private riparian land to be inspected to ensure that the sites are being managed according to the obligations specified in riparian management agreements^{8,15,16}
- the width of the fenced riparian land, which must be sufficient to meet its management objectives
- the most appropriate alignment of the fence, including consideration of the location of the Crown-private land boundary, the alignment of the fence relative to river flow, and the ability to reduce potential flood damage
- funding the replacement of fences damaged or destroyed in extreme events such as floods and bushfires
- standards of fence design and construction, considering issues such as the type of stock and the location of the fence in the floodplain
- the need for ongoing engagement between waterway managers and landholders who have riparian management agreements.

Principles

Fences are an important tool to manage the impacts of livestock on waterways and riparian land.

Riparian fences need to be on the appropriate alignment for the best riparian management outcome, giving due regard to the position of the fence with regard to flood flow, the location of the Crown frontage boundary (where applicable), impacts on access (for recreation, for fire management and to cultural heritage sites) and negative effects on native animal movements.

Fences must be built to an appropriate standard depending upon the purpose and location of the fence, giving regard to factors such as the location in the floodplain, the stock involved and the topography of the riparian land.

Once the initial riparian management works have been undertaken, the works and the fenced riparian land must be managed over the long-term.

Long-term management obligations and responsibilities for fencing and the fenced riparian land must be clearly understood by all stakeholders.



Fences are important tools in managing impacts of livestock on waterways and riparian land. Fenced riparian land on the left is contrasted with uncontrolled stock access on the right. Photographer: Terry McCormack

Policy 9.7

The following policy statements apply when the Victorian Government contributes to the costs of management activities on riparian land, particularly fencing.

The proportion of the costs for management activities on riparian land, particularly fencing, that is paid for by the Victorian Government will depend upon:

- its priority for riparian management activities
- the level of public benefit of the work
- the level of security of the agreement.

When entering voluntary partnerships with waterway managers for riparian management activities, landholders, including licensees on Crown frontages, will generally be responsible for the long-term management of the riparian fence and fenced riparian land, with the landholders' requirements specified in riparian management agreements and/or riparian management licences (when on Crown frontages).

Construction of fences and management of riparian land will be undertaken to a high quality following specified guidelines or standards (where required).

Riparian land fenced for riparian management purposes will aim to be at least 20 m wide on average from the top of the bank and must not be narrower than 10 m in any one place.

Waterway managers will maintain long-term contact with landholders who have agreements, including site visits as appropriate. Maintaining long-term relationships with landholders will help to ensure that the sites are being managed and works are being maintained according to the obligations in riparian management agreements.

The Victorian Government will be responsible for funding the replacement of riparian fences in declared natural disasters (bushfires and floods), depending upon:

- regional priorities at the time
- the level of disaster assistance and other funding available
- the extent of the disaster and the damage involved.

On temporary streams, where stock can cross the stream for part of the year, the Government will generally not invest in fencing and revegetation on only one side of the stream.

Compliance with long-term management responsibilities for fences and fenced riparian land specified in licences and riparian management agreements will be monitored.

Action 9.12: Develop cost-sharing guidelines for riparian management activities that detail a sliding scale of public investment based on the level of public benefit.

Who: Department of Environment and Primary Industries, waterway managers

Timeframe: 2016

Action 9.13: Develop guidelines for riparian fence construction in flood prone areas.

Who: Department of Environment and Primary Industries, waterway managers

Timeframe: 2014

Action 9.14: Develop options for resourcing ongoing management of fenced riparian land.

Who: Department of Environment and Primary Industries, waterway managers

Timeframe: 2016

Action 9.15: Develop a toolkit of approaches waterway managers can employ for long-term engagement of landholders with riparian management agreements.

Who: Department of Environment and Primary Industries, waterway managers

Timeframe: 2014

9.3.4 Access to water for stock when Crown frontages are fenced

Access to water for stock is a critical issue for landholders when considering their involvement in riparian management programs. Currently, an agricultural licence permitting stock to graze a Crown frontage provides direct access to water for stock at no cost and without the need for a separate water entitlement. When a landholder fences a Crown frontage they lose direct access and are required to obtain a take and use licence (TUL).

However, landholders will still incur licensing costs (for the licence application, annual fees and for renewal of the licence), which is the case for all other TUL holders. This can be an impediment to landholders agreeing to take part in riparian management works. Therefore, it is necessary to minimise the administrative burden and costs to landholders associated with obtaining and renewing the necessary TULs.

Currently, landholders in unlicensed occupation of Crown frontages may be required to vacate the land, which would require them to erect a fence at their own cost and they would lose direct access to water for stock. Such landholders will be required to take out either a traditional agricultural or riparian management licence (assuming the issue of a licence is appropriate). A riparian management licence will ensure they have continued access to water.

On private frontages, landholders have a statutory right to water for stock (in most circumstances) whether they have direct access to the waterway or have erected a fence. Therefore, they are not required to obtain a TUL.

Policy 9.8

Access to water for stock will continue to be available for landholders with riparian management licences for the adjoining Crown frontage when riparian fencing excludes stock from direct access to a waterway, through the issue of take and use licences.

Regarding take and use licence fees for landholders participating in riparian management programs and taking out a riparian management licence:

- The application fee will be paid for by the waterway manager as part of the cost of a riparian management project.
- The annual fee will be waived by rural water corporations for the first three years.
- Licences will be issued for 15 years by rural water corporations (the current legislative maximum).

Landholders occupying Crown frontages without a licence will need to take out an appropriate frontage licence to ensure they have continued access to water.



Fenced riparian land showing regeneration of vegetation and offstream watering for stock. Photographer Johanna Slijkerman

9.3.5 Carbon sequestration on riparian land

Carbon biosequestration is the storage of carbon in vegetation and soils. There is growing evidence that riparian forests have particularly high capacity to store carbon. Therefore, improved management of riparian land presents a major opportunity for carbon sequestration. Riparian land is a key location in the landscape to establish biodiverse vegetation funded through programs seeking to invest in carbon sequestration, such as through the Australian Government's Carbon Farming Initiative (CFI).

Given Victoria's extensive network of Crown and private river frontages, waterway managers and landholders are well placed to capitalise on investment made available for biodiverse plantings for carbon biosequestration.

Policy 9.9

Consistent with its *Environmental Partnerships* statement, the Victorian Government will undertake actions to better understand the amount of carbon stored in Victoria's public land and ecosystems, including riparian land and investigate opportunities for industry, waterway managers and landholders to use programs investing in permanent carbon sequestration as a mechanism to encourage biodiverse riparian plantings on Crown and private riparian land.



Improved management of riparian land presents opportunity for carbon sequestration. Photographer: Alison Pouliot

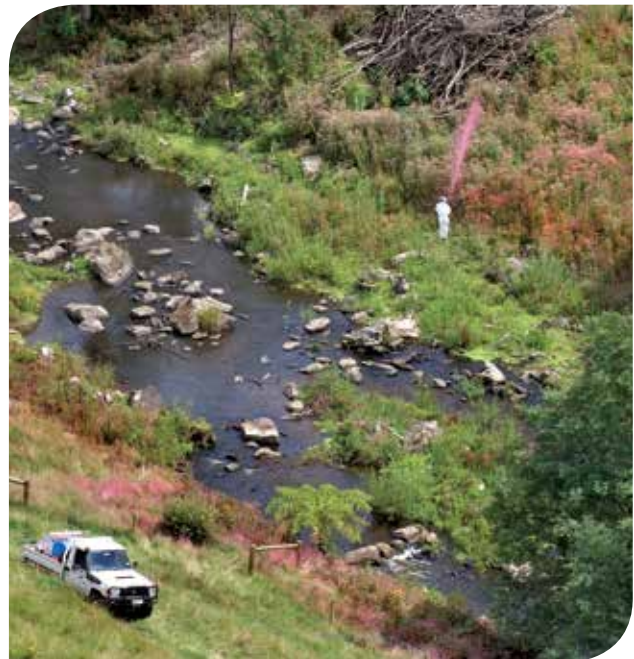
9.3.6 Managing invasive species on riparian land

Invasive species, especially weeds, are a key threat to the condition of riparian land. Riparian land is particularly prone to weed infestations spread by water and from stock access. Unless properly managed, high risk agricultural and environmental weeds (such as willows, bridal creeper and blackberry) will progressively physically transform and degrade riparian land and spread to and contaminate downstream land, as well as spreading to and from neighbouring farmland (see Box 9.3).

The deliberate planting of exotic species (including ash, elm, poplar and particularly willows) for erosion control and aesthetic purposes has led to degradation of riparian environments. Planting exotic species on riparian land has been actively discouraged for the last decade or more and activities to contain or remove weed infestations will continue to be implemented through regional waterway management programs. However, there may be some exceptions. For example, it is recognised practice that in certain circumstances, sterile non-native grasses are used as a rehabilitation tool on riparian land.

Pest animals, such as rabbits, can also be a threat to the condition of riparian land. Both pest plants and animals generally need to be managed as part of broader catchment or waterway management programs. The management of both riparian and aquatic invasive species is discussed in Chapter 16.

Landholders are currently required to manage certain pest plants and animals, under the *Catchment and Land Protection Act 1994* for private riparian land and through licence conditions for Crown frontages.



Spraying blackberries. Courtesy West Gippsland CMA

Box 9.3: Willows and willow management in Victoria

In the past, the use of willows was considered to be beneficial for preventing bank erosion and stabilising river banks. Government funding was used to plant willows in many areas. It is now recognised that:

- Willows often initiate erosion and channel widening. The extensive willow root mats extend into the channel bed and trap sediment, which raises the bed level and diverts flows into and over the bank. This results in bank erosion causing the river to widen out around the willow.
- Willows degrade the condition of rivers. Willows crowd out native plants, hence reducing native biodiversity. They also disrupt environmental processes in rivers (for example, their massed autumn leaf fall can affect water quality and deplete oxygen levels).
- Healthy fish populations require rivers to be in good condition. Willows can affect fish by reducing habitat and food. For example, willow root mats create uniform stream channels with reduced diversity of habitat for fish. Also, willows support fewer terrestrial bugs than native plants, reducing the number of bugs that fall into rivers as a source of food for fish.
- Dense stands of willows can result in reduced access for recreational use such as for fishing and can be dangerous for canoeists who can become trapped under them.
- Willows are highly invasive, with many varieties producing very large quantities of seeds. Most willow varieties are able to propagate vegetatively from broken twigs and branches.

Consequently, willows are recognised as one of the worst riparian weeds in temperate Australia and they are listed as a Weed of National Significance (WoNS) (with the exception of weeping willow, pussy willow and sterile pussy willow). Willows have currently invaded thousands of kilometres of riparian environments in south eastern Australia.

Within Victoria, most species of willows (with some exceptions, for example, cricket bat willow) were declared as “restricted” noxious weeds in 2005, meaning they cannot be bought or sold within Victoria. However, there is no legal obligation upon landholders to manage willows on their properties.

Willow removal and replacement with indigenous vegetation is now a major river management activity in many areas of Victoria. The highest priority for willow management is the control of seeding willows. The control of infestations of crack willow (a sterile species spread by vegetative propagation) is of lower priority.

While in the short-term willow removal can be aesthetically unattractive, this short-term impact is far outweighed by the long-term benefits for river condition and recreational fishing of re-establishing native vegetation along Victoria’s waterways.

More information about willows can be found on the WoNS website at:

www.weeds.org.au/WoNS/willows/



Willow removal works on Fish Creek. Courtesy West Gippsland CMA

Policy 9.10

Planting of non-indigenous species on riparian land will be actively discouraged by the Victorian Government and relevant agencies involved in riparian management*.

Victorian Government funding will not be provided for planting any non-indigenous species on riparian land*.

Any invasive plant and animal management requirements expected of landholders on Crown frontages or private riparian land above their current legal obligations will be described on the frontage licence and/or riparian management agreement.

Management of invasive species, particularly weeds, will be co-ordinated at the scale of whole river systems, across catchments and/or across investment programs, to maintain or improve the condition of priority waterways.

The Victorian Government will contribute to the management of invasive plants and animals, particularly weed infestations, as part of larger riparian management works programs. Crown frontage licensees and landholders with riparian management agreements will then generally be responsible for long-term management. Other agencies and community groups, such as Landcare groups, also play a role in long-term weed management.

*NB the use of sterile non-native grasses may be required as a rehabilitation tool in some circumstances on riparian land.

The importance of access for Victorian Traditional Owners is outlined in Section 6.6.

Access to Crown frontages through unused road reserves is also often a source of conflict between farmers holding an agricultural licence for the reserve and those requiring access to the waterway for recreation. All users of Crown frontages need to be aware of their rights and obligations regarding recreational use of Crown frontages. Under certain circumstances, access to riparian land may be limited or closed to ensure the integrity of riparian management activities, such as revegetation, or for public safety or other risk management purposes (for example, water corporations maintain rights to close access to public land around water storages in line with the risk management approach outlined in their governing legislation).

Principles

The community has the right to access public riparian land.

Recreational users and Crown frontage licensees need to be aware of their rights and responsibilities regarding recreational use of riparian land and must show mutual respect and understanding for each other's rights and responsibilities.

9.3.7 Access to Crown frontages for recreational use

Much of the 30,000 km of Crown frontage in Victoria is highly valued as a means of access to Victorian waterways for recreation (see Chapter 7 for more information on the recreational use of waterways). As Crown frontages are also highly valued for agricultural use, there is potential for conflict between recreational users and farmers, particularly closer to urban areas. For example, recreational users may find access blocked, while farmers sometimes face issues with gates left open, theft or vandalism of farm property, camp fires escaping and concern about public liability issues. The values of riparian land can, in turn, be affected by inappropriate recreational use.

Policy 9.11

The Victorian Government will support community access to and along waterways and Crown frontages, where appropriate and in accordance with the existing statutory regime.

Recreational access to Crown frontages must be considered in riparian management programs, including provision of access (such as gates and stiles) and appropriate signage, especially in areas of known high public use. Special conditions regarding public access will be included in riparian management agreements where required.

Action 9.16: Develop and strengthen existing programs aimed at developing awareness by landholders and recreational users of their rights and responsibilities regarding access to and recreational use of Crown frontages.

Who: Department of Environment and Primary Industries, waterway managers

Timeframe: 2015



10

Water quality

*Water quality impacting on the Murray Cray.
Photographer: Keith Ward*

Water quality

Guide to the chapter

10.1 Context

- Importance of water quality
- Threats to water quality
- Water quality in Victoria
- Management issues

10.2 Framework for managing water quality

- National policy context
- State statutory framework
- Regional water quality planning arrangements

10.3 Water quality monitoring

10.4 Roles and responsibilities

10.5 Prevention and mitigation of water quality incidents

10.6 Water quality incident management: preparedness, response and recovery

10.7 Managing impacts from water storages on water quality

10.8 Managing the impacts of acid sulfate soils and soil acidification

10.9 Knowledge gaps

What are the issues with existing arrangements?

Future regional planning arrangements for water quality management need to be clearly outlined. The focus on catchment-wide water quality planning or regional water quality hotspots needs to be determined. Managing water quality requires supporting information from monitoring programs. Existing water quality monitoring programs need to be improved so they better inform planning and management decisions.

Agencies involved in water quality management do not always actively implement their different roles and responsibilities, particularly for managing water quality incidents. Improved frameworks for regional co-operation are required. Further work is needed to effectively manage diffuse source water quality pollution and address knowledge gaps for emerging water quality threats.

What improvements does the Strategy make?

For water quality the Strategy will:

- update the regional planning arrangements for water quality management
- set objectives for water quality monitoring across Victoria
- outline agency roles and responsibilities for water quality management
- commit to clarifying and strengthening roles and responsibilities for managing water quality incidents.

10.1 Context

10.1.1 Importance of water quality

Water quality (the physical, chemical and biological attributes of water) is a key measure of waterway condition. It determines the suitability of water for a particular purpose, with better quality water able to support a wider range of uses than poor quality water. For example, drinking water for towns and communities requires very high water quality, but water for irrigation or stock does not require the same level of quality. There are also water quality standards for recreational activities such as swimming or boating and these activities can be affected by degraded water quality. Adopting preventative measures to protect water quality, to appropriate levels, can significantly reduce the need for expensive water treatment options.

Good water quality is vital for supporting many types of plants and animals. For example, some native fish species require particular water temperatures to trigger breeding. Other waterway species may only be able to survive where water has relatively low levels of nutrients, sediment and pollution. The key values, threats and management activities for water quality are shown in Figure 10.1.

Water quality also affects the health of receiving waters, including coastal and marine environments. Many key marine species (for example, seagrass) are sensitive to changes in nutrient loads and sediment and are adversely affected by declining water quality inputs from upstream catchments.

Water quality is a major management issue for waterways in urban areas (see Chapter 14). For example, the lower reaches of the Yarra River often have poor water quality (particularly after heavy rainfall) as a consequence of urban development, stormwater, litter, licensed discharges of point source pollution and other factors. The water quality in large catchments such as the Yarra can have significant impacts on the health of receiving environments, in this case Port Phillip Bay. Improving water quality in these systems is vital to support waterway values and enhance the liveability of urban areas. Recent reforms to better integrate urban and water planning and to improve the health of the Yarra River and Port Phillip Bay are described in more detail in Chapter 14.

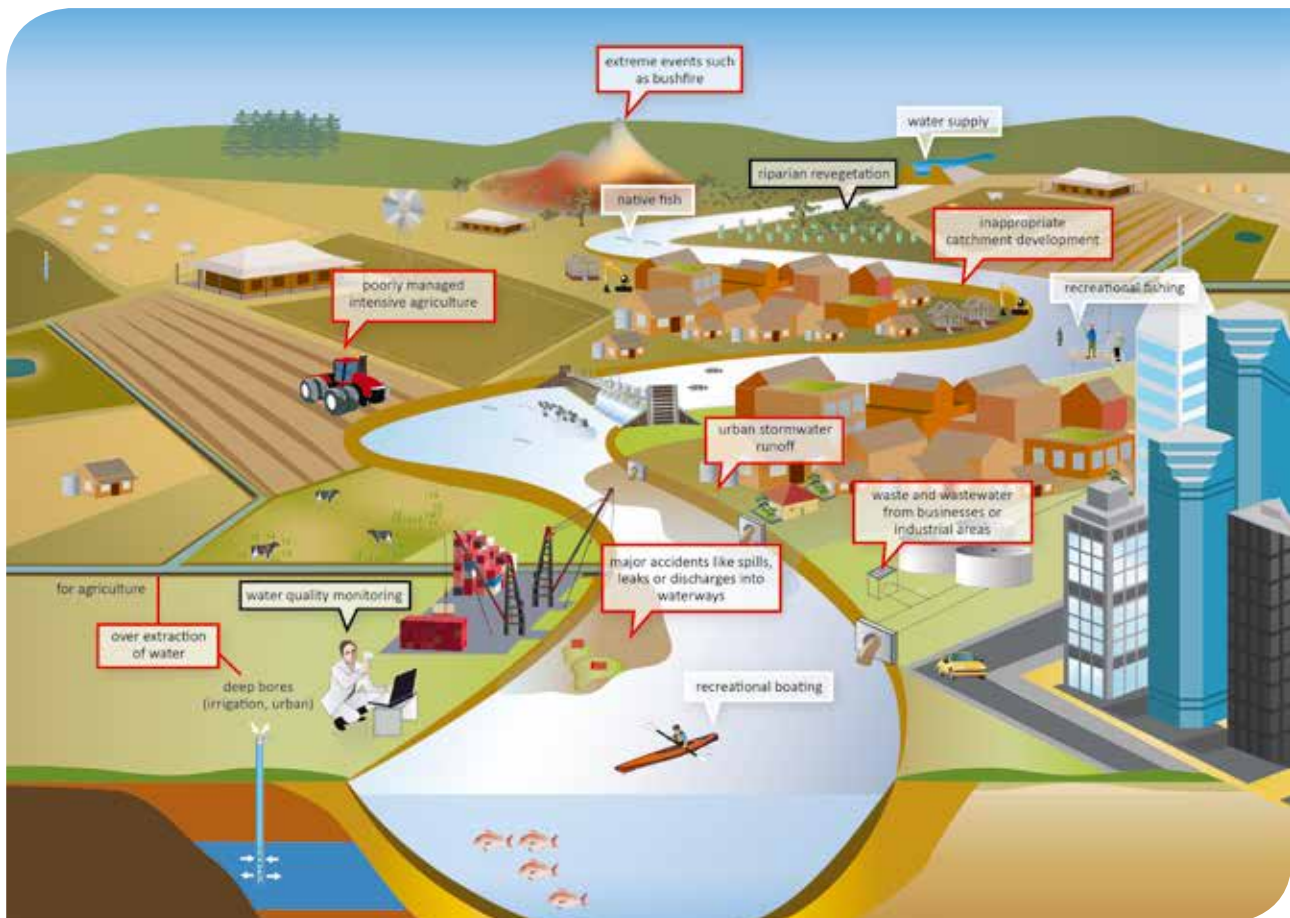


Figure 10.1. Values (white), threats (red) and management activities (black) for water quality.

10.1.2 Threats to water quality

Water quality can be affected when the physical, chemical or biological attributes of water change outside their usual range. These changes may include:

- increased nutrients (for example, phosphorus and nitrogen)
- increased sediment and turbidity
- increased salinity
- presence of toxicants (for example, heavy metals, pesticides, organic pollutants, algal toxins, pharmaceuticals from wastewater discharges, veterinary products used in agriculture and endocrine disrupting chemicals)
- pathogen and microbial contamination
- reduced dissolved oxygen levels
- altered acidity (pH)
- altered water temperatures or water regimes.

The types of activities that can cause these changes include:

- urban stormwater runoff
- over extraction of water
- poorly managed intensive agriculture
- inappropriate catchment development
- forestry
- extreme events such as bushfire and flood
- drought
- major accidents such as spills, leaks or discharges into waterways
- waste and wastewater management from homes, businesses or industrial areas
- port, marina and boating operations.

10.1.3 Water quality in Victoria

Water quality data are collected through the Victorian Water Quality Monitoring Network and the Regional Water Monitoring Partnerships (see Section 10.3). A report on long-term water quality trends from the mid 1970s up to, in some cases, 2005¹ showed that there was a small increase in total nitrogen across all regions of the state. The central and southern parts of the state also showed a small increase in total phosphorus. Increased conductivity (a measure of salinity) was evident in the western parts of Victoria. There were no clear trends for turbidity or pH.

A statewide assessment of data up to 2010² showed that since 2005 there have been no consistent, statewide trends for total nitrogen or total phosphorus, electrical conductivity generally increased and pH either did not change or slightly increased at most sites across Victoria. The assessment used detailed analysis at particular sites to provide information to help evaluate the efficiency and effectiveness of existing management activities and programs. Figure 10.2 illustrates data for total nitrogen in the Barwon River at Pollocksford between 1991 and 2010. The graph shows that nutrients levels started to improve (that is, total nitrogen decreased) around the time that the Corangamite Catchment Management Authority started actively working with dairy farmers to reduce agricultural runoff and the nearby water treatment plant was upgraded. Although there are still occasional instances where total nitrogen is outside the acceptable upper limit, it is clear that the management activities undertaken in the area have improved water quality at this site.

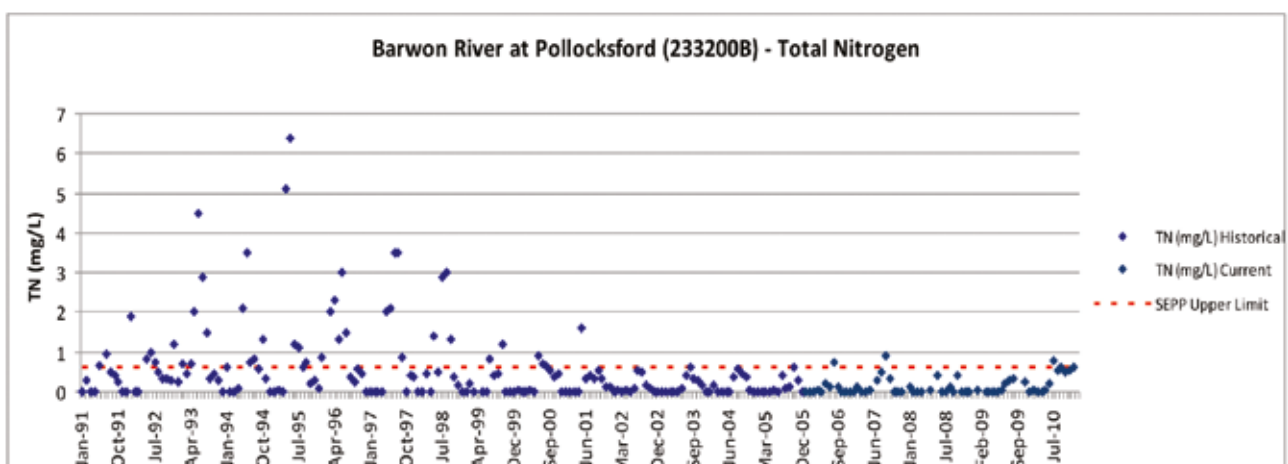


Figure 10.2. Trends in total nitrogen for the Barwon River at Pollocksford between 1991 and 2010.

10.1.4 Management issues

Diffuse and point sources of pollutants

Pollutants broadly fall into two different categories and each requires different management approaches. Point sources are direct inputs of pollutants into waterways, such as sewage outfalls and industrial wastewater. Non-point sources (or diffuse sources) are indirect inputs of pollutants into waterways that occur when pollutants are carried in surface water runoff or groundwater into waterways (for example, catchment runoff, stormwater runoff in urban areas, irrigation drainage and rising groundwater tables).

The control of point source pollutants is managed using a range of regulatory mechanisms. The Environment Protection Authority (EPA) Victoria uses tools provided under the *Environment Protection Act 1970* to prevent direct discharges of pollutants to waterways or limit discharges to levels that will ensure the environment is protected. The EPA Victoria uses a combination of works approvals, licences, issuing of notices and formal enforcement, in accordance with the levels of protection required by the *State Environment Protection Policies* (SEPPs). The EPA Victoria and the Department of Environment and Primary Industries (DEPI) undertook a joint review of the framework for statutory policies in 2013.

By contrast, the control of diffuse sources of pollutants is more difficult because there is a wide range of activities that contribute pollutants and it is difficult to track where they come from and how much can be attributed to each activity. High nutrient levels in a river might be caused by excess fertilizer running off farm properties, but since this may occur

over large expanses of land with multiple landholders it is very difficult to monitor and regulate. In urban environments, high levels of toxicants such as zinc are a common source of diffuse pollutants in rivers. Zinc particles come from galvanised tin roofs and car tyres and are washed into waterways when it rains. Stormwater runoff into waterways is a major source of pollutants and has significant impacts on water quality in urban areas (see Chapter 14).

The control of diffuse sources of pollutants requires collective effort. While the impact of any individual may be small, the cumulative impacts of many individuals may be substantial. Management of water quality can therefore only be successfully undertaken within a framework of integrated catchment management and integrated water cycle management that involves all of the land users and land managers within a catchment. Education is equally important to ensure that individuals are aware of their impacts on water quality and waterway condition and are committed to reducing these impacts.

Other influencing factors

Even when management activities are in place to improve water quality, the success of these measures can be affected by:

- time lags between a management activity being implemented and the response
- the amount of water in waterways (droughts or floods can affect water quality)
- unintended consequences of other management activities.



Protecting Melbourne's drinking water. Photographer: Amber Clarke

10.2 Framework for managing water quality

The existing management framework for water quality addresses both point and diffuse sources. This framework continues to provide the direction for water quality management in Victoria. The key aspects of the framework are:

- a national policy context
- a statewide, statutory framework that recognises regional catchment management arrangements as the main mechanism for the management of water quality
- regional planning arrangements for water quality that are developed in the broader context of waterway management and integrated catchment management
- regulatory controls and standards to minimise the impact of various land uses and other diffuse sources on water quality
- information or research on current and emerging water quality issues.

10.2.1 National policy context

The *National Water Quality Management Strategy* (NWQMS) provides the framework for improving water quality in Australian and New Zealand waterways. The main objective of the NWQMS is to achieve sustainable use of water resources, by protecting and enhancing their quality, while maintaining economic and social development. The policy framework is supported by the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZECC guidelines). The Australian Government also works in collaboration with states and territories to tackle major water quality issues in identified national water quality 'hotspots', by funding development of Water Quality Improvement Plans. In Victoria, this has included plans for Port Phillip Bay and Western Port, Corner Inlet and the Gippsland Lakes.

More recently, the National Water Initiative set out a framework for the health of water dependent ecosystems (such as those in rivers and wetlands) through environmental water management measures. As part of this framework, it also set intergovernmental obligations for water quality.

In those parts of the Murray-Darling Basin within Victoria, the management of water quality should remain consistent with arrangements under the Murray-Darling Basin Agreement, the NWQMS, the ANZECC guidelines and Victoria's statutory framework for managing water quality (see Section 10.2.2).

Victoria has negotiated a Basin Plan Implementation Agreement that clarifies obligations, including those related to water quality. Consistent with this, Victoria will be seeking to use existing state statutory frameworks to meet Basin Plan water quality requirements.

10.2.2 State statutory framework

The *State Environment Protection Policy (Waters of Victoria)* was developed in 1988 (and revised in 2003) to address water quality issues. It is a whole of government policy that identifies protection of waterways as a responsibility shared by all levels of government and industry, business, communities and the people of Victoria.

The SEPP(WoV) provides a statutory framework for the protection of the uses and values ('beneficial uses') of Victoria's fresh and marine water environments and remains the primary mechanism for managing water quality in Victoria (see Box 10.1). The SEPP(WoV) also provides other tools to manage water quality including licences on discharges, standards and encouraging best water quality management practice by industry.

The review of the framework for statutory policies (see Section 10.1.4) highlighted the need to review the SEPP(WoV) to ensure it is simple, relevant and focused on outcomes and risk.

Box 10.1: The role of the *State Environment Protection Policy (Waters of Victoria)* in managing water quality in Victoria

The SEPP(WoV) provides a statutory framework for the protection of the uses and values of Victoria's fresh and marine water environments. It provides statewide water quality objectives to protect the agreed uses and values, some of which refer to international and national guidelines, particularly for toxicant values. Specific schedules in the SEPP(WoV) deal with individual catchments and contain more detailed information on region specific objectives (for example, Waters of the Yarra Catchment, 1999).

The SEPP(WoV) also includes guidance for waterway managers, coastal boards, water corporations, communities, businesses, local government and State government agencies to protect and rehabilitate water environments to a level where environmental objectives are met and beneficial uses are protected – this is known as the attainment program. The attainment program identifies clear roles and responsibilities for environment protection and rehabilitation and identifies strategic actions and tools to address activities that pose a risk to Victoria's existing environmental management arrangements.

The purpose of the SEPP(WoV) is not to provide detailed management activities for water quality or wastewater management, but to provide a benchmark for the protection of water environments and strategic guidance on how this can be achieved. More detailed management frameworks and tools are provided through statewide strategies (such as this Strategy) and more detailed management activities are provided in regional plans developed by catchment, coastal and water management bodies (such as the regional Waterway Strategies). The SEPP(WoV) supports these important processes by providing a set of agreed uses and values to be protected, objectives needed to protect them and some strategic guidance on how this can be achieved.

The Victorian Government established the Office of Living Victoria to drive generational change in how Victoria uses and plans urban water systems to achieve better outcomes for the community. The Office of Living Victoria will oversee co-ordination of urban and water planning (see Section 14.2.3).

Further state policy relevant to the management of water quality includes discharge management (including new Memorandums of Understanding), groundwater management and the SEPP (Groundwaters of Victoria). In addition, there are several other plans where the primary objective is not the management of a water quality issue, but where the management activities will have water quality impacts (for example, the *Victorian Litter Strategy*).

Policy 10.1

The *State Environment Protection Policy (Waters of Victoria)* is the key statutory framework for managing surface water quality in Victoria and provides long-term, region-specific water quality objectives for rivers.

The *Environmental Water Quality Guidelines for Victorian Riverine Estuaries* provide specific guidance for managing water quality in estuaries.

Action 10.1: Review and update the *State Environment Protection Policy (Waters of Victoria)*.

Who: Department of Environment and Primary Industries, Environment Protection Authority Victoria.

Timeframe: TBD following review of the framework for statutory policies

10.2.3 Regional water quality planning arrangements

Existing regional water quality plans focused on areas with the poorest water quality, rather than areas of high value where poor water quality is a key threat. The regional priority setting process (see Section 4.2.3) that underpins development of the regional Waterway Strategies (RWSs) provides a mechanism to identify where poor water quality poses a threat to high value waterways and determine priority management activities. The development of the RWSs also provides a process to determine the beneficial uses in each waterway, in consultation with regional communities (the beneficial uses broadly align with the values outlined in Appendix 4.1). This is a more targeted and integrated approach to managing water quality than developing stand-alone water quality plans for each region.

Waterways with good environmental condition may be threatened by poor water quality from upstream areas or adjacent waterways. Management of water quality can require works to be undertaken outside priority areas, or require co-operation across catchment boundaries. Water quality management in estuaries and coastal wetlands needs to consider groundwater and coastal and marine influences.

Other regional policy relevant to water quality management includes the regional Sustainable Water Strategies, policies for environmental water management, water corporation standards for water re-use, municipal stormwater management plans, reviews of local government planning schemes and regional water cycle plans (see Section 14.2.3). Irrigation regions also have land and water management plans.

The DEPI is the State co-ordinator for blue-green algae management under the Blue-Green Algae Coordination Framework. The objectives of this framework are for parties to work co-operatively for effective management of blue-green algae events. The framework is broadly based on emergency management principles described in the *Emergency Management Manual Victoria*³.

Policy 10.2

Regional Waterway Strategies will identify priority waterways where environmental, social, cultural or economic values are threatened by poor water quality, resulting in high or very high risk to values ('regional hotspots').

If the sources of water quality issues for regional hotspots are known, high level management activities (aligned with the broad actions in the *State Environment Protection Policy (Waters of Victoria)*) to address these risks should be included in the regional Waterway Strategies. If the sources are unknown or uncertain, risk assessments or other investigations should be undertaken to help guide further action planning.

Catchment-scale water quality plans will only be developed in special cases when risk assessments or other investigations indicate they are required. Where relevant, these plans should also consider impacts of poor water quality on marine receiving waters.

Management activities may require partnership and negotiation between agencies (such as waterway managers, Department of Environment and Primary Industries, Environment Protection Authority Victoria, public land managers and local government) and should be negotiated during development of the regional Waterway Strategies.

Decisions on the type and quantity of water quality management activities will consider the scale of the problem and the resources available to remedy the issue. Realistic, short-term output targets that outline progress towards long-term resource condition outcomes will be required.

10.3 Water quality monitoring

Water quality reflects the environmental condition of waterways, but can also provide an integrated indicator of the health of whole catchments.

Analysis of long-term water quality trends and comparisons of changes in trends over time, can help to assess the effectiveness of water resource and catchment management activities (see Figure 10.2) and highlight areas where further management activities or investigations are required.

Water quality is measured regularly across much of Victoria through the Victorian Water Quality Monitoring Network and the Regional Water Monitoring Partnerships (consisting of 44 public and private organisations), which has historical and ongoing data from over 200 sites. In 2013 there were approximately 770 surface water monitoring sites covered under the partnerships. Melbourne Water also monitors water quality at more than 100 additional sites and water corporations conduct additional water quality monitoring (for example, at drinking water offtakes). Aquatic invertebrates are also monitored at hundreds of sites per year across the state (with an additional set of sites regularly monitored by Melbourne Water) and used as an indicator of water quality and environmental condition. Other sources of water quality data include intervention monitoring (see Section 17.3.3) and community monitoring programs (Waterwatch and EstuaryWatch). Community monitors undergo regular quality assurance and control tests to ensure that their data is of a level suitable for particular uses. Community members can also participate in water quality monitoring less formally through visual monitoring of their local waterways. They can report pollution or any activity potentially harmful to the environment to the 24-hour EPA Victoria Pollution Hotline.

Sediment quality monitoring can also help identify point source pollution in catchments and is increasingly being used to complement existing water quality and macroinvertebrate monitoring. For example, recent sediment monitoring of silver in waterways across Melbourne provided evidence that point sources of pollution were occurring in the catchment. When this data was coupled with a targeted drain monitoring program, the industry responsible for these discharges was identified and management measures were put in place.

Reporting on water quality every five years is a requirement under the *Water Act 1989* and this information can also be used to inform the future development or refinement of water quality policy and management activities.

The fourth assessment report is scheduled to be completed by 2017.

There are several issues with the current water quality monitoring and reporting framework. These include:

- lack of agreed and comprehensive objectives
- problems with accessibility and usability of data
- monitoring locations, coverage or parameters may not be sufficient to assess particular water quality issues, particularly for wetlands and estuaries
- there can be a time lag between data collection and data being available for use
- not all data is currently used to inform planning and management decisions
- current cost-share arrangements may not be equitable.

This Strategy includes a first step towards improving the usefulness and usability of the data from the Victorian Water Quality Monitoring Network with the development of a clear set of objectives for the program. Further work is also being undertaken to improve the accessibility of the data by developing the Water Management Information System (see Section 17.3.7).

Community-based water quality monitoring programs (such as Waterwatch and EstuaryWatch, see Chapter 5) can also provide an important source of information to inform regional decision-making if the appropriate quality assurance mechanisms are in place.

Policy 10.3

The objectives of the Victorian Water Quality Monitoring Network are to provide data that will:

- inform water resource management, catchment management and waterway management (including flood warning and information)
- inform assessments of catchment or waterway management programs and progress against regional targets over the long-term
- provide warning of any significant changes and detrimental environmental impacts
- inform short-term operational management
- inform long-term assessments of compliance with the *State Environment Protection Policy (Waters of Victoria)*
- contribute to public reporting requirements (including State of the Environment and catchment condition reporting).

Policy 10.4

Water quality monitoring programs will:

- Provide fit-for-purpose, high quality data that is the basis of informed decision-making and reporting.
- Be undertaken by organisations that manage for and report progress against regional or national water quality targets. Currently, these are the Department of Environment and Primary Industries, waterway managers, water corporations and the Environment Protection Authority Victoria.
- Be largely funded under a co-operative monitoring partnership that shares costs appropriately among those organisations that benefit from the data collection. The appropriateness and sustainability of the cost-share arrangement will be reviewed on an as-needs basis. Current partners include, the Department of Environment and Primary Industries, waterway managers, water corporations, Gippsland Lakes Ministerial Advisory Committee, Environment Protection Authority Victoria, Bureau of Meteorology, some local governments and the Murray-Darling Basin Authority. Additional water quality monitoring may be undertaken by individual organisations to complement data from the monitoring partnership.
- Take place at sites and frequencies as necessary to meet the objectives of the Victorian Water Quality Monitoring Network. The appropriateness of monitoring sites, the quality and the type of the information collected will be reviewed every eight years by the organisations in the co-operative monitoring partnership.
- Include ongoing development of high quality community monitoring programs that provide information that can be used to inform regional decision-making and waterway management.

Action 10.2: Publish the fourth Victorian water quality assessment for Victoria's rivers.

Who: Department of Environment and Primary Industries.

Timeframe: 2017

Action 10.3: Review the appropriateness of the location, information collected and cost-share arrangements for sites in the Victorian Water Quality Monitoring Network.

Who: Department of Environment and Primary Industries, waterway managers, water corporations, Environment Protection Authority Victoria.

Timeframe: 2016



Water quality monitoring through the Waterwatch community monitoring program. Courtesy DEPI

10.4 Roles and responsibilities

Ensuring the protection and management of Victoria's water quality requires collective effort.

Roles and responsibilities for agencies involved in water quality management and incident response (see Table 10.1 for an overview) are outlined in existing government legislation and policy. In particular, the SEPP(WoV) describes the statutory responsibilities for all key agencies. Although these roles are clearly documented, there is a need for improved co-ordination and accountability.

Water quality incidents can be broadly categorised into pollution events and 'natural' events (which may or may not be triggered by human activities).

Pollution events – include chemical spills, oil spills, discharges from industry, dead stock in waterways etc.

'Natural' events – include algal blooms, blackwater events, large scale fish death events and water quality impacts from acid sulfate soils. Bushfires, floods or extreme droughts can all increase the risk of 'natural' water quality incidents (for example, heavy rainfall after bushfire often delivers high loads of sediment and pollutants to waterways which can cause fish deaths).

Although there are currently some response plan protocols for waterway incidents (for example, fish deaths and algal blooms) these need to be further developed to provide increased capacity to deal with water quality incidents at a regional level (see Case study 10.1).

Table 10.1: Roles and responsibilities of key agencies in water quality management and incident response.

Who	Role	Responsibilities
Department of Environment and Primary Industries	Develop State legislation and policy for water quality management Facilitate sustainable development of primary industries Control agency for water and sewerage disruption	• Ensure a continuous water resources assessment program that provides for the collection, collation, analysis and publication of information about water quality (including salinity) • Develop Victorian policy on water quality management • Provide inter-governmental, statewide and regional liaison for water quality issues • Co-ordinate and maintain the statewide water quality database • Co-ordinate blue-green algae management across Victoria • Manage public lands for water quality benefits • Provide input to national water quality management policy • Invest in regional management activities to improve water quality • Work with primary industries (dairy, beef, vegetable, horticulture, intensive livestock) to recognise and reduce impacts on water quality
Parks Victoria	Manage parks on behalf of Department of Environment and Primary Industries	• Manage public lands to reduce risk to waterways from poor water quality • Ensure messages are communicated about marine and coastal values protected within parks and reserves (for example, Marine National Parks and Marine Sanctuaries) at risk from poor water quality • Manage litter in the Yarra and Maribyrnong rivers
Waterway managers	Regional waterway management	• Develop and implement programs and activities that protect or improve water quality • Support and facilitate the implementation of regional land use planning measures to improve water quality • Provide water quality advice for emergency water quality management (for example, spills and fish deaths) • Undertake community stewardship and awareness programs with a focus on protecting water quality through changes in personal behaviours • Contribute to water quality monitoring

Who	Role	Responsibilities
Environment Protection Authority Victoria	Independent regulator to protect and improve water quality Control agency for pollution of inland waters	• Work with industry (rural, industrial, building, commercial) sectors, government agencies and resource managers to assess and understand key drivers for and stressors on water quality • Work with government to develop legal frameworks (statutory policy and regulatory tools) to manage and protect water quality • Set statutory standards for acceptable water quality and indicators for healthy waterways • Support industry and water quality management agencies to comply with the law through guidance and advice • Monitor compliance with the law through the use of data and investigations to protect and manage water quality • Investigate water quality incidents classified as 'pollution' • Enforce the law through legal actions where required in accordance with compliance and enforcement policy • Encourage higher performance of industry and water quality management agencies through partnership approaches and strategic industry improvement program
Water corporations	Provide water supply and wastewater treatment services (urban) Provide water supply, drainage and salinity mitigation services for irrigation and domestic and stock purposes (rural) Manage water quality incidents in storages	• Provide of high quality drinking water in compliance with the <i>Safe Drinking Water Act (2003)</i> - urban only • Ensure appropriate contingency planning and water quality incident response and notification capabilities (including for blue-green algae in storages and for sewer spills and releases) • Develop and implement water quality incident management plans that include provisions for water quality issues resulting from water releases from water treatment plants - urban only • Assess planning permit applications to ensure that the use and development of land do not pose a significant risk to water quality • Support and facilitate the implementation of regional land use planning measures to improve water quality • Support appropriate research and development, ensuring continual improvement of the industry's performance and understanding of water quality issues from the source to the customer
Office of Living Victoria	Drive integration of water and urban planning	• Co-ordinate and facilitate the development of Integrated Water Cycle Plans for Melbourne's four growth areas and inner Melbourne • Prepare a Regulatory Impact Statement for building controls to improve the water performance of new buildings • Work with the Department of Planning and Community Development to amend the Victoria Planning Provisions to more broadly apply current performance requirements for the management of stormwater

Who	Role	Responsibilities
Local government	Develop and implement local and state planning policy	- Consider waterway management objectives in the statutory planning processes and maintenance of stormwater drainage systems - Develop municipal stormwater management plans (or contribute to Integrated Water Cycle Plans) that consider land use change and land management practices under local Planning Schemes - Ensure that subdivision designs comply with the Water Sensitive Urban Design requirements of the planning scheme and industry guidelines for best practice management - Undertake actions to improve stormwater quality - Manage public lands for water quality benefits - Manage septic tanks (including preparation and implementation of Domestic Wastewater Management Plans) and stormwater drainage services for water quality benefits - Facilitate the implementation of regional land use planning measures to improve water quality
Department of Health	Protect and enhance public health Regulate drinking water Planning and policy development Control agency for drinking water contamination	- Administer the <i>Safe Drinking Water Act (2003)</i> - Provide advice on potential public health effects of hazards in water (including chemical and microbial hazards in drinking water as well as recreational waters) - Provide advice on managing public health risk
Department of Planning and Community Development	Manage Victoria's planning system to create liveable, sustainable communities	- Manage environmental assessments of projects with potentially significant environmental effects, including water quality impacts - Ensure planning policy and urban design minimises the impact of land use change on water quality
Department of Transport	Control Agency for marine pollution incidents in Victorian waters	Ensure Victoria is adequately prepared for and effectively responds to any marine pollution incident in State coastal waters up to three nautical miles offshore
Alpine Resort Management Boards	Manage five Alpine Resorts in Victoria	Provide or arrange required basic services and utilities, including water supply and sewerage
Murray-Darling Basin Authority	Strategic planning for integrated and sustainable management of water resources in the Murray-Darling Basin	- Develop the Murray-Darling Basin Water Quality and Salinity Management Plan - Water quality monitoring
Industry	Produce goods and services	Minimise impacts on water quality by the implementation of best management practices in accordance with 'duty of care' responsibilities and good corporate citizenship
Individuals and communities	Personal behaviour and participation in programs	- Avoid and report pollution - Reduce individual water consumption - Participate in community monitoring programs such as Waterwatch

10.5 Prevention and mitigation of water quality incidents

In addition to the chronic nature of most water quality issues, there are also more acute water quality incidents (such as fish deaths, algal blooms and chemical spills) that can present very high and immediate risks to waterways.

Some acute water quality incidents could potentially be prevented or moderated through improved management of diffuse pollution sources. Limiting nutrient inputs to waterways can help reduce the frequency and severity of algal blooms. However, management activities for preventing or mitigating water quality incidents are not always well integrated into broader catchment and waterway management planning. For some other water quality incidents, further research is required to understand the risk factors or 'warning signs'.

Policy 10.5

The Department of Environment and Primary Industries and the Environment Protection Authority Victoria will encourage best management practices and specific management activities to reduce both diffuse and point sources of pollution to waterways.

Regional agencies will pursue a stronger integrated approach to management of factors contributing to water quality incidents in relevant catchment, land use, resource management and emergency management policies.



Taking samples from the Gippsland Lakes to monitor water quality. Courtesy DEPI



Blue-green algae bloom, Gippsland Lakes, contrasted with ocean water. Courtesy DEPI

10.6 Water quality incident management: preparedness, response and recovery

There are already established processes for the management of water quality incidents at both State and national levels, including the:

- *Emergency Management Manual Victoria* that sets out high level roles and responsibilities for agencies in responding to water quality 'emergencies'
- *Waterway Incident (Fish Death) Response Guideline 2006* and associated regional response plans
- Blue-Green Algae Coordination Framework
- National Oil Spill Response Atlas and Management Guidelines
- *Victorian Marine Pollution Contingency Plan*⁴.

These existing documents and processes outline roles and responsibilities for managing and responding to water quality incidents. However, apart from the *Emergency Management Manual Victoria* there is no over-arching framework for preparedness, response to and recovery from water quality incidents in Victoria. Currently, agency roles and responsibilities are better implemented for pollution events than 'natural' incidents. Regional approaches to management and response to 'natural' water quality incidents vary.

There is a need for greater integration at the State and regional level and improved regional frameworks for planning and responding to water quality incidents. In some regions, partnership agreements already exist and this may provide a useful model for other regions across the state (see Case study 10.1).

There is currently limited planning for longer-term recovery activities following water quality incidents in Victoria. There is a need for clear policy and protocols to guide management of waterway health and fisheries resources following an incident to minimise risk of the event re-occurring and maximise chances for recovery.

Policy 10.6

Statewide approaches to management of water quality incidents will be improved through review and clarification of agency roles.

Regional approaches to water quality incident response will be improved through development of regional 'waterway incident' partnership agreements between relevant agencies, where appropriate.

Action 10.4: Clarify and strengthen roles, responsibilities and accountability for agencies involved in managing water quality incidents.

Who: Department of Environment and Primary Industries, Environment Protection Authority Victoria, waterway managers, Marine Safety Act waterway managers water corporations, Parks Victoria and other relevant government departments.

Timeframe: 2015

Case study 10.1: Regional partnership agreement for managing water quality incidents in the Goulburn Broken region

A partnership agreement for managing water quality incidents was established in 2007 by key agencies with regulatory or functional responsibilities for waterways in the Goulburn Broken region. The *'Partnership Agreement for Preparedness and Response to Waterway Incidents in the Goulburn Broken Catchment'* clearly outlines roles and responsibilities for responding to regional waterway incidents and was signed by the (then) Department of Sustainability and Environment, the Environment Protection Authority Victoria, the Goulburn Broken Catchment Management Authority, Goulburn-Murray Water, Goulburn Valley Region Water Authority, North East Region Water Authority and Department of Human Services.

The agreement provides a regional framework for response and recovery from waterway incidents that are not covered by existing arrangements. The intent of the agreement was to clearly establish the framework for leadership and provide guidance on operations, communications and investigation of waterway incidents. This was considered essential for a co-ordinated approach and to maintain the confidence of the community while all agencies carry out their respective roles in protecting, restoring and maintaining water quality of waterways.

In support of the agreement, a Water and River Contingency Planning Group was also established for the region that considers a range of waterway and water quality issues, including fish death incidents. This group meets on a regular basis throughout the year and more frequently when risks to waterways increase (for example, periods of drought, floods and low streamflow).

The agreement has provided useful guidance during the dry conditions that were experienced during the drought and for managing water quality incidents such as low dissolved oxygen, blackwater and fish deaths that were caused by regional flooding.

A review of the current agreement is scheduled on a regular basis, with annual incident de-briefs and scenario planning also undertaken.

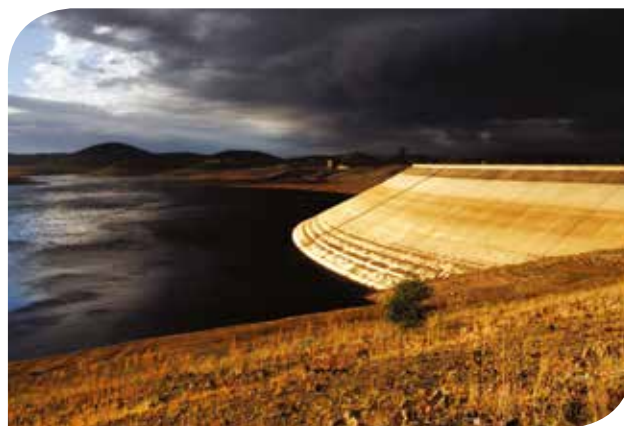
This approach provides one potential model for improved regional co-operation and leadership on managing water quality incidents that could be adopted more widely across the state. Key lessons from implementing the Goulburn Broken agreement could be used to develop and design other regional models.

10.7 Managing the impacts from water storages on water quality

The storage of water in large dams can affect water quality both within the storage and downstream of the storage when it is released. For example, holding water in storages can change the natural levels of sediment, metals, dissolved oxygen and growth rates of algae. Work is currently being undertaken by some water corporations using models to understand these impacts and test alternative operating regimes that aim to reduce negative effects on water quality while meeting water supply obligations.

There are also impacts that arise in most large storages as a result of a cold and low oxygen layer of water forming at the bottom of the storage. This can be problematic when storages have their outlets at the bottom of the dam wall (usually older storages) because this very cold and low oxygen water is transported into the downstream waterways. Conversely, in upland areas water released from storages may be too warm (for example, the upper Snowy River).

Alteration of the natural temperature regime of waterways is listed as a threatening process under the *Flora and Fauna Guarantee Act 1988*. Altered temperature regimes (or thermal water pollution) can affect on water quality (by changing levels of dissolved oxygen) and directly impacts native species. For example, thermal water pollution can interfere with natural temperature cues that trigger spawning in many native fish species. Impacts of dams and storages on waterway condition (including thermal water pollution) are addressed in Chapter 11.



Sugarloaf Reservoir. Photographer: Alison Pouliot

10.8 Managing the impacts of acid sulfate soils and soil acidification

Acid sulfate soils are soils or sediments that contain (or once contained) high levels of reduced inorganic sulfur. When exposed to oxygen, the soils or sediments undergo a chemical reaction (called oxidation) that produces acid.

If the amount of acid produced is greater than the system's ability to absorb that acid, the pH of the system falls (that is, it becomes acidic). The oxidation of acid sulfate soils consumes oxygen. In extreme cases this can remove all the oxygen from a waterway, resulting in the death of aquatic plants and animals. Oxidation of acid sulfate soils can also lead to the release of metals (such as cadmium and lead) and metalloids (such as arsenic) into the environment. Disturbance of acid sulfate soils can occur as a result of drainage, dredging, drilling for bores, drought that induces drying of soil profiles, extractive industries, infrastructure works, land use changes that alter water tables, urban and tourism development and water extraction.

Disturbance of acid sulfate soils can result in fish deaths or other negative effects on waterways. Noxious odours may result, reducing social amenity. Acid drainage water can also corrode concrete and steel in underground pipes and building foundations. The processes through which acid sulfate soils affect waterways are not all well understood and their location and level of risk is often uncertain.

Acid sulfate soils occur naturally in both coastal and inland settings. It had been assumed that acid sulfate soils in Australia were largely restricted to the coastal regions. However, they have recently been identified in inland wetlands and rivers in Victoria, including in the Corangamite region, on the Dundas Tablelands (associated with permanently flowing springs), waterways in Mildura and in waterways affected by dryland salinity. The prevalence of acid sulfate soils in inland settings is thought to have increased because of human-induced changes to surface water and groundwater flows and levels, changes to natural wetting and drying regimes and an increase of sulfate in surface waters. In inland waterways, exposure of sediments (for example, during drought) can trigger acidification events.

Coastal land in Victoria with the potential to contain acid sulfate soils has been mapped. More detail is needed in some areas, particularly those where disturbance and impacts are evident and the management of risk would be improved by more site-specific characterisation. Knowledge gaps remain regarding the occurrence of potential acid sulfate soils in most inland parts of Victoria.

Management of coastal acid sulfate soils is guided by the *Victorian Coastal Acid Sulfate Soil Strategy* and the *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils*. The *Victorian Coastal Acid Sulfate Soil Strategy* outlines the relevant legislative and approval processes that relate to coastal acid sulfate soil issues. In inland aquatic systems, national guidance is in place.

The Industrial Waste Management Policy (Waste Acid Sulfate Soils) provides a policy and management framework with specific requirements to ensure appropriate waste management and protect human health and the environment.

Policy 10.7

Management of waterways will take into account the threats posed by acid producing soils, rocks and sub-surface materials, their in situ properties, potential disturbance and the principles of best practice management.

Environmental watering plans for individual waterways will take into account any risks associated with acid sulfate soils.

Action 10.5: Identify and document current knowledge about how acid sulfate soils threaten environmental, social, cultural and economic values of waterways and identify those factors that pose the greatest risk.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016

10.9 Knowledge gaps

Diffuse sources of water quality pollution are a major threat to waterways but further information and tools are required for their effective management.

Effective management requires the development of detailed water quality models and improved strategies for ensuring all stakeholders carry out their responsibilities. Further research is required to investigate the effectiveness of different management options and strategies for selecting and implementing the most appropriate suite of tools in different situations.

There are also emerging water quality threats that are currently not being monitored or managed comprehensively and are not fully understood. These emerging threats (such as endocrine disrupting compounds from pharmaceuticals in recycled waste water, pesticide use and pathogens) are a concern for their potential impact on waterway condition and public health.

Government is investing in research to improve knowledge in these areas. This is most often through effective research partnerships involving government departments and those with waterway and catchment management responsibilities.

Action 10.6: Support research to address priority knowledge gaps in water quality management.

Who: Department of Environment and Primary Industries, Environment Protection Authority
Victoria, waterway managers.

Timeframe: 2016



11

The river channel



*Fish ladder at Cowwarr Weir, Thomson River.
Courtesy West Gippsland CMA*

The river channel

Guide to the chapter

11.1 Context

- Values of the river channel
- Threats to the river channel
- Risks to public infrastructure from waterway processes

11.2 Framework for managing the river channel

- Roles, responsibilities and statutory requirements
- Approach for managing the river channel

11.3 Preventing degradation of the river channel

- Undertaking works on waterways
- Managing instream habitat
- Existing regulation for dams in waterways
- Existing regulation for mining and sand and gravel extraction

11.4 Maintaining and improving river channel condition

- Maintenance, operation and design alteration of existing structures
- Removal of instream barriers
- Maintaining and restoring lateral connectivity
- Improving passage for native fish

What are the issues with existing arrangements?

The existing framework for managing the river channel has proved to be a solid foundation for future management. New knowledge, particularly in relation to managing structures and instream habitat in the river channel need to be incorporated into the existing framework. Investment in previous fish passage works has not always been secured through effective operation, maintenance and monitoring.

What improvements does the Strategy make?

For managing the river channel the Strategy will:

- promote a partnership approach between land and water managers, local government and the community
- identify opportunities to maintain or improve river channel condition by reducing risks associated with existing instream structures
- commit to developing best practice standards for construction and maintenance works in waterways
- improve connectivity to support native fish populations and monitor effectiveness of fish passage works.

11.1 Context

11.1.1 Values of the river channel

The river channel (see Box 11.1) supports a range of important values such as water supply to industry, agriculture and urban centres, fishing, swimming and boating, as well as important habitat for native plants and animals.

Many of these waterway values depend on the environmental condition of the river channel. For example, boat ramps rely on the stability and composition of the bed and banks, while the best swimming spots are often within deep, natural pools. Stable bed and banks of the river channel help to improve the quality of water that flows to downstream users. Fishing success depends on healthy populations of fish species which, in turn, rely on the availability and condition of habitat in the river channel. Some native fish species, such as Murray Cod, are important cultural values for Traditional Owners and Aboriginal people. It is estimated that native fish populations in the Murray-Darling Basin have fallen to 10 per cent of pre-European settlement levels and more than 60 per cent of species are threatened¹. The key values, threats and management activities for the river channel are shown in Figure 11.1.

High quality instream habitat is essential to support healthy populations of aquatic plants and animals. The key components of the river channel that determine the quality of instream habitat are:

- substrate type and diversity, such as the presence of pools and riffles
- channel shape, which influences aspects such as water depth, velocity and the presence of backwaters and undercut banks
- large woody habitat (snags) and instream vegetation, which provide protection from erosion, feeding and spawning sites for fish and increase the diversity of physical habitat types
- native riparian vegetation
- connectivity, which allows animals, organic material and sediments to move both along the river and laterally into floodplains and associated wetlands.

Changes to the presence or amount of any of these components of physical habitat will influence the plants and animals that live there.

Box 11.1: The river channel

The river channel is the bankfull channel (including the bed and banks). The physical characteristics of a river channel vary considerably among rivers and along the course of a river. The river channel usually becomes wider and deeper as a river travels downstream from its headwaters and the catchment area and water volumes increase.

There is great variation across Victoria in stream channel types and channel processes, which reflect both the landscape setting and the history of catchment, riparian and channel management. Rivers are dynamic systems that flood and change course through the natural processes of erosion, sedimentation and avulsion (a sudden change in a river's course) that are driven by changes in inflow and sediment input from the catchment. These geomorphic processes, which can operate over both short and long time scales, determine the shape of the river channel and influence floodplain evolution, habitat formation, nutrient and carbon exchange with the floodplain and downstream environments.

11.1.2 Threats to the river channel

Some processes and activities, including some management activities (see Sections 11.3 and 11.4), can degrade the condition of the river channel. In urban areas these activities are often intensified (see Chapter 14).

Erosion and sedimentation

The natural processes of erosion, avulsion and sedimentation, which are most active during floods, can be accelerated by activities within the river catchment such as the large scale clearing of catchment vegetation, poor soil management practices and bushfire. These activities can result in the delivery of excessive amounts of sediment, nutrients and ash (in the case of bushfires) to the river, especially following heavy rainfall.

Stock access and the removal of riparian vegetation can, in some cases, cause damage to the stability of the bed and banks and may also contribute to increased nutrients in the stream. The mobilisation and deposition of sediment alters the channel form, smothers habitat, reduces instream productivity and threatens native fish species that use deep pool habitats or clean gravel patches. Increased turbidity reduces visibility for native predators like Murray Cod and can affect other native fish species.

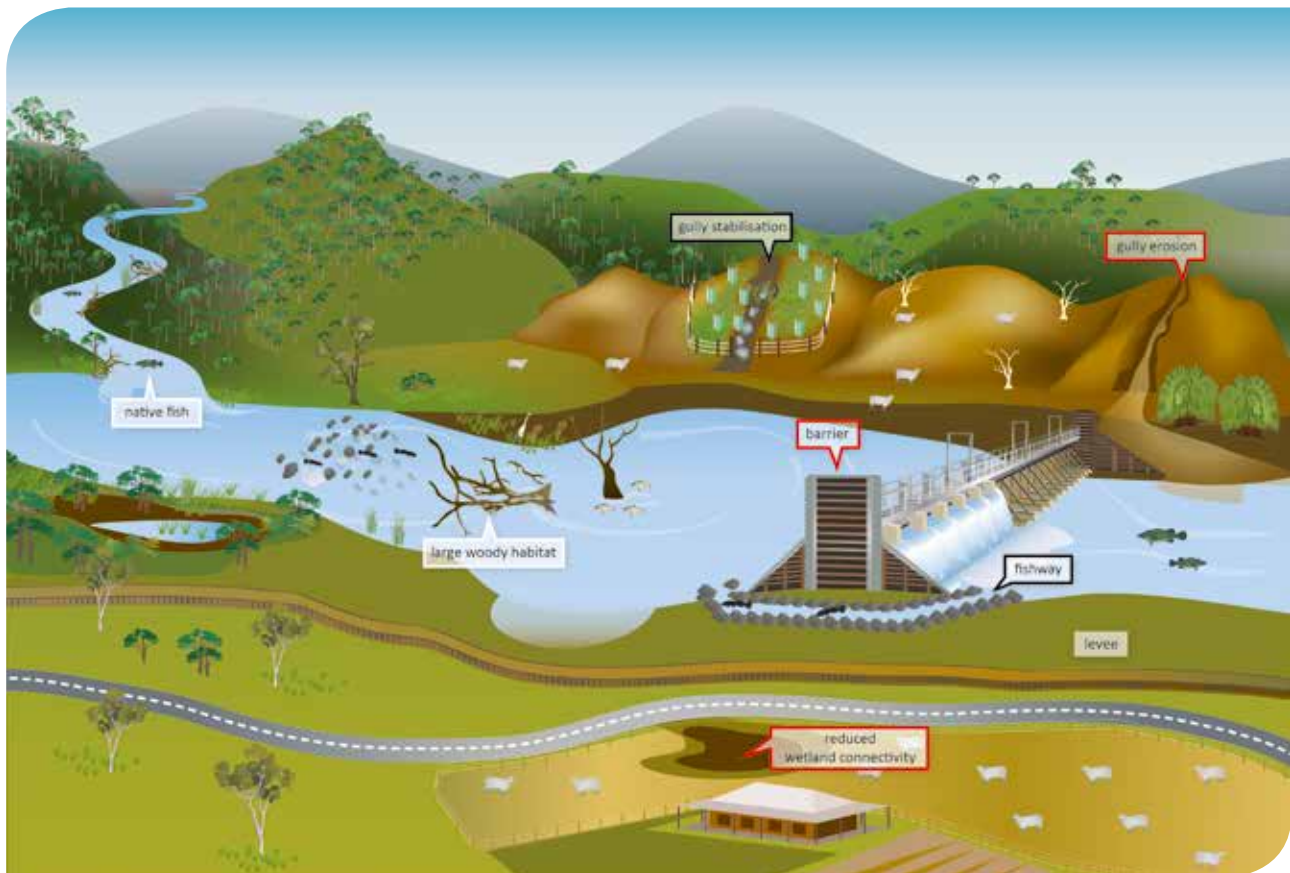


Figure 11.1: Values (white), threats (red) and management activities (black) for river channel management.

Damage to instream habitat

Activities such as channelisation, the removal of large woody habitat and instream vegetation, undertaking works on waterways, building of dams and dredging or mining can negatively affect the physical habitat in the river and disturb the substrate making the river more prone to erosion and avulsion. These activities also potentially remobilise pollutants, such as metals, that are buried in the sediments. Changes to water regimes can leave banks exposed, causing slumping that releases large amounts of sediment into the river. Downstream of water storages, scouring of the bed and banks can occur if there are large and rapid releases of water. If cold water is released from the bottom of a dam it can have detrimental impacts on native fish and aquatic invertebrates.

Loss of connectivity

Dams, weirs, culverts and road crossings are important public infrastructure, but may act as barriers preventing upstream and downstream movement of native fish and other animals and can also interrupt the transport of organic material and sediment. Barriers such as flood levees and erosion control structures can prevent lateral movement of water onto the floodplain and to its associated wetlands. This may reduce available habitat, prevent the exchange of carbon, nutrients and sediments between the river and the floodplain and limit breeding opportunities for certain fish species.

Extremes of climate

Australia's climate is naturally variable and Victoria's rivers have adapted to droughts and floods. The potential impacts of climate change may include longer periods of low flow and more frequent extreme events (see Chapter 15). River channels may experience additional impacts under these extremes causing increased destabilisation of the bed and banks. An increase in the intensity and frequency of bushfires may damage bank vegetation, instream habitat and river bank structures (such as pile fields). More extreme rainfall events with increased flood peaks will put additional pressure on the stability of the bed and banks and increase sediment loads entering rivers.

11.1.3 Risks to public infrastructure from waterway processes

The dynamic nature of waterway processes and the accelerated changes caused by human activities mean that public infrastructure in river channels may be subjected to greater loss or damage in the future, especially during floods. In settled areas, the impact of these dynamic waterway processes on regional communities can be significant. Risks to public infrastructure from waterway processes is addressed in Section 4.2.3.

11.2 Framework for managing the river channel

Successful management of the river channel requires an approach that:

- clearly identifies roles and responsibilities
- promotes partnerships with land and water managers, local government and the community
- sets out the management approach
- defines best practice standards for maintenance and improvement works.

The framework outlined in this Chapter builds on the existing approach to the management of the river channel in Victoria, taking account of statutory requirements, new knowledge and recent management experience.

11.2.1 Roles, responsibilities and statutory requirements

In Victoria, the bed and banks of most large rivers and the associated riparian land (see Section 9.1.3) are in public ownership.

Under the *Water Act 1989*, water corporations are delegated to licence works on the river channel associated with taking and using water (for example, the construction of dams and weirs). They must take into consideration all possible impacts, including native fish passage. The Act also provides for waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region) to regulate works in waterways. The responsibilities of waterway managers and water corporations are further described in the Statement of Obligations, issued under provisions of the *Water Act 1989* by the Minister of Water. For example, water corporations are required to manage the environmental impact of their activities on the waterway in accordance with the Statement of Obligations issued to them.

Following the review of the *Water Act 1989* (see Section 1.2.1), the Statements of Obligations for water corporations (including Melbourne Water) and catchment management authorities will also need to be reviewed.

In addition to the responsibilities assigned to water corporations and waterway managers, other agencies and public authorities have responsibilities under a range of legislation for land management. This includes issuing licenses or permits for certain activities (the Department of Environment and Primary Industries (DEPI) and Parks Victoria), undertaking certain functions such as water supply and regulation (water corporations) and managing recreation in certain waterways (Parks Victoria). Local government has an important role in regulating activities that may affect the river channel through administering planning schemes. Under the *Marine Safety Act 2010*, port authorities or appointed Marine Safety Act (MSA) waterway managers are responsible for altering or dredging channels for navigation in the waters under their control and regulating vessel operations and on water activities by waterway users on Victorian State Waters.

The *Conservation, Forest and Lands Act 1987* requires public authorities to submit plans of works to the Secretary of the DEPI for comment where works involve ‘*construction of dams, weirs or other structures in or across watercourses which potentially interfere with the movement of fish, or the quality of aquatic habitat*’.

Threatened aquatic species are listed under the *Flora and Fauna Guarantee Act 1988*. The Act also lists three potentially threatening processes: the removal of woody debris from Victorian rivers and streams; the prevention of passage of aquatic biota as a result of the presence of instream structures; and changes to natural temperature regimes in waterways. Maintenance or restoration of native fish passage is also supported by the *Murray-Darling Basin Native Fish Strategy 2003–2013*¹. The *Fisheries Act 1995* regulates fishing in waterways and promotes the ecologically sustainable development, use and management of fisheries.

Action 11.1: Review and update the Statement of Obligations issued by the Minister for Water to catchment management authorities.

Who: Department Environment and Primary Industries, catchment management authorities. **Timeframe:** 2014

11.2.2 Approach for managing the river channel

Management of the river channel needs to be based on an understanding of the geomorphological processes that are at work in catchments. Where catchments and water regimes are largely unaltered and processes such as erosion and sedimentation are relatively balanced, the focus of management is on maintaining natural processes, managing invasive species (see Chapter 16) and managing waterway-related bushfire risks and impacts (see Sections 9.3, 15.2.3 and 15.3).

Where natural river channel processes have been accelerated or changed by land use in the catchment (for example, land clearing and agriculture), by outdated river management activities (for example, channelisation and removal of large woody habitat) or by changes to the water regimes, the channel may become unstable and affect channel form, resulting in lower resistance to flood damage.

Improving channel stability and the condition of river channels in degraded areas requires a long-term approach that focuses on riparian management programs (see Chapter 9) and integrated catchment management to reduce erosion and improve soil health. Where the water regime is regulated, improvements to river channel

conditions may also require changes to river operations (where this can be done without compromising water supply and delivery) or environmental watering (see Chapter 8). In the shorter-term, management activities such as structural engineering works or reinstatement of large woody habitat may also be needed to address local erosion, sedimentation or habitat loss. In heavily urbanised areas, where options for sustainable catchment management and riparian restoration are limited, a greater emphasis on managing stormwater runoff or instream rehabilitation works may be necessary.

Priority management activities for the river channel outlined in the regional Waterway Strategies (RWSs) may include hard engineering works (for example, rock chutes, reinstatement of pool-riffles and fishways) or broader catchment management activities. Works standards and technical guidelines for waterway management define best practice standards for maintenance and improvement works in waterways, as outlined in Section 17.3.2. Supplementary expert advice may be required to implement best practice standards for engineered works, based on the characteristics of the site of the proposed works.

Policy 11.1

Waterways will be managed to achieve appropriate rates of erosion, sedimentation and avulsion over the long-term, consistent with natural processes.

Management of the river channel will focus on maintaining and improving the bed, banks, instream habitat, riparian land and integrated catchment management to improve resistance and resilience to the adverse impacts of waterway processes on river channel condition and public infrastructure.

Options for changing river operations to improve the water regime in priority regulated rivers will be investigated as part of the regional Waterway Strategies.

11.3 Preventing degradation of the river channel

Some works and activities that are undertaken within the river channel have the potential to degrade the physical form of waterways and affect the environmental values of the channel and associated habitats. It is important that controls, standards and guidelines are in place to manage the risks posed by such works and activities.

11.3.1 Undertaking works on waterways

Works and activities in waterways include construction of bridges and access crossings, bed and bank erosion control works, stormwater drainage outlets, removal of invasive instream vegetation, installation of pipelines and stream deviations. Controls on dams are addressed in Section 11.3.3.

Where works and activities in waterways are not undertaken in accordance with best-practice standards, they may pose a risk to waterway values, landholders or public infrastructure owners. In addition to the regulatory provisions under the *Water Act 1989* (see Section 11.2.1) the *Technical Guidelines for Waterway Management*² and the *Guidelines for Assessment of Applications for Permits and Licences for Works on Waterways* provide guidance to waterway managers on best management practice for engineering works in waterways.

Experience in recent floods indicates that to minimise the risk of flood damage to works and activities, they need to be designed to take account of the river processes of erosion and sedimentation and need to be regularly maintained.

Policy 11.2

Waterway managers will work with proponents of works and activities in waterways to:

- ensure compliance with regulatory requirements
- promote best-practice standards of design to:
 - maintain or improve the environmental condition of the site and surrounds
 - avoid causing instability or adverse site impacts or increased flood impacts
 - minimise the risk of damage to the works from future flooding and waterway processes
- reduce the likelihood of affecting other parties and infrastructure
- encourage adequate operation and maintenance of works into the future.

Action 11.2: Develop guidelines on best-practice standards for minimising risks to works and activities in waterways from flood damage.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016

11.3.2 Managing instream habitat

Large wood and native instream vegetation are important habitat in rivers. They provide shelter, food sources and breeding sites for a variety of instream animals, including threatened fish species, as well as contributing to biological processes within the river channel. Large woody habitat is an important structural component of rivers, assisting in the formation of features such as scour pools and channel bars and in stabilising the river channel. In large lowland rivers, large woody habitat may be the only stable substrate and an important instream source of nutrients.

Extensive removal of large woody habitat and instream vegetation clearing occurred in Victoria from the late 1800s to late 1990s with a view of increasing conveyance of flood water. However, extensive research has shown that large woody habitat has negligible impact on channel capacity and removal does little to improve flood conveyance. In addition, instream vegetation and large woody habitat have been found to reduce bed erosion. The removal of large woody habitat and instream vegetation increases flow velocity, bed degradation, channel enlargement and loss of important instream habitat.

There may be instances where the removal of large woody habitat or instream vegetation is warranted to maintain the social or economic values of a waterway, reduce an immediate threat to public infrastructure or reduce public risk. In such cases, waterway managers will need to balance the habitat benefits against the level of risk. Alternatives to the removal of large woody habitat may exist, such as anchoring or realignment.

Re-establishment of large woody habitat and native instream vegetation may be needed to improve the condition of the river channel and support environmental values in priority rivers. The current guidance for managing large woody habitat is limited and requires updating based on new knowledge.

The management of instream vegetation and large woody habitat in relation to reducing flood impacts is addressed further in Section 15.3.3. The Environment and Natural Resources Committee (ENRC) conducted an inquiry into matters relating to flood mitigation infrastructure in Victoria in 2012, including clearing of vegetation in waterways to mitigate flood risk. The Victorian Government's response to recommendations of the ENRC may result in changes to the management of instream vegetation and large woody habitat.

Policy 11.3

Large woody habitat or native instream vegetation will not be removed from river channels unless it is demonstrated to pose a serious risk to public safety or public infrastructure. Realignment or anchoring of large woody habitat will be undertaken where feasible, rather than removal.

The management of large woody habitat and native instream vegetation in waterways to reduce flood risk will be conducted in accordance with the Victorian Government's response to any recommendations of the Environment and Natural Resources Committee inquiry into matters relating to flood mitigation infrastructure in Victoria.

Where programs to reinstate large woody habitat or instream vegetation are planned to improve the condition of the river channel, the benefits and risks will be assessed in consultation with the community.



*Re-establishment of large woody habitat.
Photographer: Sean Phillipson*

Action 11.3: Develop guidelines on the assessment of flood risk posed by large woody habitat and instream vegetation.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

Action 11.4: Prepare updated guidance for managing large woody habitat, including information for the community.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

11.3.3 Existing regulation for dams in waterways

Dams have many social and economic values. They provide water for drinking, irrigation, industry and offer recreational activities such as fishing and boating. Although dams may provide refuge habitat for animals during dry periods, they also cause negative impacts on aquatic environments. These impacts (such as altering natural water and temperature regimes, trapping sediment and impeding the movement of native fish) need to be appropriately managed.

Private dams

Under the *Water Act 1989*, water corporations are delegated to carry out the licensing for private dams. In considering a licence application to construct a private dam on a waterway with high environmental value, the water corporation must be satisfied that the applicant has thoroughly investigated alternative sites for the dam and must ensure that requirements relating to native fish passage and environmental water are addressed. Owners of existing private dams also require an operating licence if there is a need to pass water downstream for the environment.

Water corporations must refer applications for a new private dam to the DEPI, local government and waterway managers for comment before it is approved. The RWSs provide guidance to assist water corporations and referral authorities in identifying waterways of high environmental value. Planning permits may also be required for construction of a new private dam, depending on its location.

Construction or refurbishment of dams by water corporations

The *Gippsland Region Sustainable Water Strategy*³ outlined the Victorian Government's policy on proposals for new large public storages. The policy provides for a thorough investigation into the economic, environmental and social benefits of any such proposal. Water corporations are required to ensure that works are undertaken in accordance with current environmental practice, including requirements for environmental watering, native fish passage and managing risks to downstream water quality (including thermal pollution) when constructing or refurbishing their assets (for example, weirs) on waterways.

11.3.4 Existing regulation for mining and sand and gravel extraction

Sand, gravel and mineral extraction needs to be managed to ensure minimal impact on waterway condition and river channel stability. Potential types of damage include removing substrate, changing the bedform of the river and triggering significant erosion events. Eductor dredging has

been banned in Victoria since 1990. However, there are some cases where the extraction of sand or gravel from a river can provide benefits to the river, such as in the management of sand slugs caused by catchment erosion.

The extraction of sand, gravel, rock or minerals from a waterway requires approval under various legislation such as the *Mineral Resources (Sustainable Development) Act 1990*, *Environmental Protection Regulations 2007*, *Environmental Effects Act 1978*, *Planning and Environment Act 1987* and the *Water Act 1989*. A local government planning permit is required (and, for reserved land, a licence is also required under the *Land Act 1958*) to enter reserved public land to remove materials from the bed or banks of a waterway or to seek and remove gemstones. Specific approvals may apply as outlined below:

- A work authority under the *Mineral Resources (Sustainable Development) Act 1990* is not required for sand or gravel extraction but is required for mineral extraction.
- For extraction of sand, gravel, rock or minerals up to a depth of two metres below the natural surface, and for an area of more than 2000 square metres, or for extraction to a depth greater than two metres below the natural surface, a work authority under the *Mineral Resources (Sustainable Development) Act 1990* is required.
- Extractive industry and mining activities require a Works Approval and may require an ongoing licence from the Environment Protection Authority Victoria under the *Environment Protection (Scheduled Premises and Exemptions) Regulations 2007*.
- Approval under the *Water Act 1989* is required from the waterway manager where the extractive works will interfere with the bed or banks of a waterway.
- A referral to a catchment management authority made under the *Planning and Environment Act 1987* for works within a flood zone or overlay.

Proposals to mine in a waterway may also require an environmental effects statement under the *Environmental Effects Act 1978*.

Policy 11.4

Mining and sand and gravel extraction must be conducted in accordance with current regulatory controls.

Sand and gravel extraction in the river channel may be undertaken by waterway managers as a management tool for the protection of waterway assets.

Action 11.5: Develop guidelines to assist waterway managers in determining appropriate environmental requirements when assessing proposals for new private dams.

Who: Department of Environment and Primary Industries, waterway managers, water corporations, local government.

Timeframe: 2016

11.4 Maintaining and improving river channel condition

There are opportunities to mitigate the risks to river channel condition posed by instream structures and to improve longitudinal and lateral connectivity to enhance the viability of native fish (and other animals) and support instream processes.

11.4.1 Maintenance, operation and design alteration of existing structures

The maintenance and operation of structures in waterways (such as storages or weirs) can affect the condition of the river channel. For example, desilting of weirs can adversely affect water quality. Most significant structures on waterways are operated by water corporations. Water corporations are required to manage the environmental impact of their activities on the waterway as outlined in Section 11.2.1. Water corporations holding a bulk entitlement may be required, as a condition of the bulk entitlement, to develop an environmental management program to minimise the impact of storage operation on the downstream environment. However, some such bulk entitlement holders have not yet initiated environmental management programs and limited guidance has been provided on the required content of these programs.

Structures on waterways can adversely affect the river channel by creating barriers to native fish passage, changing water regimes, causing sudden changes to downstream flow rates and affecting water quality, including downstream water temperature. Native fish can inadvertently be directed into artificial supply channels through structures that divert or pump water from the river. This reduces their chances of survival. Altering the operation or design of structures can often reduce these threats and improve river channel condition. Activities or programs to improve the operation of structures should aim to identify and minimise the impacts on aquatic plants and animals and the nearby bed and banks, manage risks to downstream water quality and, where relevant, prevent native fish from being redirected out of waterways. Alteration to the design of structures may include works to provide passage for native fish and other animals (see Section 11.4.4), increase flow variability downstream, address water quality issues, including thermal water pollution, or improve options for the delivery of environmental water (see Chapter 8).

Many large storages in Victoria were designed to release water from near the bottom of the dam wall, so that water can be provided from dams even when storage levels are low. Those that have outlets near the bottom of the dam wall may release very cold water which is low in oxygen and can substantially change the downstream water temperature and affect native species such as fish and aquatic invertebrates (see Section 10.7). In addressing thermal water pollution downstream of storages, the improvement of environmental values (such as enhancing native threatened species habitat) needs to be weighed against social values such as the value of the downstream reach for recreational fishing of species that favour cold water (for example, trout).

When water corporations upgrade their structures they are required to do so in line with Government guidelines. If upgrades are not imminent, but design alterations of a structure are a priority to reduce the threats to river channel condition, the cost of design alterations can be met from other sources (see Section 18.4). Any proposed design alterations need to be feasible and cost-effective, with the benefits outweighing costs. It is essential that, where such works are undertaken to alter structure design, ownership of the works are clear and agreements are established for their ongoing operation, maintenance and improvement, if required. This issue is addressed in Section 18.6.

Policy 11.5

Regional Waterway Strategies will identify structures where a change to operation or design is a priority to maintain or improve river channel condition. This will be done in consultation with water corporations and based on an assessment of the feasibility and cost-effectiveness of required works.

Where design alterations are required at priority structures owned by water corporations, these will be undertaken by the water corporations when upgrading their structures.

If upgrades are not imminent but planned within 10 years, a cost-sharing arrangement may be agreed between the catchment management authority and the water corporation to bring the required works forward. If upgrades are not planned, funds will be sought from other sources.

Where cost-sharing is undertaken between waterway managers and water corporations for structure upgrades, operating agreements should be developed to ensure structures are operated in a way that provide benefits to both parties.

In assessing management options for addressing thermal pollution downstream of storages, storage owners and waterway managers will consider fisheries management plans, the presence of populations of significant or endangered wildlife and the feasibility and cost-effectiveness of design alterations.

11.4.2 Removal of instream barriers

There are thousands of artificial structural barriers (see Chapter 18, Box 18.1) in Victoria's waterways and many of these structures were built long ago. Some are no longer used for their original purpose and many have fallen into disrepair or have been replaced by more modern structures. Ownership for these structures is often unclear (see Section 18.6). The removal of such structures may be a priority to improve native fish passage, water regimes and other natural waterway processes. Other reasons to remove such barriers may include avoiding any future costs associated with their maintenance or addressing issues of public risk. However, the benefits of removing a structure need to be balanced against

other values that the structure provides to local communities and possible environmental risks associated with its removal.

A structure that is no longer used for its original purpose may provide other values. For example, the permanent water in a weir no longer used for irrigation purposes may be used by the community for recreation. Some structures may be recognised for their heritage value. Potential environmental risks associated with removing a structure are the loss of refuge habitat, the potential spread of aquatic invasive species, the unwanted transport of sediment or water quality issues such as the mobilisation of heavy metals that may have accumulated behind the barrier.

Water corporations manage many instream structures. When such structures are due for major maintenance, there is an opportunity to consider if they are still required. There may be alternative means of providing a similar level of service with lower environmental impacts.

Costs for the removal of structures need to be negotiated between the structure owner and other beneficiaries.



A previous barrier, this road has been adapted to allow fish passage. Courtesy Corangamite CMA

Policy 11.6

Waterway managers will assess and identify priority structures for removal in the regional Waterway Strategies. This will be done in consultation with the structure owner, where the owner can be identified. The cost-sharing arrangements for removal will be agreed with the owner of the structure and other beneficiaries in accordance with the cost-sharing principles outlined in Section 18.5.

In assessing if an instream structure should be removed, waterway managers and the structure owner will take the following factors into account:

- environmental benefits and risks associated with its removal
- if the structure is redundant to the owner and to the community
- if the service provided by the structure is still required
- if the service is required, whether it can be provided in an alternative way with lower environmental impacts
- environmental, social, cultural and economic values associated with the structure
- the cost of maintenance of the present structure, the cost of removal and the cost of any alternative means of providing the service
- the level of public risk posed by the structure.

When water regulating structures owned by water corporations are due for major maintenance work, consideration will first be given to the need for the structure. Water corporations will conduct a community process to determine if the structure is required. If there is no ongoing need, options will be assessed for the removal of the structure.

11.4.3 Maintaining and restoring lateral connectivity

An important aspect of river channel condition is connectivity to the floodplain. The condition of floodplain wetlands also depends on lateral connectivity between the river and the wetland. The policies and actions outlined in Section 12.8 are designed to maintain or restore linkages between the river, floodplain wetlands and the floodplain generally.

11.4.4 Improving passage for native fish

Preventing further loss of connectivity and restoring passage for native fish are critical aspects of maintaining and improving their population viability. Longitudinal connectivity within the river channel is essential for many species of native fish to spawn and recolonise. If fish passage is blocked, critical spawning sites may be inaccessible. The provision of fish passage also facilitates the movement of other aquatic native plants and animals.

Barriers to the passage of native fish range from large dams and weirs to smaller structures such as culverts and road crossings. It is important to ensure that new structures required within the river channel are designed to include fish passage so that existing connectivity is not further reduced. Strategies to improve fish passage include:

- removing redundant structures within the river channel (see Section 11.4.2)
- constructing fishways or undertaking fish passage works at existing structures
- considering fish passage in the delivery of environmental water.

Policy 11.7

Passage for native fish in waterways will be maintained or improved by:

- minimising further loss of connectivity
- improving fish passage at priority sites.

Encouraging native fish passage in works on waterways

A recent review of fishways in Victoria found that there is a lack of consistency by organisations in obtaining approvals and implementing fish passage in works on waterways⁴. Apart from some dam safety improvement works, few fish passage referrals were made to waterway managers. Some new stream gauges, forest road crossings and flow regulators may have been constructed without sufficient consideration of the impacts on fish passage.

Waterway managers have a role in ensuring that proponents, including public authorities, are aware of the importance of native fish passage, design standards and regulatory requirements.

Policy 11.8

Waterway managers will advise key stakeholders involved in undertaking works and activities in waterways of the importance of, and priorities for, maintaining or improving native fish passage.

Priorities for constructing fishways or undertaking fish passage works

By 2010, 167 fishways or fish passage works had been completed in Victoria to improve connectivity for native fish. These include rock ramps at low level weirs (61 per cent) in coastal catchments, designed to cater for smaller migratory fish species and vertical-slot fishways (10 per cent) that cater for large migratory fish species. Other fish passage activities include the removal of redundant weirs, installation of 'fish friendly' road culverts and erosion control works⁴.

There are still sites where the restoration of fish passage is a high priority. In Victoria, the priorities for providing fish passage are identified using criteria adopted in 2002. A recent statewide assessment applying these criteria has identified the highest State priority sites for restoring fish passage when new funding opportunities arise (see Policy 11.9). Further priority sites may be identified at the regional level, also based on these criteria and the regional priority setting process (see Section 4.2.3). Recent mapping of Victoria's rivers and streams using light detection and ranging technology provides high quality data to improve identification and assessment of instream barriers (see Chapter 17, Case Study 17.3).

Criteria for establishing priorities for native fish passage

Statewide priorities for native fish passage are determined on consideration of:

- native fish species likely to benefit (high conservation status or migratory species will be given the highest priority)
- length of river and area of habitat made accessible to fish
- quality of habitat made accessible to fish
- proximity to the sea or Murray River (the number and diversity of native fish that would benefit is highest at the lower end of catchments)
- complementary restoration programs being undertaken within the river basin
- an assessment of adverse effects such as spread of invasive species
- a feasibility analysis that accounts for issues such as total cost of works, availability of independent financial support, enhancement of recreational/commercial fisheries, down-out weir frequency, and other management options such as modification or removal of a structure.

Policy 11.9

The Victorian Government will give priority to improving native fish passage at the following instream barriers when new funding opportunities arise:

- Broken River (Gowangardie Weir)
- Barwon River (various barriers)
- Ovens River (Tea Garden Weir)
- Thomson River (Horseshoe Bend)
- Campaspe River (Campaspe syphon & weir)
- Broken River (Rupertsdale Crossing)
- Gunbower Creek (various barriers)
- Avon River (Avon fords)
- Loddon River (various barriers)
- Gulf Creek (Barmah Forest - Gulf Creek regulators).

Regional priorities for providing native fish passage will be identified in the regional Waterway Strategies and will be assessed using the *Criteria for establishing priorities for fish passage* and the regional priority setting process outlined in Section 4.2.3.

Guidance for fishway design and construction

While guidelines such as the *Technical Guidelines for Waterway Management*² provide some fishway design information, there are currently no standard fishway design criteria for use in Victoria. Quality of fishway design is highly variable. There is an opportunity to set better design standards based on recent examples of design best practice in south-eastern Australia. There is a need for a contemporary and comprehensive suite of fish passage design guidelines for small scale structures such as stream gauging weirs, culverts and causeways. Fishways designed in consultation with engineers, fish biologists and appropriate government agencies have been found to be the highest performing and most successful fishways².



Constructing Tarwin River Fishway. Courtesy West Gippsland CMA

Action 11.6: Develop best practice guidelines for the appropriate design, approval and construction of fishways and other fish passage works.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2016

Action 11.7: Develop a suite of fish passage design guidelines for use at small scale structures.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

Fishway performance and maintenance

There is currently no statewide program for monitoring the performance of fishways and fish passage works across Victoria to ensure they meet the objectives for which they were designed. A review published in 2010⁴ found that only 7 per cent of fishways were highly efficient, 22 per cent were relatively efficient and about 25 per cent had fallen into disrepair or had limited functionality. The remainder could not be assessed due to a lack of information.

Maintenance and operation plans to ensure sustained efficiency of fishways and fish passage works are generally not in place. Performance, operation and maintenance guidelines are needed. Some fishways are not operated within their optimal range, resulting in reduced efficiency. There appears to be little routine fishway maintenance.

Ownership has not been determined for 39 per cent of fishways and some managers of instream structures with fishways in Victoria were unfamiliar with their responsibilities. The ownership and responsibility for ongoing operation, maintenance and improvement of built assets in waterways, including fishways, are addressed in Section 18.6.

Policy 11.10

Programs will be put in place to ensure the operation, performance and maintenance of fishways and other fish passage works are monitored and continue to meet best practice standards.

Action 11.8: Develop and implement a statewide program for monitoring the performance of fishways and fish passage works.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2016

Action 11.9: Develop performance, operation and maintenance guidelines for fishways and fish passage works.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2014



12

Wetlands

*Kinnairds shallow freshwater wetlands.
Photographer: Yvette Baker*

Wetlands

Guide to the chapter

12.1 Context

- The extent, nature and distribution of Victoria's wetlands
- Threats to Victoria's wetlands

12.2 Framework for managing wetlands

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- Meeting obligations for Ramsar sites
- Management of Ramsar sites
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- Addressing changes in ecological character
- Listing new Ramsar sites or extending the boundaries of existing sites

12.4 Managing water regimes for wetlands

12.5 Managing wetlands in natural landscapes

12.6 Improving wetland management in fragmented landscapes

- Managing catchment-based threats to wetlands
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12.7 Maintaining and improving wetland connectivity

- Maintaining and improving floodplain connectivity

12.8 Managing the impacts of drainage on wetlands in rural areas

- Reducing impacts of rural drainage
- Reducing impacts of irrigation drainage

12.9 Managing coastal wetlands

12.10 Information to improve wetland management

What are the issues with existing arrangements?

The wetland management framework in Victoria is outdated, lacks detail on policy and action and requires integration with the framework for managing with rivers and estuaries (and other land management frameworks).

A stronger onground works program is needed for the management of Ramsar sites and other high value wetlands. Information and advice on wetland values, threats and management activities need to be improved and periodically updated to support natural resource managers, public land managers and landholders to maintain and improve wetland condition. Landholders require continued support to further improve their capacity to manage wetlands sustainably on private land. The emerging risks for wetlands and the effectiveness of current management tools and approaches needs to be evaluated.

What improvements does the Strategy make?

For wetlands the Strategy will:

- comprehensively integrate the management of wetlands with the management of rivers and estuaries
- commit to maintaining the values of Ramsar sites (incorporating site management plans into the regional Waterway Strategies), monitoring their ecological character and providing clarity regarding the listing of new Ramsar sites
- commit to environmental watering of high value wetlands on the floodplains of regulated rivers, on a priority basis
- ensure public land managers and waterway managers work together more closely to manage wetlands in parks and reserves
- ensure that wetland biodiversity is integrated into landscape connectivity planning
- outline approaches for maintaining and improving connectivity between rivers and floodplain wetlands
- outline arrangements for improving the long-term security of wetlands on public land reserves in fragmented landscapes
- commit to providing assistance for landholders to improve the conservation and sustainable use of wetlands on private land
- outline the existing arrangements for mitigating risks to wetlands from irrigation drainage and provide for better protection of wetlands from rural drainage.

12.1 Context

Victoria's wetlands support a wide range of public and private values. They are an important part of the agricultural landscape, providing services to landholders such as sustainable grazing, water for stock and amenity.

Wetlands provide recreational opportunities such as boating, camping, bird watching, fishing and duck hunting and help to support tourism and local economies. The cultural values associated with Traditional Owner and Aboriginal use of wetlands over many tens of thousands of years have great significance and are an important part of Victoria's cultural heritage.

Wetlands act as sediment traps and filter nutrients from catchments; helping to protect the water quality of rivers, estuaries and marine areas. They help reduce the impacts of flooding by holding and slowing floodwater. Many new wetlands have been constructed in urban areas to treat sewage or reduce the adverse effects of urban runoff and stormwater (see Chapter 14). Other types of human-made wetlands include farm dams, salt works, sewage ponds and water storages. In addition to the services they were constructed to provide, they often support social and environmental values.

Victoria's wetlands are important in sustaining biodiversity at a regional, national and international scale. They provide habitat for threatened species and communities. Of the threatened native species in Victoria, 499 (24%) depend on wetlands for their survival. Over 85% of the 145 wetland ecological vegetation communities are endangered or vulnerable in at least one of the bioregions in Victoria in which they occur. Some wetland ecological communities are formally listed as threatened at a State or national level. These include shallow freshwater seasonal herbaceous wetlands, which are listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

Wetlands also help to support waterbird populations that range across Australia and to provide feeding areas for the thousands of shorebirds that migrate to Victoria each summer from the northern hemisphere. Mangrove and seagrass communities provide important nursery habitat for fish, helping to sustain fish populations, many of which provide the basis for Victoria's recreational and commercial fisheries.

The key values, threats and management activities for wetlands are shown in Figure 12.1.

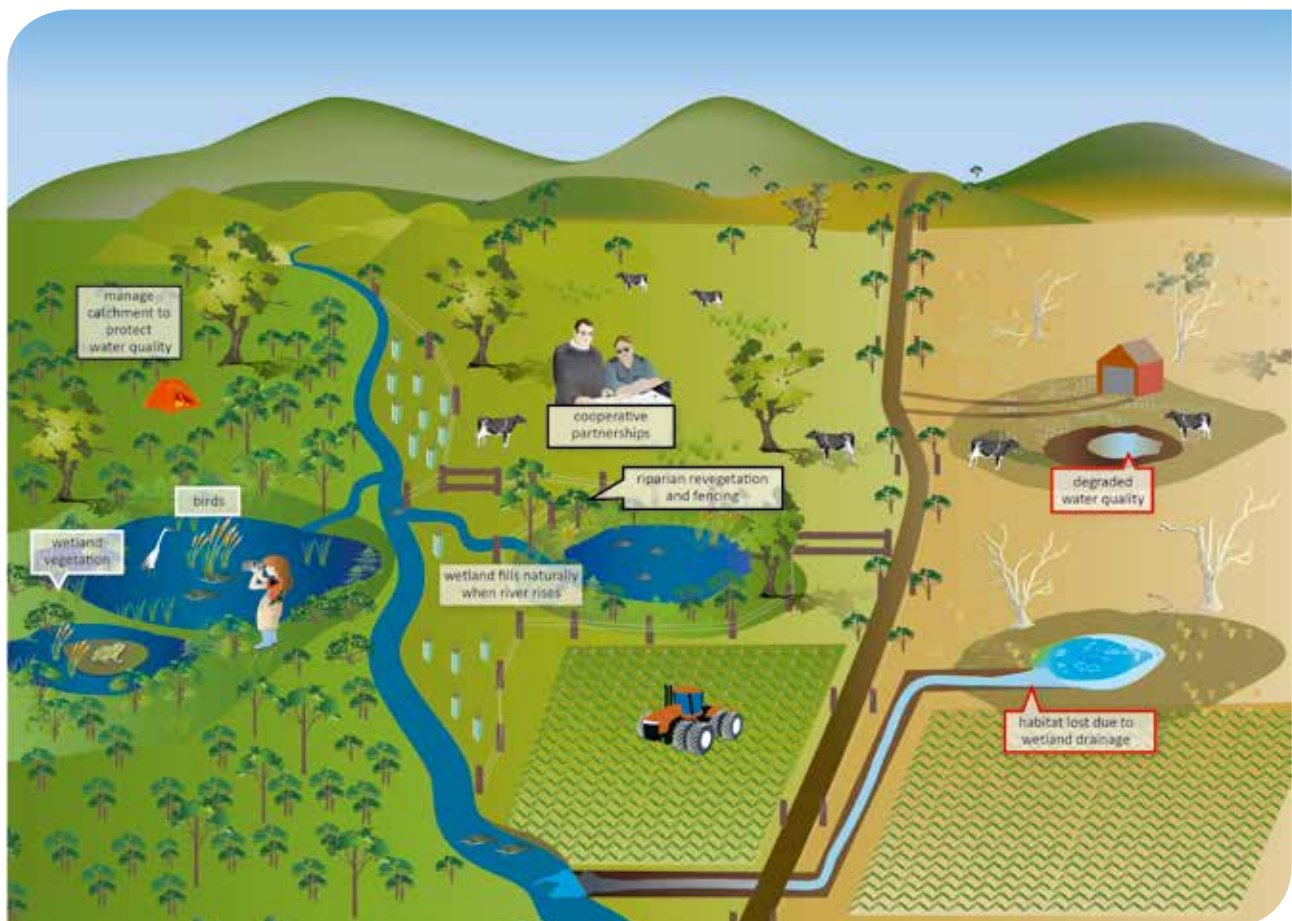


Figure 12.1: Values (white), threats (red) and management activities (black) for wetlands.

12.1.1 The extent, nature and distribution of Victoria's wetlands

Victoria's natural wetlands are diverse and include billabongs, marshes, lakes, swamps, alpine peatlands, intertidal saltmarshes, mangroves, mudflats and seagrass areas. The inventory of Victoria's wetlands was updated in 2013 and recorded 23,739 natural wetlands covering 604,322 hectares. This is greater than the number and area of natural wetlands recorded in the previous 1994 statewide inventory (12,800 wetlands covering 530,000 hectares). This difference represents more accurate and finer scale mapping, rather than an increase in the actual number or area of natural wetlands. Thirty one per cent of natural wetlands in Victoria are on public land, with an average area of 54 hectares. The remaining 69% are on private land but average only 13 hectares in area. In addition, there are 11,060 artificial wetlands that cover 170,613 hectares. Wetlands of unknown origin number 321 and cover 2,702 ha.

In 1994, it was estimated that 26% of the area of Victoria's wetlands had been lost since the time of European settlement. The loss was mainly due to drainage of wetlands and was much greater for freshwater than for saline wetlands. It has not been possible to estimate further loss across Victoria since 1994. The development of a suitable, cost-effective method to monitor changes in wetland extent and water regime is needed (see Section 12.10).

Wetlands in Victoria are concentrated in low lying areas in the south west, south east and north central parts of Victoria, on river floodplains and in settled coastal areas (Figure 12.2). Wetlands in these fragmented, largely agricultural landscapes are on private land or in small public land reserves. Wetlands are less common in more natural landscapes (such as large parks, reserves or forests) and they are often under less threat because land is in public ownership and primarily managed for conservation and native forestry. The main wetlands in these areas are alpine peatlands, coastal wetlands, the large floodplain wetlands of the Murray River and terminal wetlands of the Wimmera River. In urban areas, some natural wetlands remain on floodplains and in intertidal areas.

Box 12.1 Definition of wetlands

Wetlands are areas of permanent, periodic or intermittent inundation that hold still or very slow moving water. They support ecosystems adapted to flooding. Wetlands may be formed by natural processes or be human-made.

Several coastal wetlands are also classed as estuaries. The policy and actions in Chapter 13 are also relevant to their management.



Lake Wallawalla in the Murray Sunset National Park. Photographer: Shar Ramamurthy

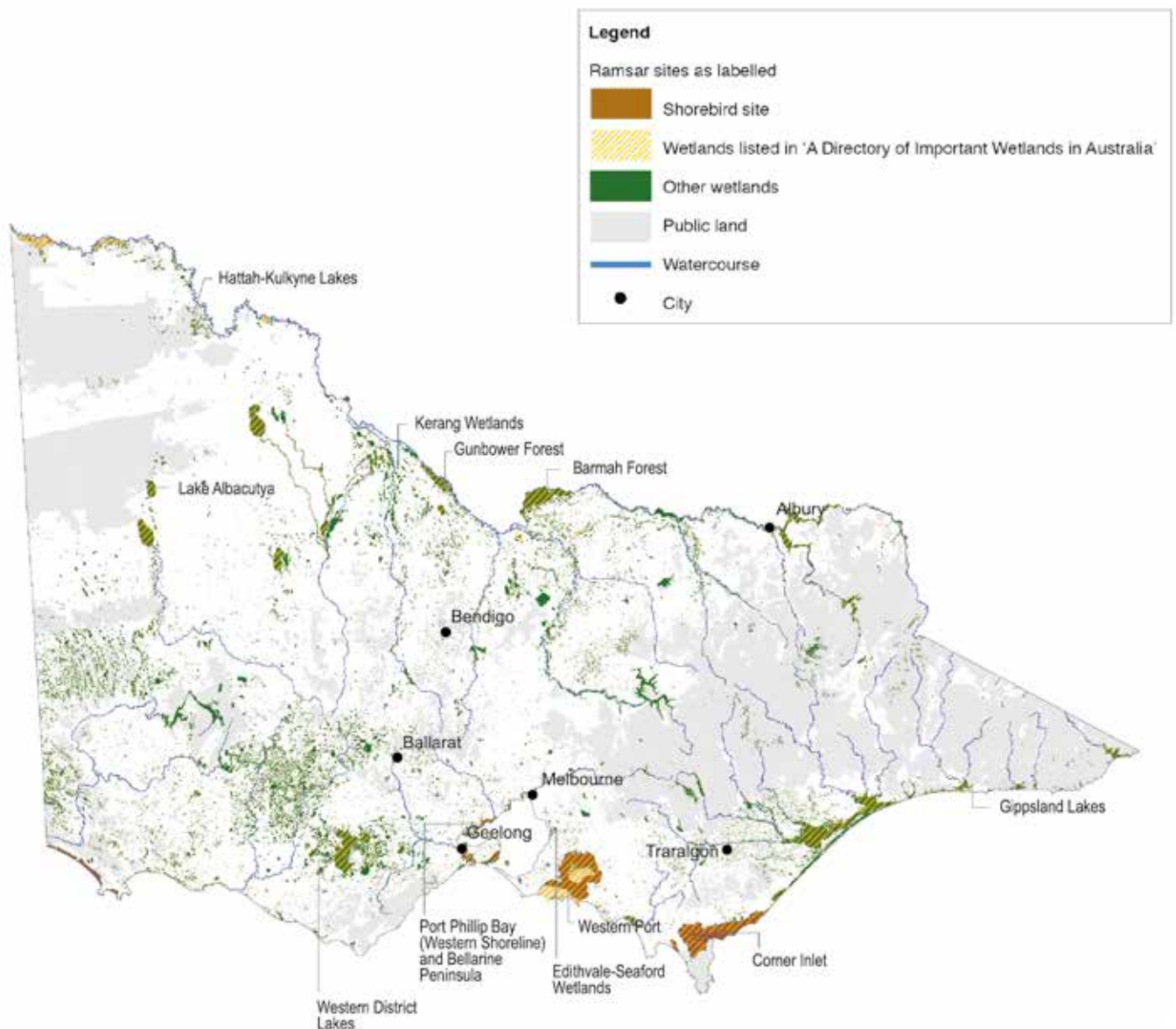


Figure 12.2: The distribution of wetlands in Victoria, including Ramsar sites and other high value wetlands.

12.1.2 Threats to Victoria's wetlands

An assessment of the condition of high value wetlands and a selection of wetland types across Victoria found that over half the wetlands assessed were subject to at least one of a range of threats (Table 12.1). Key threatening processes to wetlands include water extraction and regulation, stock grazing, nutrient runoff and wetland excavation¹.

The key threats to Victoria's wetlands vary according to the landscapes in which they occur (Table 12.2). Policies and actions to address the threats from altered water regimes, degraded water quality (including acid sulfate soil disturbance) and invasive species are addressed in Chapters 8, 10 and 16 respectively.

Some key threats to wetlands are predicted to increase given the potential impacts of climate and land use change. A recent report into the predicted impacts on wetlands found that under a high climate change scenario, wetlands in the north and west of Victoria would be more greatly affected than those in the far east of Victoria². They would be filled less often and undergo longer dry periods than under historical climate conditions. It is also predicted that coastal wetlands will be affected by sea level rise².

Table 12.1: Threats recorded in 587 high value wetlands assessed in 2009/10 and 240 representative wetlands in 2010/11¹ (wetlands can be affected by more than one threat).

Threat	High value wetlands (% affected)	Representative wetlands (% affected)
Altered water regime	46	32
Soil disturbance	19	38
Degraded water quality	15	28
Reduced wetland area	14	26
Altered wetland form	6	12

Table 12.2: Key threats to wetlands in different landscape settings.

Landscape	Wetlands	Threatening processes	Key threats						
			Soil disturbance	Invasive species	Degraded water quality	Acid-sulfate soil disturbance	Altered water regime	Altered wetland form	Loss of wetland
Natural landscapes	Alpine peatlands	Bushfire, stock grazing in State forests, pest invasion, drainage for hydro power generation, potential impacts of climate change.	✓	✓	✓		✓	✓	
	Floodplain wetlands	Water extraction and regulation, stock grazing in State forests, pest invasion, potential impacts of climate change.		✓			✓		
	Coastal wetlands	Sea level rise, marine pest invasion.		✓			✓		
Fragmented landscapes	Wetlands in reserves and on private land in dryland areas and on lowland river floodplains	Wetland loss, drainage, stock grazing, cropping, plantation forestry, nutrients, groundwater use, salinity, changed runoff patterns, pest invasion. On floodplains, water extraction and regulation, floodplain barriers, water regulating structures. Potential impacts of climate change, changes in land use and agricultural practices.	✓	✓	✓		✓	✓	✓
Settled coastal landscapes	Coastal wetlands	Sea level rise, coastal development, nutrient runoff, drainage, marine pest invasion.		✓	✓	✓	✓		✓
Urban landscapes	Urban wetlands	Intensive development, nutrients and pollutants, drainage, high levels of human disturbance, pest invasion, changed runoff patterns.		✓	✓	✓	✓	✓	✓

12.2 Framework for managing wetlands

The management of wetlands in Victoria is based on an integrated approach at international, national, state and regional levels. It requires collaboration between states and territories, and among wetland managers, natural resource managers and policy makers.

In 1974, Australia became a contracting party to the Convention on Wetlands of International Importance (the Ramsar Convention). The Convention provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources.

It obliges contracting parties to:

- list wetlands of international importance (Ramsar sites)
- maintain the ecological character of Ramsar sites (see Box 12.2)
- establish nature reserves on wetlands
- formulate and implement planning to promote conservation and sustainable use of all wetlands.

The Australian Government is the Australian Administrative Authority to the Ramsar Convention. The Australian and state government agencies and land and water managers have collective responsibility for the wise use of wetlands, each having clearly defined roles and responsibilities³. The Victorian Government is responsible for implementing Ramsar matters in Victoria through State legislation, policy and programs.

Ramsar sites are a matter of national environmental significance under the EPBC Act. The EPBC Act and associated regulations require that Ramsar sites are managed in accordance with Australian Ramsar Management Principles to maintain their ecological character from the time they were listed. It also requires assessment and approval of actions with the potential to affect the ecological character of a Ramsar site.

Other matters of national environmental significance are relevant to wetlands, such as nationally threatened species and communities and listed migratory species. Actions affecting these matters also require approval under the EPBC Act.

In Victoria, nature reserves or protected areas are established under the *National Parks Act 1975* and the *Crown Land (Reserves) Act 1978*. They protect 55 per cent of the area of wetlands in Victoria (13 per cent of wetlands by number) and are managed by Parks Victoria. Plans are in place to guide the management of many wetlands, particularly those of high value. These include Ramsar site strategic management plans, park and forest management plans and environmental watering plans.

In Victoria, the legislation, regulatory and policy controls for wetlands are derived from a number of different tools that promote the protection of the environment and sustainable use of natural resources. The *Water Act 1989* contains specific provisions to assess and manage impacts on waterways (including wetlands). The *State Planning Policy Framework* of the *Victorian Planning Provisions*, the *Environmental Effects Act 1978* and the water entitlement and allocation framework include mechanisms to protect wetlands. This Strategy co-ordinates these regulatory mechanisms within a strategic management framework, addressing gaps and uncertainties in management direction, accountability and onground management activities for wetlands.

Policy 12.1

The *Victorian Waterway Management Strategy* will provide the leading statewide strategic direction on the management of the environmental condition of wetlands.

Regional management of wetland condition will be integrated with that for rivers and estuaries through the regional Waterway Strategies.

12.3 Protecting the values of Ramsar sites

The sound management of Victoria's 11 Ramsar sites (Figure 12.2) is of vital importance to protect the environmental values for which they are listed as well as their significant social and economic values such as tourism, recreation, fishing and forestry.

Ten of Victoria's Ramsar sites were listed in 1982. The Edithvale-Seaford Wetlands Ramsar Site was listed in 2001. Ramsar site managers are responsible for onground management. Nearly all land in Victoria's Ramsar sites is public land managed by Parks Victoria, Melbourne Water or the Department of Environment and Primary Industries (DEPI). These agencies take the lead role as site managers, although small areas within some Ramsar sites are managed by other public agencies or are privately owned. The DEPI is responsible for co-ordinating Ramsar site management in Victoria, while a range of other agencies, including waterway managers are responsible for catchment management and other aspects of natural resource management that is important for protecting Ramsar site values. The Australian Government works with the states to promote the conservation of Ramsar sites and to review their condition. The obligations and responsibilities for managing Ramsar sites are set out in National Guidelines for Ramsar Wetlands⁴.

12.3.1 Meeting obligations for Ramsar sites

In managing its Ramsar sites, Victoria's role is to undertake actions that address the Ramsar Convention obligations and Australian Government requirements to maintain the ecological character of Ramsar sites (see Box 12.2) and to maintain the currency of the Ramsar site documentation. This requires a co-ordinated approach within Victoria between the DEPI (lead agency), site managers and other natural resource management agencies and a partnership with the Australian Government to:

- adhere to the Australian Ramsar Management Principles, national Ramsar site guidance and direction for describing ecological character, mapping site boundaries, notifying change in ecological character and preparing management plans
- monitor and report on the ecological character of Ramsar sites, including any change in ecological character at individual sites every three years (see Box 12.2)
- maintain up-to-date documentation for Ramsar sites, including Ramsar information sheets, ecological character descriptions, management plans, site descriptions and maps.

Most land in Victoria's Ramsar sites is covered by Victorian legislation relating to the use and management of the land for conservation or for utilisation purposes such as, water storage, disposal of saline drainage water, duck hunting or forestry. To avoid adverse impacts on the ecological character of the Ramsar site, these uses need to be sustainable. If they lead to a change in ecological character, the policies in Section 12.3.4 apply.

Box 12.2: Ramsar Convention definition of ecological character and change in ecological character

Ecological character is the combination of ecosystem components, processes and benefits and services that characterise a wetland at a given point in time. For Ramsar sites this is the time of Ramsar listing. A change in ecological character is a human-induced adverse alteration of any ecosystem component, process and/or ecosystem benefit/service.

Policy 12.2

The Department of Environment and Primary Industries will work in partnership with Ramsar site managers and the Australian Government to maintain and report on the ecological character of Ramsar sites and the status of Ramsar site documentation.

Ramsar sites in Victoria will be monitored to detect change in ecological character.

Action 12.1: Endorse the ecological character descriptions and updated Ramsar information sheets for Victoria's Ramsar sites that are being developed by the Australian Government.

Who: Department of Environment and Primary Industries, Ramsar site managers, waterway managers.

Timeframe: 2014

Action 12.2: Monitor the ecological character of Ramsar sites and provide information to the Australian Government on the status of ecological character and Ramsar site documentation for inclusion in three-yearly national reports to the Ramsar Convention.

Who: Department of Environment and Primary Industries, Ramsar site managers.

Timeframe: 2015, 2018

12.3.2 Management of Ramsar sites

Management of Victoria's Ramsar sites is currently covered by individual Ramsar site management strategies. In addition, there is a range of other management plans and strategies that relate to aspects of Ramsar site management (such as those for the management of waterways, catchments, parks, reserves and State forests and environmental water).

Periodic renewal of Ramsar site management planning is necessary to evaluate management effectiveness, reflect evolving management policies and programs (for example, those relating to environmental water – see Chapter 8) and to address emerging risks from processes such as land use change and the potential impacts of climate change. Ramsar site management planning needs to integrate relevant management activities from the range of complementary plans and strategies with the aim of achieving a co-ordinated approach to Ramsar site management. Regional Waterway Strategies (RWSs) are the appropriate mechanism for incorporating Ramsar site management planning for most sites. However, in some cases the complexity of the management issues may require preparation of an individual management plan for a Ramsar site. Ramsar site management plans need to be consistent with the management planning arrangements for Ramsar sites set out in the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth).

In addition to routine catchment and public land management, there are several significant programs, actions and management arrangements in Victoria with the potential to maintain and improve the values of particular Ramsar sites.

These include:

- the allocation and use of environmental water through State and national programs (see Chapter 8)
- changes in the management of the Woody Yaloak Diversion Scheme as outlined in the *Western Region Sustainable Water Strategy*⁵ to allow more water to flow to Lake Corangamite in the Western District Lakes Ramsar Site
- the establishment of the Gippsland Lakes Ministerial Advisory Committee covering the Gippsland Lakes Ramsar Site and the development and implementation of the *Gippsland Lakes Environmental Strategy*⁶.

Policy 12.3

Regional Waterway Strategies will incorporate Ramsar site management planning, unless the complexity of management arrangements for the site warrants an individual management plan.

Ramsar site management planning documents will set out the range of management activities required to maintain the ecological character of Ramsar sites and address emerging risks.

The maintenance of the ecological character of Ramsar sites will be given high priority in the management of environmental water.



Ramsar site, Hattah-Kulkyne Lakes. Source: Index of Wetland Condition database

12.3.3 Approvals for actions affecting Ramsar sites

Proposals for development or changes in land and water management have the potential to affect Ramsar site values. As outlined in Section 12.2, approvals for proposed actions with the potential to adversely affect Ramsar sites are required under the EPBC Act. In Victoria, approvals may also be required under the *Environmental Effects Act 1978*, other legislation or planning schemes. It is the responsibility of the proponent of the action to obtain the necessary approvals.

Policy 12.4

The Victorian Government will continue to require all necessary approvals for actions with the potential to cause long-term change to the ecological character of Ramsar sites.

12.3.4 Addressing changes in ecological character

Despite the best management efforts, it is possible that a change to the ecological character of a Ramsar site may occur. Threatening processes such as drought, floods, bushfires, invasive species outbreaks or significant widespread changes in land and water management sometimes occur at level of severity that limits the ability of managers to respond effectively. The *National guidance on notifying change in ecological character of Australia's Ramsar Wetlands (Article 3.2)* outlines the process to be followed if monitoring indicates that change in ecological character has occurred or is likely to occur at a particular Ramsar site. In such a case, Victoria must notify the Australian Government and prepare a response strategy. There may be circumstances under which there are limited feasible or cost-effective options to respond to persistent, major threats such as changes in climate and associated sea level rise. In this case, management objectives would need to be reassessed for the Ramsar site in accordance with the process outlined in Section 4.2.7 and taking account of relevant Ramsar Convention guidance.

Article 2.5 of the Ramsar Convention makes provision for deleting or restricting the boundaries of a Ramsar site, only in the urgent national interest. Resolution IX.6⁷ of the Ramsar Convention covers principles and procedures for other situations not foreseen in the Convention text concerning loss or deterioration of the ecological character of Ramsar sites. This guidance only applies where the loss of ecological character is unavoidable. The Resolution sets out a procedure that follows on from the notification of change in ecological character to the Ramsar Secretariat described previously. It involves assessing if the change is truly irreversible, such that all attempts at recovery and restoration have failed to the extent that the site fails to meet any of the Ramsar Convention criteria for identifying wetlands of international importance⁸.

Policy 12.5

If monitoring indicates the ecological character of a Ramsar site is likely to change or has changed, the Victorian Government will notify the Australian Government and develop a response strategy for the site and monitor the effectiveness of its implementation.

If there are no feasible or cost-effective management response options to maintain the site's ecological character, Victoria will engage the Australian Government to agree on a process to review management objectives for the site. This will be done in consultation with the community and will be aimed at facilitating adaptation to a new ecological regime that maximises existing and likely future values.

Deleting or restricting the boundary of a Ramsar site will only be investigated where irreversible change results in a loss of critical values to the extent that the Ramsar site fails to meet any of the Ramsar Convention criteria for identifying wetlands of international importance.

Action 12.3: Evaluate and renew management planning for Victoria's Ramsar sites.

Who: Department of Environment and Primary Industries, Ramsar site managers, waterway managers, other agencies involved in Ramsar site management.

Timeframe: 2015

Action 12.4: Develop, implement, monitor and evaluate management response strategies for any Ramsar sites where monitoring indicates that a change in ecological character has occurred or is likely to occur.

Who: Department of Environment and Primary Industries, Ramsar site managers, Australian Government.

Timeframe: as required

12.3.5 Listing new Ramsar sites or extending the boundaries of existing sites

Victorian Government agencies, the community, organisations, individuals or the manager of a wetland can propose a wetland in Victoria for listing as a Ramsar site. Proposals may also be made to extend the boundaries of an existing Ramsar site to incorporate additional wetland areas. The Australian Government makes the final decision regarding the listing of a new Ramsar site or extending the boundaries of an existing site and requires the endorsement of the Victorian Government. National guidance outlines the process for listing a new Ramsar site and the ongoing obligations and administrative requirements. The DEPI is responsible for assessing the evidence for any proposal to list a new Ramsar site or extending the boundaries of an existing site.

Ramsar site listing may have benefits such as raising the profile of a wetland, increasing the level of support for conservation and sustainable use and providing greater security for long-term management. Many Victorian wetlands potentially meet the Ramsar Convention criteria for identifying wetlands of international importance⁸. However, this does not mean that listing of all such wetlands is necessarily appropriate. Other mechanisms to protect wetlands in Victoria (see Section 12.2) may be more suitable. A range of factors are relevant in considering the suitability of a wetland for Ramsar listing. These relate to the eligibility of the wetland in relation to the Ramsar convention criteria, the actions needed to meet the obligations associated with listing, the support of the wetland manager and other stakeholders for listing, international and national strategic objectives of the list of Ramsar sites and the advantages that listing would have over other management alternatives.

Policy 12.6

Investigations to list a new Ramsar site or extend the boundaries of an existing site may be initiated in response to proposals by the community or other parties and will consider the following factors:

- the Ramsar Convention criteria for identifying wetlands of international importance met by the wetland
- the Ramsar Convention *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance of the Convention on Wetlands* and any national strategic direction on priorities for Ramsar site listing
- agreement by the land manager and key stakeholders involved in the management of the wetland and the actions they propose to meet relevant Ramsar obligations
- the current degree of protection of the wetland and the opportunities for increasing the level of protection by listing the wetland as a new Ramsar site
- alternative legislative and management frameworks for management of the wetland
- the level of threat to the wetland, and the contribution that listing would make to improving the management of threats

- the feasibility and cost-effectiveness of maintaining the ecological character of the wetland in the long-term
- the contribution that listing would make to awareness raising and community education in relation to the values of the wetland and wetland conservation in general
- the level of community support for listing
- the national and international documentation and administrative requirements.

The Victorian Government will recommend listing of a new Ramsar site or extending the boundaries of an existing site to the Australian Government where:

- there is agreement by the owner or manager of the wetland
- there is compelling evidence that listing will provide clear benefits in:
 - protecting highly significant wetland values relating to the Ramsar criteria for listing
 - raising the wetland profile
 - increasing the level of support for conservation and wise use measures that cannot be achieved through other mechanisms.

12.4 Managing water regimes for wetlands

The extraction, regulation and use of water from rivers for consumptive purposes is essential to provide human drinking water and help support agricultural productivity.

However, such extraction must be managed to reduce the adverse impacts on the water regime of wetlands located on the lowland floodplains of regulated rivers. Such wetlands include Ramsar sites (Section 12.3.2) and other high value wetlands, as well as a large number of smaller billabongs.

Wetlands dependent on groundwater are vulnerable to lowered water tables where groundwater is licensed for consumptive use. Section 8.7.3 outlines the approach for better defining the groundwater needs of such wetlands.

The management framework for environmental water is outlined in detail in Chapter 8. Regional Waterway Strategies will identify priority wetlands where environmental values are at risk from altered water regimes and, if environmental watering is feasible and cost-effective, specify the management activities planned to address this risk. This may include development of environmental water management plans and environmental watering.

The water regime of a wetland is one of the critical processes for supporting wetland values. Many wetlands are adapted to a periodic cycle of wetting and drying. This needs to be taken into account when setting water regime management objectives for wetlands where the water regime is actively managed, either through environmental watering or through excluding artificial inflows. Artificial inflows, such as those derived from stormwater, disposal of drainage water or artificial water connections, can prolong inundation and may require management to ensure they do not adversely affect wetland condition.

Policy 12.7

Regional Waterway Strategies will identify priority wetlands where environmental water management plans and environmental watering is required to maintain or improve wetland values at risk from altered water regimes.

The groundwater allocation framework will take account of the water requirements of high value groundwater-dependent wetlands.

Appropriate wetting and drying regimes will be taken into account in managing artificial inflows to a wetland.

12.5 Managing wetlands in natural landscapes

In the parts of Victoria where large areas of native vegetation remain, the landscape is in a largely natural state. In these natural landscapes, most wetlands are on public land and are managed as part of largely intact ecosystems in extensive parks, reserves or forests.

The management of these wetlands involves managing threats within the park, reserve or forest (for example, invasive species or bushfire). It also involves the management of visitor access and permitted activities and uses, for example timber harvesting in State forests. Management is guided by legislation such as the *National Parks Act 1975*, *Crown Land (Reserves) Act 1978*, *Forests Act 1958* and the *Land Act 1958* and park and forest management plans. While public land managers are responsible for management of land within parks, reserves and forests, waterway managers also have a role in identifying priority management activities for wetlands and managing catchment and water related issues. These responsibilities need to be co-ordinated.

Management may also involve targeted programs, such as those to rehabilitate the alpine peatlands. Alpine peatlands are listed as a threatened community at the State and national level and are adversely affected by weeds, stock grazing and trampling, altered water regimes, increased fire frequency and intensity and the potential impacts of climate change. Where they occur within land set aside for alpine resorts, Alpine Resort Management Boards have a role in their management. The Alpine Resorts Planning Scheme regulates land use and development in alpine resorts.

Policy 12.8

The Victorian Government will ensure that threats to wetlands in natural areas on public land continue to be addressed through legislative controls and park and forest management planning.

Public land and waterway managers will work together to ensure that priorities and management activities for wetlands in regional Waterway Strategies and park and forest programs are aligned.

12.6 Improving wetland management in fragmented landscapes

Most wetlands in Victoria are in the north central, south west and south east of the State and the majority of these are located in fragmented landscapes (Figure 12.2).

Wetlands in these landscapes include most of Victoria's small, shallow, periodically inundated wetlands as well as larger wetlands such as those in the Western District Lakes Ramsar Site and many of the wetlands listed in *A Directory of Important Wetlands in Australia*⁹. Some shallow freshwater wetlands are classed as seasonal herbaceous wetlands and listed as nationally threatened under the EPBC Act.

Wetlands in fragmented landscapes occur on both public and private land and collectively support habitat for both threatened and non-threatened wetland species. A high proportion of wetland species, such as waterbirds, rely on the wetland habitat remaining in fragmented landscapes. Wetlands in fragmented landscapes are important for amenity, recreation and tourism but experience a range of threats (Table 12.2). In the Wimmera, for example, of 986 wetland features assessed in 2004 and 2011, a dam or drain had been constructed since 2004 in 7% of features and cropping initiated in almost 25%.

12.6.1 Managing catchment-based threats to wetlands

Wetlands in fragmented landscapes are surrounded by land that has been altered for agriculture (Figure 12.3), peri-urban and urban development. These changes adversely affect wetland water quality, habitat and water regimes. Integrated catchment management is an important aspect of wetland management. Maintaining or improving native vegetation around the wetland is a key management activity to minimise threats associated with adjacent land use.

Wetlands on public land are located in parks and reserves that are often relatively small and surrounded by private land. In many cases, the wetland catchment, riparian vegetation and sometimes part of the wetland itself are on private land (Figure 12.4).

Almost 70% of wetlands are on private land and they represent 35% of Victoria's wetland area. Wetlands on private land contribute significantly to the character of the landscape and the viability of wetland species and provide opportunities for recreation.

The actions of private landholders who manage land adjacent to wetlands and in the broader catchment are often critical to achieve management outcomes. Local government has a role in regulation of land use and development that may adversely affect wetlands. Wetland management involves collaboration between the public or private wetland manager and the waterway manager as well as between planners and landholders in the catchment.

Policy 12.9

Catchment-based threats to wetlands in fragmented landscapes will be addressed in Regional Catchment Strategies, regional Waterway Strategies and local government planning schemes, where appropriate.

The Victorian Government will provide assistance to private landholders to undertake voluntary measures on their own land that complement management activities by the wetland manager to protect and improve high value wetlands.



Figure 12.3: Aerial image showing the land use context of wetlands in a fragmented agricultural landscape. Wetlands surrounded by agricultural land are often affected by altered water regimes and excess nutrient and sediment runoff.

12.6.2 Managing public wetlands in fragmented landscapes

Wetlands on public land in fragmented landscapes are located in national, State or regional parks, conservation or other public reserves. The objectives of management for public land are established by the government-approved recommendations of the former Land Conservation Council (LCC), former Environment Conservation Council (ECC) and the Victorian Environment Assessment Council (VEAC). As with larger parks and reserves, the management of threats and activities within parks and reserves in fragmented landscapes is guided by legislation and management plans, where these exist.

Policy 12.10

On-site threats to wetlands within public parks and reserves in fragmented landscapes will continue to be managed in accordance with Government-approved recommendations of the Land Conservation Council, Environment Conservation Council and the Victorian Environment Assessment Council, relevant legislation and approved management plans.

12.6.3 Supporting conservation and sustainable use of wetlands on private land

Individual landholders, community groups (for example, Landcare) and non-government organisations (for example, Trust for Nature, Field and Game Australia and Greening Australia) make a significant contribution to maintaining and improving the condition of wetlands on private land. It is important to build on this effort to improve the level of conservation and sustainable use of privately owned wetlands.

Shallow, temporary wetlands may be dry for periods of time, especially during droughts and are often not recognised as wetlands by private landholders. They are often used for stock grazing, cropping, as a site for farm dams and for plantation forestry.

Stock grazing in wetlands can damage native vegetation, disturb soils and cause nutrient enrichment but can be managed sustainably in some circumstances. Crops and plantations may be established in shallow wetlands in extended dry periods and this sometimes involves draining the wetland (see Section 12.8.1). These uses generally have greater impacts than grazing because native vegetation is removed and soils are more highly disturbed. In addition, the crop or plantation may be adversely affected when the wetland fills, leading to a loss of investment by the land manager. Although the *Code of Practice for timber production*¹⁰ provides guidance for wetland protection in the establishment and management of plantation forests, shallow temporary wetlands are often not recognised as wetland habitat and can be affected by plantation forests.

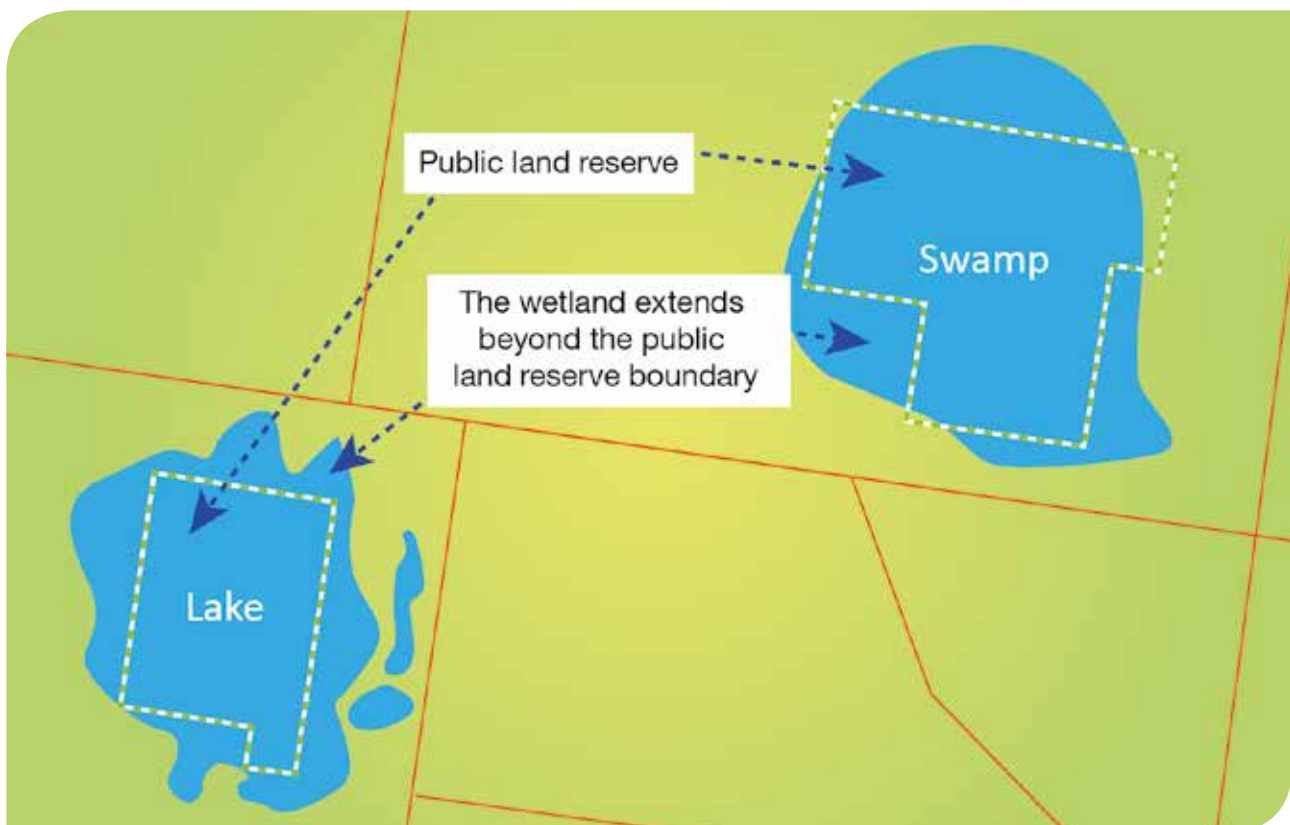


Figure 12.4: Stylised examples of the context of public reserve wetlands in a fragmented landscape where the wetland extends beyond the reserve boundary and is surrounded by private land.

Raised-bed cropping is an example of a practice that is becoming more widespread and can affect shallow freshwater wetlands by disturbing soil, altering water regimes and accelerating runoff, which may affect landholders downstream. The extent of the practice in wetlands and its impacts need further investigation.

Maintaining and improving wetland condition on private land involves a range of tools and approaches (see Section 4.2.4 for more detail). These include market-based incentive programs (for example, HabitatTender, EcoTender, BushTender, WetlandTender), other incentive and grant programs, whole farm planning programs and provisions under legislation such as the *Water Act 1989*. Permanent protection of wetlands can be effected under Trust for Nature covenants or agreements under Section 69 of the *Conservation, Forests and Lands Act 1987*. Another option to secure land in or adjacent to high value wetlands is the purchase and reservation of land when it is offered for sale. Local government regulates land use and development through planning schemes in line with the *State Planning Policy Framework*, which includes objectives for protection and conservation of Ramsar sites, other wetlands and native vegetation (including that in wetlands). The application of native vegetation planning controls can be difficult for wetlands due to seasonal variations in vegetation.

An important aspect of delivering programs and applying mechanisms to maintain and improve wetland condition on private land is increasing the level of knowledge about wetlands. Landholders, community-based natural resource management groups, natural resource managers and local government need access to the appropriate information and knowledge about wetland priorities, values, threats and management activities. Sound information on the location of wetlands, their characteristics and current condition is also important (see Section 12.10).

Policy 12.11

The Department of Environment and Primary Industries, in partnership with waterway managers and local government, will design and deliver regional programs for the maintenance or improvement of wetland condition and the sustainable use of wetlands. Actions by landholders to maintain and improve the condition of high value wetlands on their land will be encouraged through market-based instruments and other incentives.

The selection of the most appropriate management activity to maintain or improve wetland condition on private land will depend on program objectives, resources, regulatory requirements, cost-effectiveness, suitability and level of stakeholder support.

Information, advice and guidance on wetland priorities, values, threats and management will be provided to landholders, community-based natural resource management groups, natural resource managers and local government to enhance the effective design and delivery of wetland programs.

Action 12.5: Prepare guidance for landholders on sustainable use of wetlands, including guidance on sustainable stock grazing in appropriate circumstances.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016

Action 12.6: Educate and train natural resource management professionals working with landholders about the importance of wetland conservation and prepare guidance to assist them in identifying management options to improve protection of high value wetlands on private land.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016

Action 12.7: Investigate the extent and impact of different land use practices on high value wetlands.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

Action 12.8: Improve information about wetland vegetation and develop guidance to assist local government in the application of native vegetation planning controls for wetland vegetation.

Who: Department of Environment and Primary Industries, waterway managers, local government.

Timeframe: 2016

12.7 Maintaining and improving wetland connectivity

Connectivity between wetlands is important for the conservation of native wetland plants and animals.

Connectivity refers to the ability of plants and animals to move between habitats in the landscape that are necessary for their ongoing survival, for example allowing them to escape adverse conditions and recolonise habitat and breed in more favourable times. Plants and animals move between wetlands by flight (waterbirds), through suitable terrestrial habitat (frogs, reptiles and eels), in water (fish, plants and aquatic invertebrates), through dispersal by wind or in the gut or plumage of waterbirds (plant seeds and fragments and aquatic invertebrates). Short-term refuges and longer-term refugia play an important role in ensuring survival of wetland plants and animals.

Connectivity is also important for the wetland biological processes (for example, flooding, drying and cycling of nutrients and energy) that are necessary to provide the habitat to support wetland plants and animals. On floodplains, the high degree of lateral connectivity that occurs during overbank flooding is essential for the exchange of nutrients, sediments, carbon, organic matter and native plants and animals between the floodplain, floodplain wetlands and the river. An understanding of connectivity can help define groups of wetlands that can be managed together.

Threats to wetland connectivity include the obstruction of flow paths to wetlands and the loss and degradation of key wetlands or the terrestrial habitat that allows species to move between them. A recent project has identified the different levels of connectivity for wetland plants and animals based on their dispersal pathways¹¹. Further investigation is required to apply this knowledge at the regional level, to define wetland systems, integrate wetland connectivity into the regional priority setting process (Section 4.2.3) and into the design of biolinks.

Policy 12.12

Wetland connectivity will be incorporated into the regional priority setting framework for waterway management and into the design of biolinks.

12.7.1 Maintaining and improving floodplain connectivity

The river channel, its floodplain and the wetlands that occupy depressions on the floodplain form part of a larger ecological system. Lateral connectivity between these landscape elements is important to sustain habitat for native plants and animals, promote nutrient cycling and provide flood storage and conveyance.

Connectivity between a river, the floodplain and floodplain wetlands can be disrupted by obstructions to the natural flow paths of floodwaters, changes to water levels within the river channel or reductions in the frequency of overbank flows.

The *Victoria Flood Management Strategy* (currently scheduled for renewal) adopts the principle that rivers should, wherever possible, be allowed to flood naturally, maintaining connectivity to floodplains and their associated wetlands. Regional floodplain management needs to better integrate the management of flood risk with the protection of high value waterways identified in regional Waterway Strategies.

Connectivity between a river, its floodplain and wetlands can be disrupted by development on the floodplain. Zoning and overlay instruments in local government planning schemes (which apply throughout Victoria), assist in preventing further loss of connectivity between the river, its floodplain and the wetlands. These instruments include the Urban Floodway Zone, which applies in Melbourne, the Floodway Overlay (FO) and the Land Subject to Inundation Overlay (LSIO). One purpose of these instruments is to ensure that, based on flood studies and advice from the relevant floodplain manager, the responsible planning authority considers the potential effects of proposed developments on redirecting or obstructing floodwater, stormwater or drainage water and on reducing flood storage and increasing flood levels and flow velocities. The LSIO and FO also aim to ensure that development on the floodplain maintains or improves river and wetland health, waterway protection and floodplain health. Most rural floodplain wetlands are covered by LSIOs or FOs. The Environmental Significance Overlay is another planning instrument that can be tailored to protect specific environmental values of wetlands and floodplain habitat in local planning schemes.

In floods, levees on floodplains can obstruct flow paths to parts of the floodplain, including wetlands. In August 2012, the Environment and Natural Resources Committee (ENRC) reported to the Government on the management of levees in Victoria as part of the Inquiry into Flood Mitigation Infrastructure in Victoria. The Government's response will inform the policy for the management of levees to be set out in the updated *Victoria Flood Management Strategy*.

Action 12.9: Identify wetlands that have a high value for protecting or improving landscape connectivity.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2014

In some situations, works can be undertaken to reinstate hydrological connectivity to individual floodplain wetlands. One approach involves lowering the flooding threshold so the wetland floods at lower flood levels. Where individual wetlands have been isolated from overbank flows by infrastructure or past development, it may be possible to reinstate hydrological connectivity by removing or by-passing blockages in flow paths (for example, by installing a culvert under a road). Issues to be considered in seeking to reinstate connectivity in this way include the values of the wetland, any impacts on the community, feasibility and cost-effectiveness, integration with other management activities for waterways (such as environmental watering), riparian management and viability of the wetland under future river flow regimes.

Where river levels are kept artificially high by in-channel water storage structures such as weirs or by maintaining high river levels to deliver irrigation water downstream, this can result in adverse prolonged or unseasonal flooding of connected wetlands. Restoring the natural wetting and drying cycle of affected wetlands may involve building regulators on the effluent channel to the wetland so the water regime can be managed appropriately.

Connectivity can also be improved by reinstating a more natural water regime to priority floodplain wetlands affected by river regulation and water extraction through environmental watering (see Chapter 8). Deliberate inundation of private property will not be undertaken without the landholder's consent (see Section 8.6.1).

Principles for restoring hydrological connectivity to floodplain wetlands

Works to reinstate hydrological connectivity to high value floodplain wetlands will be undertaken on a priority basis where:

- they are feasible, cost effective and have community support
- the wetland is viable under the predicted, future flooding regimes; taking account of available environmental water
- any impacts on community services and public and private assets can be mitigated
- they can be integrated with any other works or environmental watering programs required to protect or improve the values of the wetland.

Policy 12.13

The updated Victoria Flood Management Strategy will take account of floodplain values in establishing policies for floodplain management.

The integration of flood risk management and the protection of floodplain wetlands and other high value floodplain areas will be improved at State and regional levels. The updated Victoria Flood Management Strategy will be aligned with the *Victorian Waterway Management Strategy* and regional floodplain management will be informed by regional Waterway Strategies.

Waterway managers will provide information and advice to local government to ensure wetland and floodplain values are taken into account in flood planning and the administration of the planning controls for floodplain management.

Connectivity for floodplain wetlands will continue to be protected, through the use of the Land Subject to Inundation Overlay and Floodway Overlay. Additional planning controls such as the Environmental Significance Overlay may be applied where environmental values require stronger protection.

Regional Waterway Strategies will identify priority floodplain wetlands where hydrological connectivity will be reinstated or works undertaken to prevent inappropriate permanent or unseasonal flooding.

12.8 Managing the impacts of drainage on wetlands in rural areas

12.8.1 Reducing impacts of rural drainage

There is a long history of rural drainage in Victoria and the extent of drainage in dryland agricultural areas is significant. For example, in the Glenelg Hopkins region, over 196,000 hectares has been drained. Drainage has been the main cause of the loss of freshwater wetlands in Victoria (Section 12.1.1). Drainage became less of an issue in the dry period between 1997 and 2009. However, there is renewed pressure for drainage following high rainfall and floods, as occurred in 2010 and 2011.

While drainage usually directs water away from wetlands, water may also be drained into wetlands. While this often negatively affects the water regime of the receiving wetland, in some cases, the additional water may assist in supporting waterway values, for example maintaining high water levels for recreation. The mitigation of adverse effects on water quality is also an issue in drainage management. Drainage may disturb and activate acid sulfate soils (see Section 10.8).

Planning controls provide the main mechanism to regulate local drainage. Local government can apply an Environmental Significance Overlay or use the schedule to the Farming Zone to specify that a permit is required for works that affect the flow of water across a property boundary. However, these controls are not universally applied in planning schemes. In some local government areas there is no requirement for approval to undertake smaller drainage works on individual farms.

Drainage is a complex issue and many aspects of its management are beyond the scope of this Strategy. The Environment and Natural Resources Committee (ENRC) initiated an inquiry into rural drainage in 2012 that addressed the impacts of rural drainage on landholders and waterways. In addition, the functions and powers of authorities in relation to regional drainage will be investigated as part of the review of the *Water Act 1989* (see Section 1.2.1).

At the State level, a framework is needed to manage the risks to waterways from drainage, taking into account the Government's response to the ENRC inquiry and any relevant *Water Act 1989* amendments. At the regional level, for high value waterways impacted by drainage, it may be possible to identify local solutions to mitigate these impacts, taking into account feasibility, cost-effectiveness and any effects on surrounding and downstream stakeholders. Where drainage water supports environmental and social values, it is important these values are considered when developing management options. A trade-off may be required between a wetland that is drained and a wetland that receives the drainage water. Water quality issues associated with drainage also need to be addressed.

Policy 12.14

The Victorian Government will ensure that any future reform of drainage management in Victoria includes measures to protect the environmental, social, cultural and economic values of waterways.

Regional Waterway Strategies will identify priority projects to mitigate the impacts of existing drainage on high value wetlands where this is feasible and cost-effective, has community support and does not affect other stakeholders. Rehabilitation of high value, privately-owned wetlands affected by drainage will be encouraged through market-based instruments and other incentives.

Waterway managers will provide advice to local government on threats to high value wetlands that are associated with drainage for land use and development.

12.8.2 Reducing impacts of irrigation drainage

Drainage associated with irrigation can change the water regime of wetlands and lead to salt accumulation, poor water quality and vegetation change. Irrigation areas can cause disruption of natural water regimes and the discharge of drainage water to wetlands. Some wetlands now depend on drainage where drainage water has replaced former natural runoff or where wetland habitat has adapted to the changed water regime. Reductions in drainage volumes associated with dry climatic conditions, improved irrigation practices and water saving projects often result in less flow of drainage water to wetlands. This may have positive or negative effects, depending on the individual site characteristics. The disposal of drainage water to wetlands often leads to progressive salinisation and high nutrient levels.

Irrigation drainage in Victoria's three major irrigation regions (the Goulburn-Murray, Sunraysia and Macalister irrigation districts) is managed under the Victorian Irrigation Drainage Program. The *Victorian Irrigation Drainage Program Strategic Direction 2010–2015*¹² aims to enhance the environmental services provided by water and natural environments in landscapes influenced by irrigation. It includes a project to manage environmental assets at risk from irrigation-induced shallow water tables, loss of drainage flows or residual drainage flows.

Action 12.10: Develop a framework to manage risks to waterways from rural drainage.

Who: Department of Environment and Primary Industries.

Timeframe: 2014

New irrigation developments outside established irrigation areas require a Water Use Licence (WUL) or Take and Use Licence (TUL) under the *Water Act 1989*. Rural water corporations, which have the power to grant licences, must consider the impacts of the proposed water use on the environment. Outside established irrigation areas, waterway managers are responsible for the development of regional Irrigation Development Guidelines (IDGs) which are designed to guide new irrigation developments to meet expected environmental and performance standards that avoid or minimise the offsite impacts of water use and irrigation. IDGs provide guidance, to both irrigation developers and government agencies, on the process, matters for consideration, conditions and approvals required to obtain

or modify a WUL or TUL. These requirements provide a sound basis for minimising the environmental impacts of irrigation drainage associated with new or expanded irrigation development outside the major irrigation regions.

Policy 12.15

The impacts of irrigation drainage on wetlands will be minimised through the incorporation of environmental risk assessment and mitigation in irrigation drainage management programs.

12.9 Managing coastal wetlands

Coastal wetlands are valued for tourism, recreational activities such as fishing and boating and their environmental values. The key threats to coastal wetlands are sea level rise, coastal development, invasive species and the disturbance of acid sulfate soils.

Climate change projections predict that sea levels will continue to rise and storms will be more frequent and intense. The lowest lying coastal areas are most at risk from inundation and it is in these areas that coastal wetlands occur. A report² found that sea level rise is likely to result in the permanent inundation of tidal wetlands. Saltmarshes, which are currently intermittently inundated during spring tides and storm surges, are predicted to become more frequently inundated. Permanent coastal and mangrove wetlands are likely to persist, although their distribution is expected to change as they move into intermittent coastal wetlands. Saltmarshes will be at most risk because of barriers to inland migration associated with topography and land use. They are likely to diminish significantly in area. In addition, coastal freshwater wetlands at low elevations may become inundated by seawater.

The most vulnerable coastal wetlands are those in low lying areas adjacent to embayments and estuaries and where inland migration is restricted. These include wetlands around Port Phillip Bay and Western Port (constrained by infrastructure) and along the Otway and far east coast (constrained by topography).

A range of tools and approaches is available to facilitate adaptation. The identification of vulnerable coastal wetlands and options for facilitating their adaptation to the salinity and water regimes that are predicted to occur in the future will assist in regional priority setting.

Population growth is occurring rapidly in Victoria's coastal areas. If not carefully managed, this could adversely affect water quality and environmental condition of coastal wetlands.

Policy 12.16

Regional Waterway Strategies will identify appropriate management activities to facilitate adaptation of high value coastal wetlands to sea level rise and to mitigate adverse effects associated with coastal land use and development.

Long-term strategic waterway and coastal planning will consider the impacts of potential future sea level changes on wetlands.

Action 12.11: Undertake research to identify high value coastal wetlands that are vulnerable to sea level rise and quantify risks and opportunities for adaptation to predicted future salinity and water regimes.

Who: Department of Environment and Primary Industries, waterway managers, regional coastal boards, Gippsland Lakes Ministerial Advisory Committee.

Timeframe: 2015

12.10 Information to improve wetland management

Sound, current information on the location and characteristics of wetlands, their extent, condition, threats and values is needed to provide the basis for continuous improvement in policy setting, strategic planning and management effectiveness.

Wetland managers need knowledge about the most appropriate management activities. Policy makers and planners need to better understand the extent and impact of current and future actions that cause or are likely to cause significant wetland loss and degradation. Measures and techniques to mitigate significant and common impacts need to be periodically assessed for their effectiveness and improved or changed, if necessary. Section 17.3 provides further information on intervention monitoring and resource condition assessment for waterways.

Action 12.12: Maintain the Victorian wetland inventory, allowing for updates of wetland attributes in response to new knowledge or changes to attributes and ensure wetland information is accessible to landholders, community networks and groups, local government and natural resource managers.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2020

Action 12.13: Develop and apply a method to routinely monitor changes in wetland extent and changes in wetland water regime.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

Action 12.14: Improve the framework for identifying high value wetlands and assessing risk.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016



Assessing the characteristics of wetlands on the Wimmera River from the air. Photographer: Andrea White



13 Estuaries

Powlett River. Courtesy West Gippsland CMA

Estuaries

Guide to the chapter

13.1 Context

- Values of estuaries
- Threats to estuaries

13.2 Framework for managing estuaries

13.3 Specific estuary management issues

- Management of estuary entrances
- Maintaining and improving environmental condition of estuaries
- Setting water quality objectives for estuaries
- Determining environmental water requirements for estuaries
- Managing coastal acid sulfate soils

13.4 Information to improve estuary management

13.5 Increasing community awareness and understanding of estuaries and their management

What are the issues with existing arrangements?

The management of estuaries in Victoria requires improved co-ordination with the coastal management framework and comprehensive integration with the management of rivers and wetlands. Roles and responsibilities for managing estuaries across government agencies and the community are currently unclear and there is a need for clear strategic direction for estuarine policy and management at State and regional levels. While our understanding about how threats to estuaries affect estuarine condition is improving, continued research is required to provide the evidence base for effective planning and management.

What improvements does the Strategy make?

For estuaries the Strategy will:

- comprehensively integrate the management of estuaries with the management of rivers and wetlands
- clarify and formalise organisational responsibility for estuary entrance management
- outline arrangements for strategic planning of management activities to maintain or improve the environmental condition of estuaries
- enhance knowledge to support improved estuary management
- strengthen programs to increase community awareness of and involvement in estuary management.

13.1 Context

Estuaries connect rivers to the sea. They are a transition zone where freshwater draining from the land mixes with the saltwater from the ocean to create unique and important ecosystems.

Estuaries are partially enclosed waterbodies that may be permanently or periodically open to the sea and have salinities that vary from almost fresh to very saline. Estuarine ecosystems are highly complex and dynamic environments. Since estuaries are at the bottom end of catchments, their condition can be affected by activities occurring within the upstream freshwater catchment. Where the condition of catchments, rivers or estuaries is poor there are likely to be additional impacts on the marine receiving waters and coastal areas.

The majority of Victoria's estuaries are brackish mouths of rivers and streams that flow directly into the ocean or into large marine bays (such as Port Phillip Bay, Western Port and Corner Inlet). There are more than 100 estuaries in Victoria; 83 of which exceed one kilometre in length. The definition of estuaries also includes coastal barrier lagoons (such as the Gippsland Lakes) and some coastal inlets (such as Anderson Inlet).

Many of Victoria's estuaries close intermittently as a result of sand bar formation at the estuary entrance. This usually occurs during periods of low freshwater inflow. Intermittently closed estuary entrances are a natural feature of the Victorian coastline and can be critical to the ecology and physical form of estuaries.

13.1.1 Values of estuaries

Victoria's estuaries have long been important to Victoria's Traditional Owners and many contain sites of cultural significance (see Chapter 6). Sheltered estuarine waters across Victoria were among the first areas to be settled by non-indigenous people. Many estuaries in the late 1800s and early 1900s supported important industries such as ports and commercial fishing and these early settlements have since developed into some of Victoria's most densely populated areas. Estuaries are valued for recreational use (for example camping, swimming and boating) and contributions to local and regional economies through tourism and commercial or recreational fishing. They also provide opportunities for connecting with wildlife or enjoying the scenery. The key values, threats and management activities for estuaries are shown in Figure 13.1.

Estuaries also have many environmental values. They support a range of distinctive aquatic and terrestrial plants and animals, including rare and threatened species and communities. Estuaries are important drought refuges, and provide significant breeding and feeding areas for birds and spawning and nursery areas for fish. Vegetation and saltwater marshes adjacent to estuaries maintain water quality, assist with nutrient cycling, and provide a buffer to catchment-derived sediments and pollutants entering the marine environment.

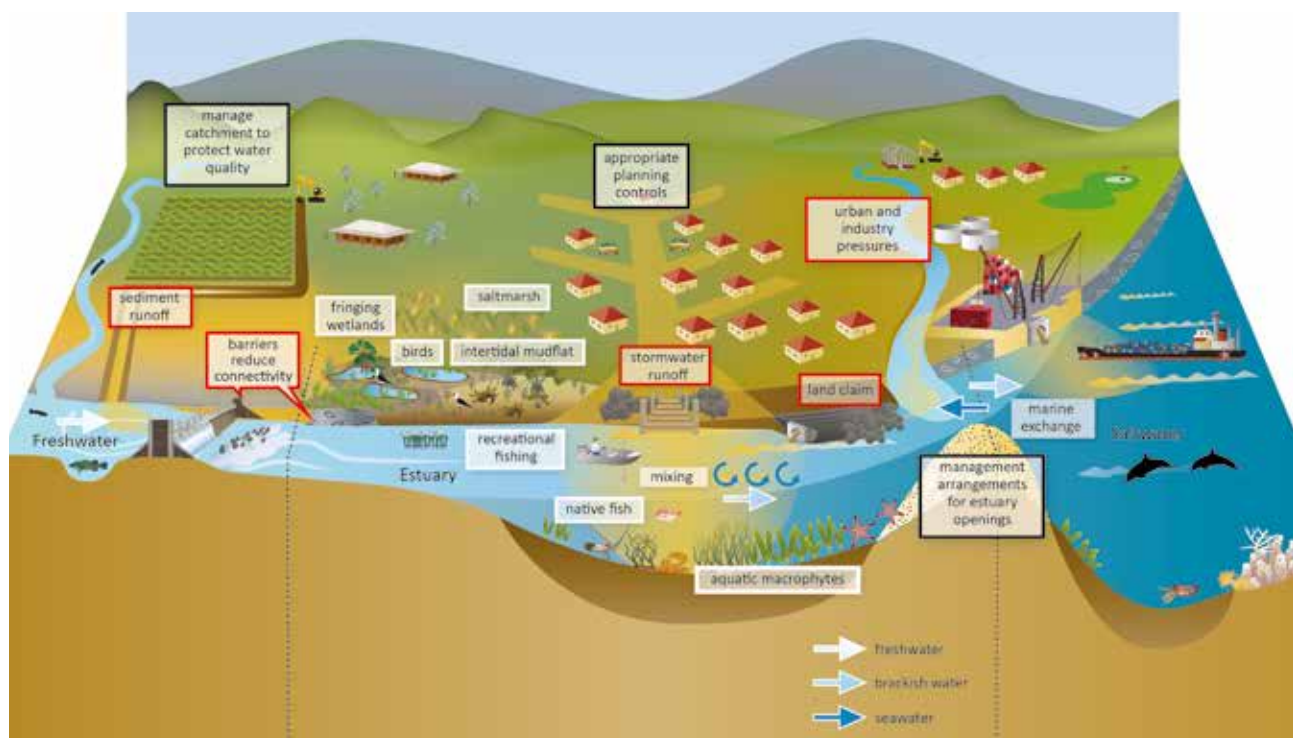


Figure 13.1: Values (white), threats (red) and management activities (black) for estuaries.

13.1.2 Threats to estuaries

A diverse range of threats can potentially degrade the condition of estuaries. Estuaries are often surrounded by dense coastal settlements and can be exposed to intensive levels of recreation and use. Other threats include:

- unpermitted estuary entrance openings (for example, people using machinery to remove sand from the mouth of an estuary so that it flows into the ocean)
- changes in water regimes
- high levels of sediment and nutrients
- pollution events (such as oil spills)
- habitat modification
- land-claim (creating new land from areas that were previously below high tide)
- invasion by weeds or pests
- salinisation and acidification.

Land use change, such as agriculture or residential development, may also have impacts on environmental condition that need to be managed.

Estuaries are particularly vulnerable to reduced freshwater inflows from rivers. While reduced inflow can lead to a reduction in sediment and nutrient inputs from upstream, it can also decrease the mixing and flushing of estuary water (increasing salinity), change sediment and nutrient dynamics, increase the frequency of algal blooms and reduce the number of entrance openings in some estuaries. Changes in water level and salinity regimes can also have serious impacts on existing plant and animal communities.

The potential impacts of climate change are another key challenge for estuary management. If the climate warms over the long-term it is predicted that sea levels will rise, storm surge intensity will increase and freshwater inflows will decrease. A rise in sea level will result in increased inundation of fringing vegetation and low lying land adjacent to existing estuaries. This can cause saltwater intrusion, where saltwater extends further up river channels into the freshwater sections, and potentially alter the dynamics of the estuary entrances to be open more frequently or permanently in some cases.

Dealing with natural climate variability is also a major challenge in the planning and management of Victoria's estuaries.



Aire River estuary. Photographer: Alison Pouliot

13.2 Framework for managing estuaries

The *Victorian Coastal Strategy*¹ (VCS) provides the current statewide direction for managing coastal, estuarine and marine environments.

The VCS is the statewide policy for coastal management and planning, prepared in accordance with the *Coastal Management Act 1995*. The Act also establishes regional Coastal Action Plans (CAPs) to implement the VCS directions at the regional level. Local coastal management plans then guide management of coastal public land consistent with both the VCS and CAPs.

The VCS, CAPs and coastal management plans are robust tools to address use and development issues related to estuaries in Victoria, particularly for issues that require planning responses. Coastal Action Plans specifically to address estuary issues have also been developed previously in Victoria's south-west and Gippsland regions. Together these plans are important tools to address use and development issues, but do not comprehensively include management of the environmental condition of estuaries. They also lack integration with the management of river and wetland condition.

The development of this Strategy provides a consistent, strategic direction for the management of the environmental condition of Victoria's estuaries that is integrated with rivers and wetlands.

In coastal catchments, waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region) will lead the development of regional Waterway Strategies (RWSs) to provide regional direction for managing the environmental condition of estuaries.

Policy 13.1

The *Victorian Waterway Management Strategy* will provide the leading statewide strategic direction on the management of the environmental condition of estuaries. The *Victorian Coastal Strategy* will continue to provide strategic direction for coastal land use planning and sustainable development issues.

Regional management of estuary condition will be integrated with that for rivers and wetlands through regional Waterway Strategies.

The RWSs will identify high value estuaries and priority management activities over an eight-year period (see Section 4.2). In their development, outstanding actions and strategic directions related to estuaries from relevant CAPs will be considered (see Figure 13.2). The RWSs will also identify where Estuary Management Plans need to be developed (or updated) and will help provide a clear picture of the actions required to maintain or improve the health of priority estuaries.

Estuary Management Plans may also link to broader catchment management approaches to protect estuary condition, such as improved land management practices. These plans will need to consider and be considered in coastal management plans prepared by local land managers to ensure alignment of management activities.

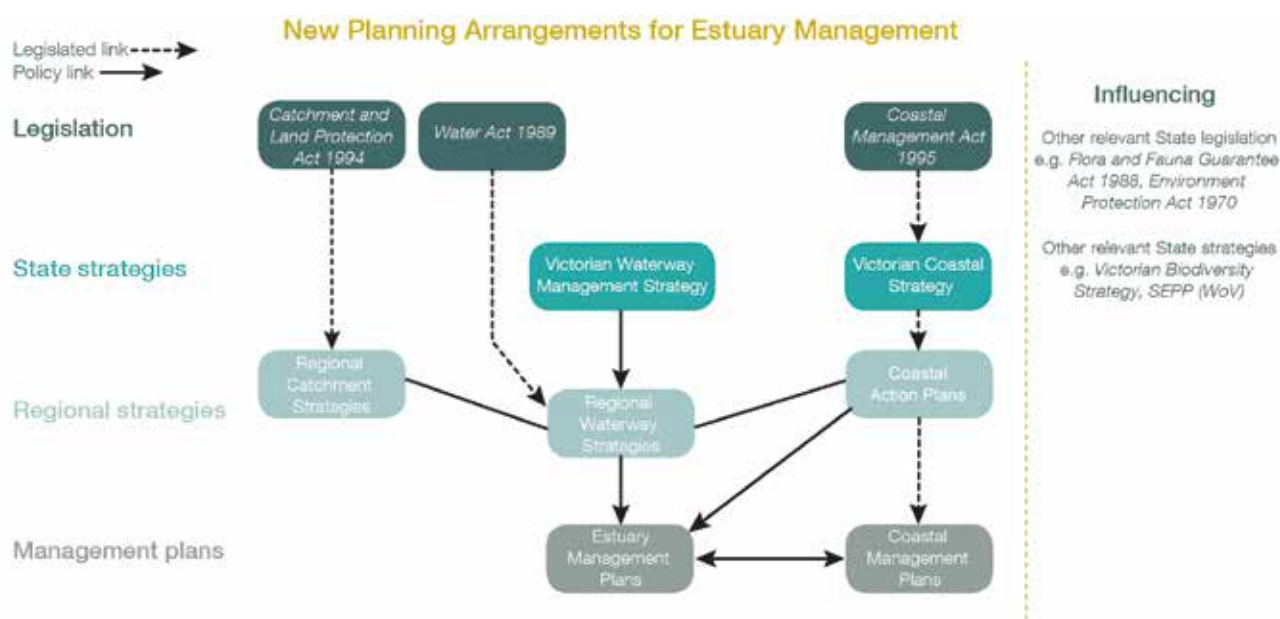


Figure 13.2: Key legislation and new planning arrangements for estuary management.

Policy 13.2

Regional coastal boards will continue to provide strategic direction, in partnership with local government, for coastal land use planning and sustainable development issues through implementation of the *Victorian Coastal Strategy* and Coastal Actions Plans.

At the regional level, waterway managers, regional coastal boards and public land managers (that is, the Department of Environment and Primary Industries, Parks Victoria, local government and coastal committees of management) will undertake a co-ordinated approach to estuary management.

Waterway managers are responsible for strategic planning for estuary condition management through the development of regional Waterway Strategies.

Regional Waterway Strategies will identify priority Estuary Management Plans for development (or updating) and nominate the organisation to develop and implement the plans (in conjunction with key stakeholders).

Coastal Action Plans may also provide guidance for Estuary Management Plan development (or updating) regarding land use planning for land use and development.

Estuary Management Plans have the capacity to deliver outcomes under the regional Waterway Strategies and Coastal Action Plans and will help provide a clear picture of the management activities required to maintain or improve the condition of priority estuaries.

Future Estuary Management Plans will also consider upstream catchment influences, influences on marine receiving waters and the potential impacts of climate change on the environmental condition of estuaries.



Surry River estuary entrance. Courtesy Glenelg Hopkins CMA

Action 13.1: Consider outstanding actions and strategic directions (related to estuaries) in Coastal Action Plans during development of the regional Waterway Strategies.

Who: Waterway managers, regional coastal boards.

Timeframe: 2014

Action 13.2: Review and update current Estuary Management Plans or develop new plans as required.

Who: Waterway managers, Parks Victoria, regional coastal boards, local government, committees of management, Department of Environment and Primary Industries, Department of Transport, Planning and Local Infrastructure.

Timeframe: 2018

13.3 Specific estuary management issues

13.3.1 Management of estuary entrances

The closure of an estuary entrance can result in an increase in water level and inundation of adjacent land. Inundation is a natural process and plays an important role in the life cycle of many species and the cycling of nutrients. Periodic inundation of adjacent wetlands and fringing vegetation is also necessary to ensure their ongoing health. For some estuaries, reduced freshwater inflows, as experienced in drought periods, reduce the frequency of flushing flows that open estuary entrances and result in increased periods of inundation.

However, high water levels and prolonged inundation can have social and economic impacts through flooding of adjacent agricultural or residential land, roads and structures (such as jetties and boat ramps).

Artificial estuary entrance openings

The social and economic costs associated with flooding from estuaries can be reduced through the provision of a drainage service, that is, artificially opening the estuary entrance to allow the excess water to flow out to sea. However, there are potential environmental impacts associated with this intervention if conducted under the wrong conditions. The detrimental effects of an artificial estuary entrance opening can include:

- disruption to the natural patterns of variation in water quality
- impacts on plant and animal species, including mass fish deaths (for example, the Surry River fish death event in 2005)
- disruption of animal migration and reproductive cycles.

Artificial estuary opening is regulated by waterway managers who are responsible for issuing approval under the *Water Act 1989*. Due to past management practices, there is a widespread community belief that an artificial estuary opening is automatically initiated when the water reaches a particular level. However, the decision process should commence when water level is considered to have a significant impact on the environmental, social and economic values of the estuary. The impact associated with a particular water level may vary at different times of the year.

A history of unpermitted estuary entrance openings and community concern about the lack of clear and consistent guidelines led the Victorian Government to develop the Estuary Entrance Management Support System (EEMSS). EEMSS provides estuary managers with a powerful tool for considering impacts on the environmental, social and economic values of an estuary and properly accounting for all of the likely risks involved with decisions to artificially open (or not to open) an estuary. In addition to its use as a decision support tool, the EEMSS also provides sound guidance for the ongoing management of estuaries by establishing important baseline data such as records of estuary entrance openings, water levels, water quality data, and species lists.

Principles

An artificial estuary entrance opening will only occur if:

- a risk-based assessment that considers impacts on the environmental, social and economic values of the estuary determines it is appropriate
- weather and physical conditions allow for a safe and effective opening as outlined in approval conditions.



*Artificial estuary opening at Painkalac Creek.
Courtesy Corangamite CMA*

Policy 13.3

Waterway managers will take the lead role in the regulation of estuary entrance opening using the process outlined below:

- a. A risk-based assessment considering the environmental, social and economic values of an estuary is conducted when making a decision whether or not to open an estuary. The Estuary Entrance Management Support System (EEMSS) should be used by waterway managers to inform decisions about artificial estuary entrance openings, where possible.
- b. Waterway managers will be primarily responsible for all decisions regarding requests to artificially open an estuary entrance. Approval under the *Water Act 1989* issued by the waterway manager will outline the conditions of estuary openings.
- c. Where required, waterway managers in conjunction with relevant agencies will develop a Memorandum of Understanding (MOU) for estuary openings. On a case by case basis MOUs will identify roles and responsibilities, the process and the beneficiaries of artificial openings, which will in turn guide funding arrangements for the works component and water quality monitoring requirements of the estuary opening. The MOU will be signed by all parties and reviewed as required.
- d. The land manager or delegated responsible entity (permit holder) identified in the relevant MOU will be responsible for carrying out the works component of all artificial estuary entrance openings.

Waterway managers in conjunction with relevant agencies will investigate alternative management options for agricultural or residential land and infrastructure (built) assets that are regularly threatened by inundation due to estuary closures.

Action 13.3: Implement a risk-based assessment process to help inform estuary entrance management decisions.

Who: Waterway managers.

Timeframe: late 2013

Action 13.4: Identify land or built assets that regularly are the subject of requests to open an estuary entrance and determine if any alternative actions can be undertaken to minimise the long-term threat of inundation.

Who: Waterway managers.

Timeframe: 2016

Managing estuary entrances for flooding impacts

While estuary entrance opening may be undertaken to reduce inundation impacts on current built assets, it is also important to manage future development in areas that may be inundated when the estuary entrance is closed. Flood planning controls (such as the Urban Floodway Zone, Land Subject to Inundation Overlay and Floodway Overlay) may be used to reflect the extent of potential inundation due to estuary entrance closures and provide a trigger for more detailed consideration of risks from development in these areas as well as riverine flooding. Riverine flooding results from heavy rainfall events in the catchment, whereas flooding from estuary entrance closures can occur in times of low inflow. These controls may need to be reviewed over time as information on the vulnerability of estuaries and other coastal assets to sea level rise and potential climate change impacts (as identified in the VCS) is better understood and mapped.



Thompson Creek estuary. Courtesy Corangamite CMA

Principles

To avoid inappropriate development in areas subject to inundation from estuary entrance closures, land use planning controls will reflect the extent of potential inundation based on the best available information about coastal processes, estuary entrance dynamics and riverine hydraulic considerations.

Flood provisions in planning schemes for estuarine areas will be reviewed by waterway or floodplain managers and local government as information about the vulnerability of estuaries and other coastal assets to sea level rise and potential climate change impacts is improved.



Benedore River estuary. Courtesy East Gippsland CMA

Action 13.5: Review and update planning controls in local planning schemes to include areas that are subject to inundation due to estuary entrance closure, which are not currently addressed.

Who: Waterway and floodplain managers, local government.

Timeframe: 2020

13.3.2 Maintaining and improving environmental condition of estuaries

The environmental condition of instream and riparian estuarine habitat, vegetation communities and animal species can be affected by threats from the surrounding catchment. Erosion and sedimentation can affect the water quality of estuaries. The maintenance and improvement of these habitats (and their associated values) is vital for improving estuary condition as they provide food, cover, migratory corridors and breeding/nursery areas for many species.

Connectivity between the river, fringing wetlands, floodplains and the ocean is important for some estuarine species (particularly fish) to complete their life cycles and for nutrient exchange between habitats. Barriers such as concrete banks (built to protect infrastructure), weirs, and sand banks can reduce connectivity of estuaries both longitudinally and laterally (with fringing ecosystems such as wetlands). Inappropriate timing of estuary entrance openings can also affect longitudinal and lateral connectivity of estuarine habitats. Such openings are often triggered by impacts on adjoining private land.

Sea level rise may result in wetland and estuarine habitats naturally migrating inland, but this adaptive process may be hindered by built assets and infrastructure. Management activities to enhance connectivity and condition, such as riparian management programs (see Chapter 9) and barrier removal (see Section 11.4), along both river and estuarine reaches are critical for waterway health.

Policy 13.4

Work programs will be developed and implemented through regional Waterway Strategies to maintain or improve environmental condition of priority estuaries. Enhancing latitudinal and longitudinal connectivity of estuaries will be a critical part of the work programs.

Regulation through legislation, statutory processes, works on waterways approvals and planning controls will continue to be used to protect the environmental condition of Victorian estuaries.

Long-term strategic waterway and coastal planning will consider potential future changes to coast lines, estuary structures (built), estuarine extent, sea level changes and other relevant factors to prepare for potential changes in the extent of estuary areas and their associated plants and animals.

Waterway managers will identify opportunities to mitigate the impact on estuarine condition caused by sea level rise, more frequent estuary closures expected from reduced flows in dry periods and regular artificial estuary openings.

Where private land interfaces with high value estuaries, arrangements may be sought with the landholders to maintain the condition of the estuary. This may include landholder agreements and/or covenants. In limited circumstances where land is offered for sale, the government may choose to purchase the land.

13.3.3 Setting water quality objectives for estuaries

Water quality objectives for estuaries in Victoria are included in the *State Environment Protection Policy (Waters of Victoria)* and are drawn from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC guidelines) (see Section 10.2.1). However, these guidelines are based on data from estuaries that are not representative of many of Victoria's estuarine systems. In 2010, the Environment Protection Authority (EPA) Victoria developed *Environmental Water Quality Guidelines for Victorian Riverine Estuaries*² to support the sustainable management of Victoria's estuarine ecosystems (see Box 13.1). These guidelines provide a specific framework and tools for assessing the water quality of Victorian riverine estuaries.

Policy 13.5

Where sufficient monitoring data is available, the *Environmental Water Quality Guidelines for Victorian Riverine Estuaries* will be used to inform water quality targets for Victoria's riverine estuaries in the regional Waterway Strategies.

Box 13.1: Environmental Water Quality Guidelines for Victorian Riverine Estuaries

The *Environmental Water Quality Guidelines for Victorian Riverine Estuaries* support the sustainable management of Victoria's estuaries.

The guidelines were developed using water quality and estuary condition data collected from 31 reference estuaries across Victoria and provide preliminary water quality guideline values and a tool to allow estuary managers to improve their understanding of estuaries. The water quality guideline values represent a level at which there is a potential risk that adverse environmental effects may occur and a risk-based investigation may need to be conducted.

The guidelines use control charting to provide users with a graphical tool to detect patterns in the measurements of estuary environmental variables. Control charts allow the user to compare environmental measurements taken in an estuary of interest with what would be expected for an estuary in good condition. The use of control charts reflects a new approach to assessing condition in waterways. Control charting allows the natural causes of variability to be taken into consideration, removing their effect and reducing the overall variability of the data.

The guidelines can be refined as additional regular monitoring data becomes available. This will enhance understanding of estuaries and their processes and provide the basis for their sustainable management.

13.3.4 Determining environmental water requirements for estuaries

A key gap in the management of estuaries has been the lack of a consistent and systematic approach to determine the environmental water requirements of estuaries. The input of freshwater from rivers or groundwater is a major influence on estuary condition, but there is little knowledge regarding the extent of effects caused by altering freshwater flows to estuaries.

To fill this management gap, the Victorian Government developed the Estuary Environmental Flows Assessment Methodology (EEFAM) (see Section 8.3.1). EEFAM is a decision support tool to guide the delivery of environmental water to support estuarine condition.

13.3.5 Managing coastal acid sulfate soils

An emerging issue for estuary management is the disturbance of coastal acid sulfate soils in estuarine wetlands and marshes (see Section 10.8). The *Victorian Coastal Acid Sulfate Soils Strategy*³ aims to protect the environment, humans and infrastructure from the potentially harmful effects of disturbing coastal acid sulfate soils. The development of the *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils*⁴ provides land managers with guidelines to address this problem.

A map of where coastal acid sulfate soils are a potential issue in Victoria is provided by the *Victorian Coastal Acid Sulfate Soils Strategy*. The map identifies locations where immediate action or protection or installation of detailed monitoring networks might be warranted.

13.4 Information to improve estuary management

Improved knowledge about estuaries is critical to inform policy and management.

It is vital to understand the links between the values of estuaries, threats to those values and how management activities can reduce threats and improve environmental condition of estuaries. Logic models can be used to predict the impact of management interventions on the values and condition of estuaries (see Section 17.2.1). A consistent method for assessing the environmental condition of Victorian estuaries has not previously been available. However, the Department of Environment and Primary Industries (DEPI) has now developed a pilot Index of Estuary Condition (IEC) program (see Sections 3.2.3 and 17.3.4). Victoria's estuaries are likely to become increasingly vulnerable to climate variability and land use changes. Potential sea level rise will increase areas of inundation in low lying land adjacent to current estuaries. Reductions in freshwater flow will allow marine waters to move further upstream. The combination of these physical factors will have serious implications on where critical habitats, such as saltmarsh, mangroves and seagrass will exist in the future. Changes in these habitats will also have impacts on a range of natural values, including those that support important

industries such as fishing and tourism. Models and maps of vulnerable estuaries affected by expected changes in climate are needed to inform management decisions.

The potential impacts of artificial estuary entrance openings on the environmental condition of estuaries are poorly understood. It is important to understand the impacts of artificial openings on the hydrological cycle within the estuary and impacts on the surrounding coastal environment. This information is vital to inform decisions on artificial estuary entrance openings.

Policy 13.6

The Victorian Government will increase knowledge that supports the management of estuaries, giving priority to research:

- into vulnerability of estuarine function to potential changes in climate and catchment threats
- that improves understanding of consequences of altered estuarine hydrology, including artificial estuary entrance opening and water harvesting activities within the catchment.

Action 13.6: Review vulnerability of estuaries from coastal sea level rise and other potential impacts of climate change to inform appropriate adaptation strategies.

Who: Department of Environment and Primary Industries, Department of Transport, Planning and Local Infrastructure, waterway managers, local government.

Timeframe: 2016



Sydenham Inlet. Photographer: Sean Phillipson

13.5 Increasing community awareness and understanding of estuaries and their management

Efforts to maintain or improve estuary condition require community support. Several initiatives that raise community awareness of waterway management issues already exist, such as Waterwatch, EstuaryWatch, Coastcare Victoria, Land for Wildlife, Fishcare and Landcare.

Of these, EstuaryWatch is the only program specific to estuaries. EstuaryWatch is a community-based estuary monitoring program that collects water quality and other estuary data. It aims to help local communities learn more about the unique characteristics and health of individual local estuaries and to provide information to inform estuary management. Community data collected by EstuaryWatch participants can also be used to inform decisions regarding artificial estuary entrance openings.

EstuaryWatch was established by the Corangamite CMA and the Western Coastal Board in 2006. The success of the Corangamite program led to an expansion of EstuaryWatch into the Glenelg Hopkins and West Gippsland CMA regions. EstuaryWatch allows community members to actively participate in estuary health monitoring and provides a pathway for community members to increase their knowledge about estuaries through regular seminars, information days and training.

Policy 13.7

The EstuaryWatch program will be supported to:

- provide opportunities for the community to participate in estuary monitoring activities that help inform decision-making
- increase community awareness of estuary management issues, particularly the management of estuary entrances.

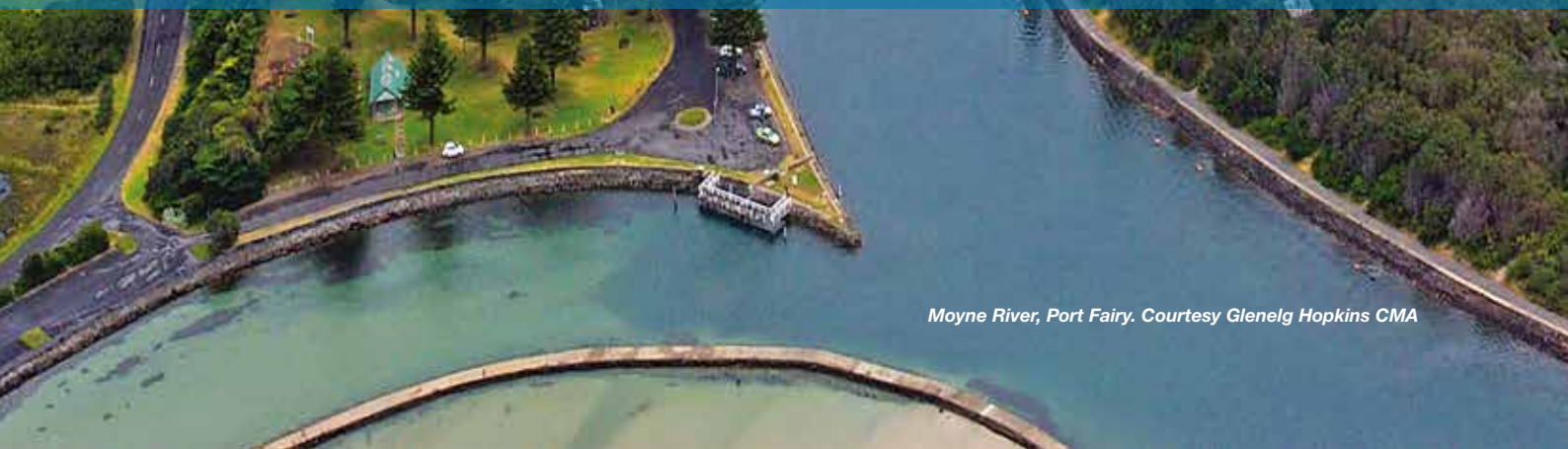


Water quality monitoring at Anglesea River. Courtesy Corangamite CMA



14

Waterways in urban areas



Moyne River, Port Fairy. Courtesy Glenelg Hopkins CMA

Waterways in urban areas

Guide to the chapter

14.1 Context

- Values of waterways in urban areas
- Threats to waterways in urban areas

14.2 Strategic waterway planning arrangements

- Roles and responsibilities for waterway management
- Current waterway management in urban areas
- Urban water reform: *Living Victoria*

14.3 Knowledge gaps

What are the issues with existing arrangements?

Waterways in urban areas are often in poor environmental condition, typically due to impacts from stormwater runoff. Research has shown that retaining stormwater in urban catchments for local use, or infiltrating stormwater into soils or vegetated areas could improve waterway condition. Better use of urban stormwater could also reduce reliance on drinking water supplies, provide water to green urban spaces, reduce the heat island effect in built environments and reduce the risk of flooding. Realising these multiple benefits will require greater integration of urban planning, water service planning and waterway management planning and improved co-ordination and collaboration between responsible agencies.

What improvements does the Strategy make?

Improved condition of waterways in urban areas will be a key outcome of the Government's *Living Victoria* initiative for urban water, which is a commitment to:

- support liveable and sustainable communities
- protect the environmental health of urban waterways and bays
- provide secure water supplies efficiently
- protect public health
- deliver affordable essential water services.

The above policy will:

- improve the condition of waterways in urban areas and achieve other benefits by adopting new whole-of-water-cycle management principles and approaches in planning and managing urban waterways.
- ensure co-ordination and common understanding of whole-of-water-cycle management across agencies and the community through the activities of the Office of Living Victoria, including the preparation of regional and local water cycle plans.

14.1 Context

Waterways are a focal point for many cities and towns throughout Victoria and most urban communities have a long history of interaction with their local waterways.

Historically, waterways in urban areas (such as the Yarra River in Melbourne throughout the 1800s) were treated as little more than pipelines to remove waste from rapidly expanding communities. Meat industry waste, factory waste, huge amounts of litter and raw sewage all ran directly into the Yarra River¹ and other rivers running through regional centres. The eventual development of sewerage systems to pipe waste directly to treatment plants was a major advance in waterway management. Waterways in urban areas were also historically managed with a strong engineering focus on flood conveyance and the provision of drainage services, which involved modification of many waterways into concrete drains and channels.

Major clean-up campaigns of the late 1970s and 1980s led to improved waterway health for many waterways in urban areas. For example, significant work in the Yarra River and surrounding catchment saw the return of animals such as platypus and a range of migratory native fish species. Despite the muddy appearance of the water, the Yarra River is probably one of the cleanest capital city rivers in the world². Currently, water quality in the Yarra River varies along its length, from good in the upper reaches to poor in some locations in the lower Yarra, particularly after heavy rain.

Generally though, water quality in the Yarra is suitable for many of the uses valued by the community.

The next stage in this transformation is to value waterways as an integral part of our cities and towns and work to improve the health of these waterways through better planning and use of water resources to make urban areas more liveable and sustainable.

The key values, threats and management activities for waterways in urban areas are shown in Figure 14.1

14.1.1 Values of waterways in urban areas

Although waterways in urban areas are often highly modified, they provide many important benefits for communities. The Yarra River supports considerable recreation and tourism; providing the setting for a range of sports, festivals and major events each year. In regional urban areas, waterways often run through the centre of towns and provide a meeting place and setting for recreational activities, as well as a focal point and sense of identity for the community. For example, many towns have weir pools that once had an historic water supply function, but now provide important recreation and amenity values.

Waterways in urban areas are often prized for their very high social values, due to their location near to large populations that access waterways on a daily basis for a range of beside water activities. Walking, running, cycling and barbeques are all popular activities along waterways in urban areas.



Figure 14.1: Values (white), threats (red) and management actions (black) for waterways in urban areas.

Recreational fishing is an important social and tourist activity in some regional centres. Access to waterways and associated public space, and the amenity that they provide, is an important consideration in improving liveability in urban and urbanising areas. Management of waterways is focused on maintaining or improving the environmental condition of waterways to support environmental, social, cultural and economic values (see Section 3.4). In urban areas, this may include planting native trees for shade (to support passive recreation), or improving water quality to a level that is safe for rowing or kayaking.

In addition to providing the setting for recreation, physical activity and tourism, waterways in urban areas also provide a valuable point of connection with nature in an ever intensifying urban environment. The *My Victorian Waterway* survey found that the Merri Creek in Melbourne's north is Victoria's most popular urban creek, despite the fact that it is heavily affected by urban development³. Waterways in urban areas provide critical services with significant economic value, including town water supplies, flood conveyance and disposal of wastewater and stormwater. They also help to sustain vegetation in the urban landscape and aid in natural cooling of urban areas. Urban waterways and their riparian corridors often provide the only opportunity for the movement of wildlife in developed areas and provide important habitat within the built landscape.



Relaxing by the Yarra River. Photographer: Melissa Clarke

14.1.2 Threats to waterways in urban areas

Waterways in urban areas are often adversely affected by urban development (new or infill) that increases impervious (hard) surfaces and changes the natural water cycle of catchments. Adverse impacts result from the increased runoff of polluted stormwater into waterways. That is because stormwater has traditionally been directly piped to the nearest waterway to help facilitate development. The subsequent increased frequency and intensity of flows can degrade waterway condition, while also reducing important base flows that were previously supplied by slow infiltration through catchment soil and vegetation. The health of waterways in urban areas has also been affected by the removal of riparian vegetation and channelisation of waterways, including the piping of their smaller tributaries.

Future population growth, increased urban infill and development, and the potential impacts of climate change will put increasing pressure on waterways in urban areas. A new approach to managing Victoria's urban water systems is therefore needed.

Scientific research has shown that retaining stormwater in urban catchments for local use, or assisting infiltration of water into soils and vegetation can improve waterway condition. Making better use of and retaining stormwater in our urban areas can also help to secure drinking water supplies, green our towns and cities, reduce the heat island effect present in developed areas, improve our natural environments and reduce the risk of localised flooding. This needs to be reflected in how we plan for and manage our urban environments and urban waterways in the future.

Planning for urban waterways, urban water resources and the built environment is currently managed across a number of agencies and planning processes. Better integration, collaboration and co-operation between these agencies is needed to deliver integrated water cycle management outcomes. The *A Cleaner Yarra River and Port Phillip Bay – A Plan of Action*⁴ (see Box 14.1) is an example of government agencies collaborating to deliver a range of improved water quality outcomes for the Yarra River and Port Phillip Bay.

Box 14.1 Water quality in the Yarra River and Port Phillip Bay

The Yarra River and Port Phillip Bay are iconic natural assets that are highly valued by Victorians, as well as visitors from interstate and overseas. They support a wide range of environmental, social, cultural and economic values; many of which are dependent on environmental condition. Water quality is particularly important for animals and plants (such as platypus, fish, birds, riparian vegetation and seagrass), as well as supporting opportunities for recreation and tourism. While the Yarra and the Bay are overall in good condition, water quality in the Yarra River can vary along its length, from good in the upper reaches to poor in some locations in the lower Yarra, particularly after heavy rain. Water quality in the Bay and along the beaches is highly valued for recreation and social events during summer but these are dependent upon the quality of water from rivers and catchments upstream.

Actions by a number of government agencies have been identified to improve water quality and ensure that current and future generations can have the confidence to use and enjoy the values provided by the Yarra River and Port Phillip Bay. These actions are specified in the *A Cleaner Yarra River and Port Phillip Bay – A Plan of Action*, released by The Hon. Ryan Smith MP in early 2012 which focuses on four priority tasks to improve water quality in the Yarra River and Port Phillip Bay:

- enable more effective co-ordination between government agencies in protecting water quality and providing timely information to communities about water quality events
- manage threats to water quality, including pollution, litter and stormwater inputs by identifying new priority actions to address them
- develop easier ways for the community to access information about water quality of the Yarra and the Bay
- support Victorians to take actions that care for and protect the Yarra and the Bay.



Litter and pollutants entering waterways through drains. Courtesy Melbourne Water

14.2 Strategic waterway planning arrangements

14.2.1 Roles and responsibilities for waterway management

Institutional arrangements, roles and responsibilities of key agencies in waterway management are outlined in Chapter 18. Regional planning processes for waterway management are outlined in Chapter 4. The differing institutional arrangements for the metropolitan Melbourne region compared to urban areas in other parts of Victoria are described in Section 18.2.2.

14.2.2 Current waterway management in urban areas

Waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region) implement state policy for waterway management through various strategies and plans prepared for the waterways in their region.

In the metropolitan region, Melbourne Water also has responsibility for the regional drainage system. In undertaking this role Melbourne Water works closely with the 38 local governments, which have responsibility for local drains, road networks, streets and property drainage that feed into regional drains and urban waterways in the metropolitan region.

Catchment management authorities (CMAs) are the waterway managers for the sections of urban waterways outside of Melbourne Water's area of responsibility. In some areas, local governments may be appointed Marine Safety Act (MSA) waterway managers (see Ch 1, Box 1.2 and Section 18.2.2). As with the Melbourne region, local governments have responsibility for managing urban stormwater. CMAs also work collaboratively with local governments to manage the impacts of urban stormwater runoff on urban waterways.

There are currently several strategies, plans and approaches relevant to waterway management in urban areas.

For the Department of Environment and Primary Industries and other agencies and organisations these include:

- This *Victorian Waterway Management Strategy* – which describes the state policy framework for managing rivers, estuaries and wetlands from 2013–2020
- *A Cleaner Yarra River and Port Phillip Bay-A Plan of Action* – which outlines actions to improve water quality in the Yarra River and Port Phillip Bay (for the metropolitan region only).

For Melbourne Water these include:

- *Healthy Waterways Strategy* – which focuses on waterway management for the Port Phillip and Westernport region and proposes a range of targets and associated programs to be carried out by Melbourne Water from 2013/14 to 2017/18

- *Stormwater Strategy* – which focuses on the management of stormwater in metropolitan Melbourne and its surrounding peri-urban and rural areas
- *Development Planning Servicing Plan* – which focuses on providing drainage services for the developing urban areas of Melbourne for the period 2013/14 to 2017/18
- *Port Phillip and Westernport Region Flood Management and Drainage Strategy* – which focuses on addressing drainage and flooding issues across the Port Phillip and Westernport region.

For CMAs these include:

- regional Floodplain Management Strategies – which focus on floodplain management
- regional Waterway Strategies (see Chapter 4) – which identifies priority management activities for waterways in their region (replacing the regional River Health Strategies)
- reliance on strong partnerships, cost-sharing arrangements and good will from local governments and other partners to deliver improved waterway management outcomes.

For local governments these include:

- participating in the development and implementation of the range of waterway management initiatives of Melbourne Water and CMAs
- regulating land use and development through municipal planning schemes to meet a range urban stormwater management objectives
- developing and implementing urban stormwater management plans.

A significant challenge for managing urban waterways is stormwater runoff from impervious surfaces in existing and new urban areas. Despite some advances in water sensitive urban design and urban development projects, urban stormwater has largely been managed as a nuisance that needs to be removed from urban areas through drains and waterways as quickly as possible. This has been considered appropriate to enable stormwater and urban waterway managers to effectively manage inundation constraints of land in urban areas and reduce the risk of flooding. Stormwater is more recently being considered a valuable resource that can provide a range of benefits to towns, cities and communities. Future arrangements for planning and managing urban stormwater and its interactions with the built environment and impact on urban waterways will have to be adapted to reflect this.

14.2.3 Urban water reform: *Living Victoria*

As part of the *Living Victoria* initiative, the Government has created the Office of Living Victoria (OLV) to drive the integration of water and urban planning and the delivery of whole-of-water-cycle management in urban areas.

The OLV was established in May 2012 and has commenced work on a number of key initiatives relevant to urban waterways. These initiatives include:

- preparation of *Melbourne's Water Future*, a high level strategy listing all the initiatives that need to be undertaken to improve how we manage Melbourne's urban water cycle. The draft strategy was released 1 July 2013 for community consultation⁵.
- administration of the Living Victoria Fund, which will provide funding to a number of stormwater related projects
- co-ordinating and facilitating the development of regional water cycle plans for Melbourne's four growth areas and inner Melbourne
- preparing a Regulatory Impact Statement for building controls to improve the water performance of new buildings
- working with the Department of Transport, Planning and Local Infrastructure to amend the Victoria Planning Provisions to apply the current performance requirements for the management of stormwater more broadly.

These, and other initiatives by the OLV, will help deliver the Government's *Living Victoria* initiative by ensuring water is planned for using a whole-of-water-cycle management approach in ways that support and enhance Melbourne's liveability.

The adoption of whole-of-water-cycle management should reduce the impacts of urban development on waterway condition through increased retention, use and infiltration of stormwater at the local level. The benefits of such an approach are evident from the Little Stringybark Creek Project (see Box 14.2).

Further information on these and other initiatives relating to waterways in urban areas can be found at www.water.vic.gov.au/initiatives/livingvictoria/office-of-living-victoria

The introduction of the new whole-of-water-cycle management policy and approaches will have implications for the strategies and plans outlined in Section 14.2.2. In time, these strategies and plans may be incorporated into, or be further developed to incorporate, the new whole-of-water-cycle management policy and approaches. This may provide opportunities for integrating or rationalising the multiple plans and strategies currently guiding waterway management in urban areas of Victoria.

Box 14.2: Little Stringybark Creek Project

The Little Stringybark Creek Project is a research program co-ordinated by the University of Melbourne and Monash University. It is putting into practice new approaches to stormwater management to help improve the health of waterways in urban areas.

Little Stringybark Creek is in the Dandenong Ranges, east of Melbourne and has interactions with the urban township of Mount Evelyn. Extensive monitoring indicates that the environmental condition of Little Stringybark Creek is affected by stormwater runoff. However, the extent of stormwater drainage in the catchment is small enough that a relatively small investment in stormwater retention can achieve improvements in waterway health.

Intercepting stormwater drainage pipes with alternative drainage systems that allow capture of water from most rainfall events (for use or infiltration) is likely to be an effective means of reducing the impact of urban stormwater on receiving waterways. Private properties typically make up 50% of the impervious area of urban catchments and are therefore a large contributor to the poor environmental condition of many waterways in these areas. However, property owners can make a substantial contribution to improving waterway health by reducing the frequency and volume of stormwater entering local waterways through retention of stormwater on their properties.

The Little Stringybark Creek Project has worked with property owners in Mount Evelyn to install rainwater tanks, raingardens or a combination of both on their properties. By using auction processes for this program, the project has determined a market price for stormwater retention works. This price has been used to prioritise funding of larger stormwater harvesting and infiltration projects constructed by the Yarra Ranges Shire Council to manage the stormwater generated from roads and untreated properties of the catchment.

The project is continuing to monitor the environmental condition of the creek (and other nearby waterways) to demonstrate the effectiveness of dispersed stormwater retention and infiltration in improving waterway health.

For further information on this project visit www.urbanstreams.unimelb.edu.au

14.3 Knowledge gaps

Onsite wastewater systems aim to treat and manage domestic wastewater to an acceptable standard and contain it within the boundaries of the property (for example, septic tanks).

In 2007, the Municipal Association of Victoria estimated that there were around 300,000 domestic onsite wastewater systems across Victoria. On an appropriate site and when an appropriate system is in place that is maintained and managed properly, onsite systems can effectively manage wastewater. However, when the site is not suitable, the sites are further developed, or when the onsite systems are not managed and/or maintained correctly, they can be a source of pollution and diminished water quality.

In 2012, the Victorian Government released guidelines for *Planning permit applications in open, potable water supply catchment areas*⁶. The guidelines enable consideration of higher density of development if certain conditions are met, including the development and implementation by the relevant local council of a Domestic Wastewater Management Plan.

While considerable work has been undertaken to date, the extent and magnitude of potential impacts on waterways from onsite wastewater systems is complex and remains a current knowledge gap that requires further investigation.



Onsite wastewater systems are common for properties in rural Victoria. Courtesy DEPI



15

Extreme events of flood
and bushfire



Extreme events of flood and bushfire

Guide to the chapter

15.1 Context

- Extreme events of flood and bushfire
- Impacts of floods on waterways
- Impacts of bushfires on waterways

15.2 Management arrangements for extreme events of flood and bushfire

- Emergency management arrangements
- Flood management arrangements
- Bushfire management arrangements

15.3 Reducing flood and bushfire impacts in waterways

- Establishing a strategic risk-based approach to disaster mitigation
- Management of levees
- Management of instream vegetation and debris
- Ensuring best practice standards for works on waterways in extreme events
- Reducing future flood risk through riparian management programs

15.4 Flood and bushfire response

15.5 Flood and bushfire recovery

- Natural disaster assistance
- Prioritising flood recovery activities
- Reprioritising actions for waterways affected by flood or bushfire

What are the issues with existing arrangements?

Land use change, development on floodplains and predicted changes in climate may increase the severity and frequency of floods and bushfires and reduce the resilience of waterways, limiting their ability to withstand or recover from extreme events. There is a need to describe how the existing arrangements for floods and bushfire management apply to waterway management, how flood and bushfire damage can be reduced and how flood and bushfire response and recovery can be improved. Studies of recent floods have demonstrated that public investment in riparian management programs between floods can reduce the amount of damage to private and public infrastructure during floods. This highlights areas where waterway management can better complement flood management.

What improvements does the Strategy make?

For extreme events of flood and bushfire the Strategy will:

- better integrate future flood management with waterway management
- improve consideration of waterways in bushfire planning and management
- ensure that waterway values and assets are included in bushfire and flood rapid risk assessment processes
- provide direction for reviewing and reprioritising resource allocation after an extreme event.

15.1 Context

This chapter outlines the policy for dealing with natural disasters that are of rapid onset, cause acute short-term stress to waterways, and require emergency management.

The two main such events are floods and bushfires. While drought can also affect waterways, the effects are chronic rather than acute and unlike floods and bushfires, droughts are not classified as natural disasters (see Box 15.3). Managing waterways through periods of drought is addressed as part of the seasonally adaptive approach, as outlined in Section 4.2.5. The management of water quality incidents is addressed in Sections 10.5 and 10.6.

15.1.1 Extreme events of flood and bushfire

In the last decade, Victoria experienced several severe bushfires and floods. Extensive bushfires occurred in 2003, summer 2005/2006, summer 2006/2007 and in 2009. In 2007, severe rainfall caused flooding in West Gippsland and parts of East Gippsland. Widespread flooding occurred across much of Victoria in 2010, 2011 and 2012.

This chapter outlines the management framework to reduce, respond to and recover from the impacts on waterways from the extreme events of flood and bushfire (see Box 15.1).

Floods and bushfires are a natural part of Victoria's environment. Waterways have evolved with natural flood and bushfire cycles and are adapted to benefit and recover from these periodic disturbances. Under natural conditions, floods and bushfires can be important for nutrient cycling. Floods drive many of the geomorphological and biological processes that sustain the health of rivers, estuaries and wetlands. They can scour sediment deposits from instream pools, provide inputs of large woody habitat to waterways, aid dispersal of native species and open estuary entrances. Many of Australia's plants and animals have evolved to survive bushfire events and many plants rely on bushfires to regenerate.

Changes in catchment and floodplain land use from human settlement have contributed to an increased frequency and severity of floods¹. Also, possible changes in climate may increase the intensity of future floods and bushfires in Victoria². Under these changed conditions, waterways may have a reduced ability to withstand or recover from these disturbances. In addition, the public infrastructure for transport, services and communication that crosses or is located near waterways is at the risk of damage in floods and bushfires.

Box 15.1: Extreme events of flood and bushfire

Flood or bushfire is regarded as an extreme event when it requires a response that is beyond the normal level of local resources, has complex and wide ranging impacts on communities and built and natural assets and overwhelms normal protective measures in waterways.



2012 flood in Nathalia. Courtesy DEPI

15.1.2 Impacts of floods on waterways

The adverse impacts of floods on waterway condition and values are primarily related to accelerated rates of river channel erosion, which have been exacerbated by past clearing of native vegetation in catchments and on riparian land. Impacts include avulsion (the abandonment of the main river channel in favour of a new course), channel widening, infilling of large pools by sediment, erosion of important habitat, damage to native riparian vegetation and loss of large wood for instream habitat. Fences protecting riparian vegetation may be lost or damaged. Floods can affect estuaries and wetlands, primarily through the delivery of large amounts of sediments and nutrients. Flood events can also accelerate the spread of invasive species. Debris (such as logs and branches) may accumulate above bridges or culverts and erosion of the channel may threaten infrastructure. Waste from sewage treatment facilities may enter waterways and stock may be killed during floods.

Over the past 25 years in Victoria, river restoration works to address flood impacts have required grants of approximately \$74 million, equivalent to approximately \$3 million per year³. A large proportion of the flood response and recovery cost relates to impacts from high energy flows in rivers and streams. Floods with the highest energy tend to occur in Gippsland and the north east of Victoria due to steep terrain, relatively steep river channels and the high intensity of rainfall in the Great Dividing Range.

Accelerated rates of erosion and channel change can also damage public infrastructure associated with waterways as well as agricultural land. The full cost of recovery, including bridge replacement, is estimated to be an order of magnitude higher than that for river restoration works³. Following the 2010 and 2011 floods in Victoria, the State Government budgeted \$141.5 million for repairs to roads, bridges and railways alone³.

15.1.3 Impacts of bushfires on waterways

Excessive runoff from recently burnt catchments into waterways can cause flooding and can carry high loads of sediments and nutrients into waterways, particularly if a bushfire is followed by heavy rains. Increased nutrients can lead to algal blooms in downstream water bodies. Sediments can reduce available instream habitat, cause low oxygen levels in the water and disrupt the natural breeding cycles of aquatic native animals or cause fish deaths. In wetlands, bushfires can change vegetation composition and structure, destroy native animal habitat, impair biological functions, increase soil erosion and increase the risk of weed invasion. Loss of riparian vegetation through bushfires can reduce shading, increasing the water temperature of rivers or wetlands. In rivers it also increases the risk of erosion in the next flood.

Bushfires in water supply catchments can have significant impacts through contamination of water storages and drinking water supplies with ash, sediment and fire retardants.

Medium-term impacts include decreased catchment runoff to waterways through increased uptake of water by immature trees as the forest regenerates. Bushfires can also damage public infrastructure and waterway assets, such as fences that protect riparian vegetation or pile fields that prevent erosion. Bushfires can also result in stock deaths in the vicinity of the waterway with the risk of water contamination if they are not promptly removed.



Ash in the Cowwarr Weir after the 2007 bushfires. Courtesy DEPI

15.2 Management arrangements for extreme events of flood and bushfire

15.2.1 Emergency management arrangements

Floods and bushfires can be classed as emergencies. The key legislation for emergency management is the *Emergency Management Act 1986*. The *Victorian Emergency Management Reform White Paper*⁴ sets out the strategic priorities and actions for emergency management in Victoria. Emergencies caused by the extreme events of flood and bushfire cause a range of social, economic and environmental impacts, of which the impact on waterways is just one. The *Emergency Management Manual Victoria*⁵ identifies high level roles and responsibilities for agencies involved in emergency management. The Manual also contains the *State Emergency Response Plan*, *State Relief and Recovery Plan* and outlines structures for emergency planning at State and regional levels.

The emergency management framework (Box 15.2) guides the approach to the management of extreme events of flood and bushfire in waterways.

Box 15.2: Emergency management framework

Emergency management consists of three types of activities.

1. Prevention, mitigation and preparedness activities eliminate or reduce hazard impacts, increase community or environmental resilience, establish planning arrangements and increase community education and awareness.
2. Response activities take place during and immediately after an emergency event.
3. Recovery activities involve reconstruction of physical infrastructure and restoration of affected environments and communities.

Policy 15.1

Managing risks to waterways and associated public infrastructure from the extreme events of flood and bushfire will be guided by the framework for emergency management.

15.2.2 Flood management arrangements

The *Victoria Flood Management Strategy*⁶ provides the policy framework for managing floods and guiding regional floodplain management. That strategy is in the process of being renewed. Catchment management authorities (CMAs) and Melbourne Water have floodplain management functions, prescribed in the *Water Act 1989*. They work with other agencies, particularly local government, to develop processes and plans for the implementation of floodplain management activities.

Regional Floodplain Management Strategies have been developed by the CMAs and Melbourne Water and are also scheduled for renewal. They set out the policy framework, the floodplain characteristics and the detailed programs for each region, focusing primarily on flood damage prevention or mitigation.

State and regional flood strategies need to take account of the aspects of flood management that affect waterway values and public infrastructure. In addition, management activities required to manage serious risks to public infrastructure from waterway processes (including flood related erosion or avulsion) should be negotiated by asset owners, waterway managers and relevant beneficiaries of the public infrastructure (see Section 4.2.3 and Section 15.3.1).

Many flood studies are being carried out, or are planned, following the 2010/2011 floods to assess the broader issues associated with the risk of flooding to vulnerable Victorian communities. Flood planners need to consider the condition of waterways as part of their evaluation of flood studies and cover issues such as the effect of instream vegetation on floods, the effects of upstream vegetation on flood levels through towns, blockages under bridges and damage to infrastructure. Ensuring that there is an appropriate setback of new developments from waterways is important for reducing future flood risk to communities and for minimising the cost of ongoing maintenance activities to alleviate flood risk. The updated Victoria Flood Management Strategy needs to complement the policy in this Chapter by addressing these issues and take into account any changes to floodplain management as a result of the Government's response to the Environment and Natural Resources Committee (ENRC) Inquiry into Flood Mitigation Infrastructure in Victoria (see Section 11.3.2) and the review of the *Water Act 1989* (see Section 1.2.1).

Policy 15.2

The integration of flood management and flood related aspects of waterway management will be improved by the alignment of:

- relevant policy between the updated Victoria Flood Management Strategy and the *Victorian Waterway Management Strategy*
- Regional Floodplain Management Strategies and regional Waterway Strategies.

15.2.3 Bushfire management arrangements

Management of waterway-related bushfire risks in Victoria is undertaken in the broader context of the bushfire policy framework. The *Code of Practice for Bushfire Management on Public Land*⁷ establishes the framework for bushfire management (including prevention, preparedness, fuel management, response and recovery) on Victoria's public land. The Code sets the primary objectives for bushfire management, as follows:

- to minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment. Human life will be afforded priority over all other considerations.
- to maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

The Code sets out the risk-based framework for bushfire management planning that aims to reduce the risk to these objectives. The management planning framework is co-ordinated by the Department of Environment and Primary Industries and operates at three levels, as outlined below:

1. Strategic level – Strategic bushfire management plans outline landscape and regional strategies for achieving the objectives of bushfire management and are prepared in collaboration with managers of public and private land, the community and interested stakeholders. They also inform the other levels of planning.

2. Operational level – Consistent with strategic bushfire management plans, fire operations planning sets out a forward-looking program of works and prioritises the annual implementation of actions.

3. Tactical level – Tactical plans (including burn plans, incident action plans and recovery plans) outline how specific actions are to be undertaken.

The Code outlines the intention to engage with stakeholders to identify State, regional and local needs that may be affected by bushfires or bushfire management strategies and actions, to understand the issues and impacts, to seek to mitigate any negative effects and bring about the best practicable bushfire planning outcomes, balancing community and stakeholder needs. In this context, bushfire management planning needs to take account of waterway values and management priorities as set out in regional Waterway Strategies and include actions to minimise the impacts of bushfires and bushfire management activities on waterways.

The *Emergency Management Manual Victoria*⁸ sets the framework for integrated planning by fire management agencies across public and private land at the State, regional and local levels. Under the *Emergency Management Act 1986*, local governments are required to develop Municipal Emergency Management Plans, which (for local governments wholly or partly in regional areas) must include a municipal fire management plan. Municipal fire management plans are reviewed every three years and must identify environmental values and address priority risks in the planning area.

Fire risk for riparian land is covered in more detail in Section 9.3.1.

Policy 15.3

Waterway managers will work with the Department of Environment and Primary Industries, other fire management agencies and local government to ensure that the impacts of bushfires and bushfire management activities on waterway condition and values are minimised, taking account of the priority to protect human life.

15.3 Reducing flood and bushfire impacts in waterways

It is certain that large floods and bushfires will occur in the future.

The scale and relatively unpredictable nature of such events limits the ability of waterway managers to fully protect waterways and associated public infrastructure from the adverse impacts of floods and bushfires. However, there are activities that can be undertaken to reduce impacts from future floods and bushfires.

15.3.1 Establishing a strategic risk-based approach to disaster mitigation

Waterway managers need to prepare for the impacts of floods and bushfires on waterways and public infrastructure. The high energy flows that occur during floods can cause avulsions, river breakaways and bed and bank erosion. Flow energy may be increased by the removal of vegetation after a bushfire. As resources are limited, waterway managers need to adopt a risk-based approach to disaster mitigation that identifies significant risks to waterway condition and public infrastructure in the event of floods or bushfires and prioritises cost-effective actions for risk reduction. Management activities to protect public infrastructure or reduce risks from extreme events are considered in the regional priority setting process (see Section 4.2.3 and Figure 4.2).

There is a range of possible management activities to reduce risk. These include works to prevent erosion when high energy flows occur, removal of debris that has piled up against bridges or culverts during a previous flood and contingency planning for the management of wastes that may enter waterways in floods or the removal of dead stock. Longer term management activities may also be required such as the management of levees and instream vegetation (Section 15.3.2 and 15.3.3) and the reduction of future flood risk through riparian management programs (Section 15.3.5). Section 4.2.3 outlines the policy for managing serious risks to public infrastructure from waterway processes (see Policy 4.3).

Policy 15.4

Waterway managers will adopt a risk-based approach to reduce the likely impacts of floods and bushfires on waterways and identify priority management activities in regional Waterway Strategies.

15.3.2 Management of levees

Levees have a role in protecting communities and landholders from flooding. However, they can affect flood behaviour by confining flow, or by directing flow into new paths. They can affect waterway condition by reducing the natural frequency of flooding on floodplains. Groundwater and nutrient balances are affected by levees, as are floodplain wetlands (see Section 12.7.1) and the native plants and animals dependent on the connectivity of river systems and their floodplains. In August 2012, the Environment and Natural Resources Committee (ENRC) reported to the Government on the management of levees in Victoria as part of the Inquiry into Flood Mitigation Infrastructure in Victoria. The Government's response will inform the policy for the management of levees, which will be set out in the updated Victoria Flood Management Strategy.

Policy 15.5

The updated Victoria Flood Management Strategy will take account of waterway condition in establishing policies for the future management of levees.



Piled up debris against a bridge on the Loddon River following the 2011 flood. Courtesy DEPI

15.3.3 Management of instream vegetation and debris

Vegetation in waterways may include native plants or weeds such as willows. Debris may include wood and other plant material from riparian land and the floodplain as well as rubbish and litter, particularly in urban areas.

Woody debris and native instream vegetation have many benefits for communities and the environment. They provide instream habitat for native animals and support underlying biological processes that maintain waterways in good condition, as outlined in Section 11.3.2. In floods, instream and riparian vegetation also reduce erosion, sedimentation and the movement of wood and other debris downstream. The management of weeds in waterways is addressed in Section 9.3.6 and Section 16.4.

Large-scale removal of vegetation or large wood from rural waterways to alleviate the impacts of flooding is seldom justified. Research has demonstrated that vegetation plays an important role in slowing floodwaters and lowering flood peaks, providing agencies and the community additional time to prepare for flooding³. However, there may be some situations in urban areas where actions to manage instream vegetation are warranted, such as where willows, weeds or woody debris impedes flow and a flood study has demonstrated that this contributes to increased flood risk.

The ENRC Inquiry into Flood Mitigation Infrastructure in Victoria addressed vegetation clearing in waterways and their general maintenance. The Government's response to the recommendations of the ENRC inquiry will guide the management of instream vegetation, as outlined in Section 11.3.2.

15.3.4 Ensuring best practice standards for works on waterways in extreme events

In extreme events, land managers or landholders may undertake works on waterways as an immediate response to perceived risks to their property or assets. However, these works may not always comply with accepted standards or licence requirements under the *Water Act 1989*. Where works are not constructed to the necessary standard, they are likely to pose an immediate or future risk to waterway condition or values and to other landholders, for example, by exacerbating downstream flooding.

Policy 15.6

Waterway managers will work with stakeholders to:

- improve awareness of the need to comply with licence provisions and best-practice standards in undertaking works on waterways in the extreme events of flood and bushfire
- ensure that any substandard works undertaken during extreme events are removed or brought up to standard to minimise future risk to waterway condition or values and to other stakeholders.

15.3.5 Reducing future flood risk through riparian management programs

River erosion during floods can result in the loss of valuable land or public infrastructure (for example, bridges and roads) and degrade habitat for native plants and animals. Improving the resilience of waterways to floods can be achieved through works (for example, erosion control works and small grade control structures) and through riparian management programs (for example, fencing, revegetation, native vegetation enhancement, weed management and provision of offstream stock watering infrastructure, as outlined in Chapter 9). These combined measures can reduce the impacts of floods, hence reducing the costs of flood recovery. Riparian management programs also have many other benefits (see Section 9.1.1).

A study³ on the impact of riparian revegetation on stream erosion during floods in Victoria found:

- the absence of native riparian vegetation increases the occurrence and scale of flood related channel change in streams in Victoria and associated flood related recovery costs in Victoria
- native riparian vegetation, including vegetation established through waterway management programs, is effective at reducing the occurrence, extent and scale of flood related channel change.

The study found that to increase resistance to flood related channel change, riparian vegetation needs to be structurally diverse, an appropriate width to ensure it is ecologically and physically functional and largely continuous along the waterway. The study also indicated that, while native riparian vegetation corridors will increase the resistance and resilience to flood related channel change, where there is significant public infrastructure located near waterways, additional structural works for river bed and bank stabilisation may also be required. This is addressed in Section 11.2.2.

Policy 15.7

The Government will continue to support large-scale riparian management programs and structural works for river bed and bank stabilisation as a means of reducing the longer term risk of flood damage to waterways and associated public infrastructure and property.

15.4 Flood and bushfire response

Urgent works may be required after extreme flood or bushfire events to address immediate risks.

These may include clearing of flood debris in waterways to protect public infrastructure, stabilising waterways affected by erosion, addressing threats to water quality (such as overflows from sewage works or dead stock in waterways), erecting temporary silt barriers after a bushfire or relocating threatened species that cannot survive in waterway habitats affected by bushfire.

A rapid risk assessment approach was initiated in Victoria to assess the immediate risk that resulted from the 2009 bushfires. This approach has now been incorporated as a standard approach for risk assessment after bushfires and floods. The approach was also used to assess the immediate risks of the 2010/11 floods. Assessments are carried out by Bushfire Rapid Risk Assessment Teams with a range of specialist skills including those related to waterway management, biodiversity, flooding, erosion and built assets. The teams prepare a report that identifies priority risks and risk treatment strategies that include an estimate of costs.

Scoping the scale and nature of necessary emergency stabilisation, rehabilitation and recovery works in a waterway as soon as possible after a bushfire or flood event provides timely information to waterway managers, local government, other government agencies and public infrastructure owners to enable them to rapidly prioritise and manage the immediate risks in their areas of responsibility. It also assists government to determine the likely cost implications. Long-term waterway management program priorities may need to be adjusted to enable urgent works to be undertaken after a bushfire or flood.



*Bridge on Guys Forest Road, Burrowye (before flood).
Courtesy Towong Shire Council*



*Bridge on Guys Forest Road, Burrowye (after flood, 2012).
Courtesy Towong Shire Council*



Impacts of bushfire on waterway condition. Photographer: Jarod Lyon

Policy 15.8

After floods and bushfires, the Department of Environment and Primary Industries may undertake rapid risk assessments that will assess the risks to waterway condition and values, water quality and public infrastructure associated with waterways.

Waterway managers, in consultation with local government, other government agencies and public infrastructure owners, will respond to the findings of the rapid risk assessments by identifying and implementing priority management activities to address immediate threats to waterway condition and values affected by floods or bushfires.

15.5 Flood and bushfire recovery

There are two main aspects to flood and bushfire recovery in relation to waterway management. These are the funding and prioritisation of recovery activities and the reassessment of waterway values that have been affected.

15.5.1 Natural disaster assistance

The Natural Disaster Funding Assistance Program administered by the Victorian Department of Treasury and Finance provides funding assistance to local governments, State government departments and CMAs for recovery from natural disasters. When the estimated costs of a disaster exceed an agreed threshold, the Australian Government also contributes funding. The National *Natural Disaster Relief and Recovery Arrangements Determination 2011*⁸ (NDRRA determination) defines a natural disaster (Box 15.3) and sets out the terms and conditions for Commonwealth financial assistance to the states and territories in line with agreed funding thresholds.

Box 15.3: Definition of a disaster

In the National *Natural Disaster Relief and Recovery Arrangements Determination 2011* a natural disaster means a serious disruption to a community or region caused by the impact of a naturally occurring rapid onset event that threatens or causes death, injury or damage to property or the environment and which requires significant and co-ordinated multiagency and community response.

Natural disasters include bushfires and floods but not drought.

Under the natural disaster assistance arrangements, the cost of eligible emergency and recovery works by CMAs are met. No financial co-contribution from CMAs for works is required. However, CMAs meet the costs of co-ordinating, managing and supervising eligible works. Eligible actions include the restoration or replacement of essential public assets (such as bridges and roads) to a pre-disaster standard or to a more disaster resilient standard (if it is considered that the proposal is cost-effective and will mitigate the impact of future natural disasters).

The policy for the replacement of fencing destroyed in floods and bushfires is set out in Section 9.3.3.

The process for developing, assessing and reporting on the implementation of flood claims under the Victorian Government Natural Disaster Funding Assistance Program requires review. There are opportunities to streamline the current process for assessing and approving flood claims and reporting on the implementation of approved works.

Policy 15.9

For natural flood and bushfire disasters, waterway managers will prepare and submit to the Department of Treasury and Finance, applications for funding in accordance with the National *Natural Disaster Relief and Recovery Arrangements Determination 2011*.

Action 15.1: Review and improve the process for developing, assessing and reporting on the implementation of flood claims under the Victorian Government Natural Disaster Funding Assistance Program.

Who: Department of Environment and Primary Industries, Department of Treasury and Finance, waterway managers.

Timeframe: 2014

15.5.2 Prioritising flood recovery activities

Prioritisation of flood recovery activities in waterways is undertaken by waterway managers. Prioritisation of proposed recovery works is essential as the amount of natural disaster funding allocated may not cover the cost of all eligible works, additional activities to those eligible for funding may be required and the initial cost estimate for an action may be exceeded. In addition, prioritisation assists in scheduling the implementation of recovery works. Waterway managers require guidance to ensure a consistent statewide approach.

15.5.3 Reprioritising actions for waterways affected by flood or bushfire

There are several circumstances in which the management activities outlined in regional Waterway Strategies may need to be reprioritised following a flood or bushfire.

Allocated disaster relief and recovery funding may not cover all priority waterway response and recovery activities following a flood or bushfire event. Also, the event may not be of a type or scale that triggers natural disaster funding arrangements. In these cases, waterway managers need to fund priority response and recovery activities for flood and bushfire events in their region from the funds which have been allocated to implement their regional Waterway Strategy.

Flood events may provide opportunities for enhancing some waterway values. Examples include relocation of large wood for instream habitat conservation projects and use of fallen timber from damaged riparian and other vegetation to stabilise and protect banks. After bushfires, there is often greater access to waterways, allowing for easy access to control or eradicate of weed species.

Weeds often germinate aggressively after a flood or bushfire event and may need to be controlled as a priority in line with the policy in Section 16.3. Replacing fencing that has been destroyed or damaged in flood and bushfire events can provide an opportunity for better placement of fence lines. Burnt timber from bushfires can be stockpiled for later use as large wood in streams.

Damage from bushfires and floods may be so severe that the former values of a waterway will be changed or potentially lost. The habitat may be damaged to the extent that it can no longer support local populations of key aquatic native plants or animals. It may not be feasible or cost-effective to return particular values to a site in the short-term. The focus may need to change to facilitating a long-term process of recovery.

In the reprioritisation of management activities, waterway managers need to consider both the immediate response that is required as well as the longer term recovery needs. They must also consider the costs and benefits of redirecting funds to other activities and identify opportunities that might arise to improve waterway values following a flood or bushfire.

Principles for prioritising flood recovery actions

In undertaking flood recovery actions, waterway managers will give priority to actions that are required to:

- assess flood damage
- reduce the threat to critical waterway works, public works or public infrastructure
- treat or prevent river avulsions and maintain physical river stability
- protect the environmental, social, cultural and economic values of priority waterways.

Principles for reprioritising activities following a flood or bushfire

In reprioritising activities following a flood or bushfire, waterway managers will consider:

- both the immediate flood and bushfire response and the longer term recovery of waterways from flood and bushfire events
- the costs and benefits of redirecting resources from other management activities
- changes in the environmental, social, cultural and economic values of waterways affected by the flood or bushfire
- changes to the level of threat to waterway condition following floods or bushfire
- opportunities to enhance waterway condition or values as a result of the flood or bushfire.



Restoration works on the Macalister River following 2007 flood. Courtesy West Gippsland CMA



16

Invasive species management in waterways

*Holding a carp caught in the Murray River at the Mallee CMA
Catch A Carp Day 2009. Courtesy Mallee CMA*

Invasive species management in waterways

Guide to the chapter

16.1 Context

16.2 Framework for managing invasive species

- International agreements
- National agreements and strategies
- Victorian strategies
- Role of the *Victorian Waterway Management Strategy*

16.3 Using a risk-based approach for invasive species management in waterways

16.4 An holistic and integrated approach to invasive species management in waterways

16.5 Improved support mechanisms

- Improved knowledge and information systems
- Better surveillance
- Greater community and industry awareness

What are the issues with existing arrangements?

Management of invasive species is complex and requires a high degree of co-operation between international, national, state and regional agencies. A shift towards a more risk-based approach would help focus management efforts and use limited resources more efficiently. Knowledge gaps about the threats, pathways of spread and options for invasive species management in waterways can reduce the effectiveness of management activities. Greater capacity and awareness by community and industry about their role in the management of invasive species that affect waterways is required.

What improvements does the Strategy make?

For invasive species management in waterways the Strategy will:

- establish a risk-based approach, which takes into account both current and future risk for invasive species management in waterways
- outline an holistic and integrated approach to invasive species management
- identify priorities for improved knowledge, surveillance and community and industry awareness.

16.1 Context

Invasive species (see Box 16.1) in waterways and along riparian land are an increasing threat to the health of rivers, estuaries and wetlands in Victoria. The establishment and spread of invasive species is often a symptom of broader land use change and disturbance. It is very difficult to eradicate invasive species and therefore management activities to prevent their establishment are critical.

Past management of invasive species in Victoria has been focused on land-based primary industries, with less consideration of waterways. However, compared to most land, waterways (including riparian land) appear to be especially vulnerable to invasive species. Riparian land is prone to invasion due to high productivity and frequent disturbances¹. The spread of invasive species through waterways and riparian land is assisted by high connectivity as a result of water flowing downstream, or laterally to the floodplain and associated wetlands. It is common for significant movement of invasive species to occur during flood events.

Invasive species affect waterway condition and also have the potential to threaten environmental, social, cultural and economic values. Examples of economic costs are outlined in Box 16.2. Environmental impacts may include predation on, or competition with, native species, loss of habitat and changes to water quality or sediment and nutrient levels. The impacts associated with invasive species are often underestimated as there may be a time lag between their introduction and their effects being noticed, or it may be difficult to calculate the costs associated with the damage caused.

Some invasive species (for example, trout) can pose a risk to environmental values, but at the same time support social and economic values, such as recreational fishing (see Section 7.2.3). A balanced management approach is therefore required to reduce the impacts of invasive species that cause substantial harm, while continuing to acknowledge that in some limited cases invasive species may provide other benefits that are valued by the community. The key values, threats and management activities for invasive species management are shown in Figure 16.1.

Box 16.1: Definition of invasive species

What are invasive species?

An invasive species is a species occurring, as a result of human activities, beyond its original range and that threatens valued environmental, agricultural or other social resources by the damage it causes. This can include organisms endemic to a country other than Australia, or translocated native species.

Which invasive species are considered in the Victorian Waterway Management Strategy?

Invasive pathogens and diseases can pose a significant threat to Victorian waterways, but they are not addressed in this Strategy. The current *Biosecurity Strategy for Victoria*² and other biosecurity policies and tools, including those at a Commonwealth level (for example, the Australian Quarantine and Inspection Service), are the appropriate approaches to address these threats.

Whilst terrestrial invasive species can have impacts on the health of waterways, this Strategy focuses on those invasive species dependent on inland aquatic and riparian habitats. These invasive species may live in natural freshwater or brackish environments (such as rivers, wetlands and estuaries), man-made environments (such as channels or reservoirs) or along riparian land. Invasive species that affect waterways may include vertebrates (such as fish, turtles and frogs), plants (aquatic and riparian species), invertebrates (such as snails, leeches and crayfish) and algae. Marine and coastal invasive species are considered only where they have the potential for significant impacts on coastal wetlands and estuarine areas. Invasive species that affect riparian land are further discussed in Section 9.3.6.

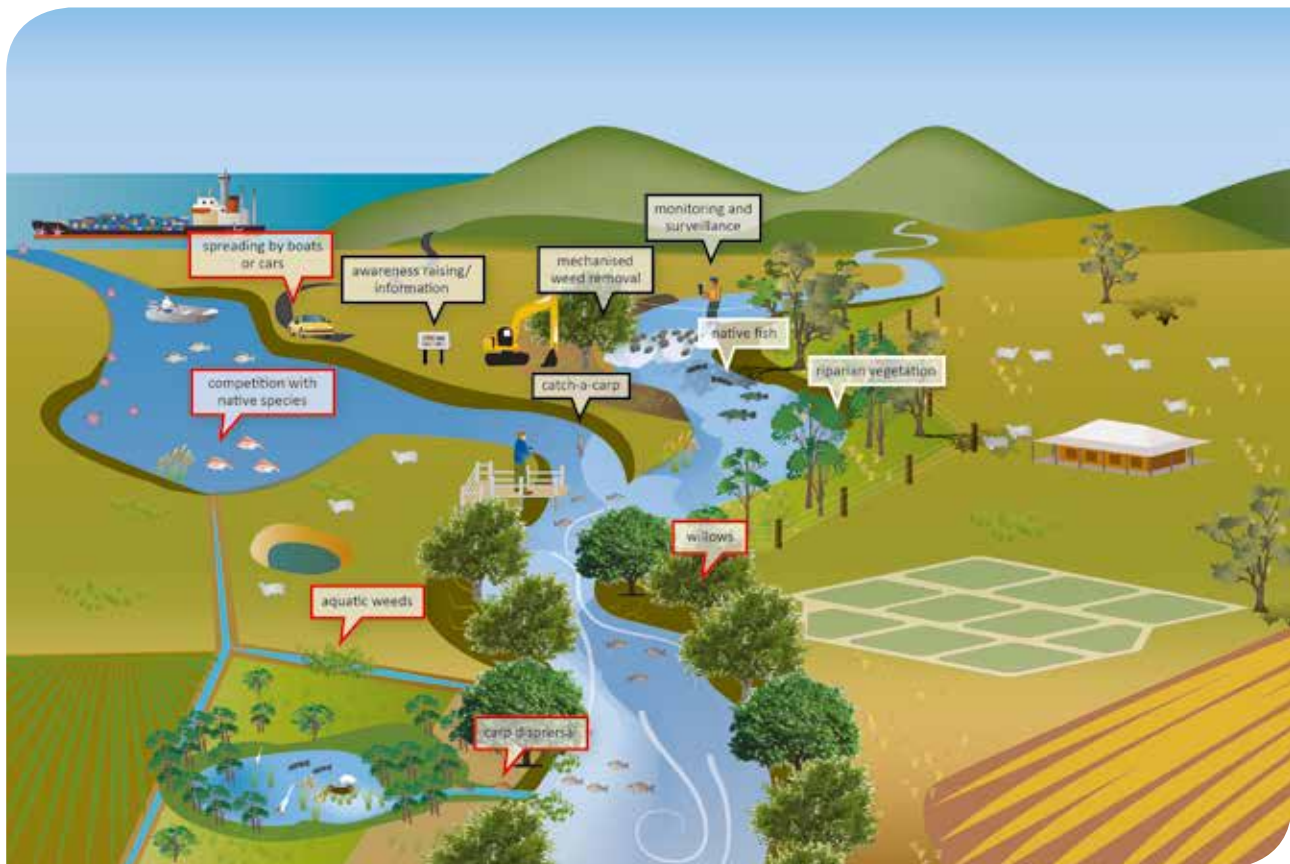


Figure 16.1: Values (white), threats (red) and management activities (black) for invasive species management.

Box 16.2: Economic costs of invasive species management

Economic costs of invasive species management include the funds spent on prevention, preparedness, containment, eradication, control and research activities, as well as costs of reducing impacts and recovery. Indirect economic costs may also occur through reduced business and tourism opportunities.

Substantial investment has been made to control and prevent the spread of invasive species that affect waterways. For example:

- Around \$6–10 million per annum is spent on willow control by Victorian waterway managers³.
- At least \$15.8 million per annum is spent on carp control in Australia⁴.

- In 2006, the Victorian Government spent \$1.8 million on installing screens at Rocklands Reservoir to restrict the spread of carp in the Glenelg River.
- Goulburn-Murray Water and Murray Irrigation Ltd spend around \$250,000 per annum to control arrowhead (an inland aquatic weed) in irrigation channels and natural waterways in northern Victoria.
- Since 2008, \$890,000 has been spent controlling *Spartina* (a saltmarsh grass) in tidal wetlands and estuaries in West Gippsland.

In addition to the direct costs of management, invasive species can undermine the outcomes of previous investment into waterway management activities. The costs of the impacts on waterways from invasive species in Victoria have not been fully estimated.

Case study 16.1: Didymo – Beware the rock snot!

Didymo (*Didymosphenia geminata*), commonly called rock snot, is a fresh water algae from the cool temperate regions of the Northern hemisphere that is causing major ecological, social and economic issues around the world. Didymo is a serious pest that is not currently present in Australia, but is a problem in its native range and has recently spread to New Zealand, choking its waterways. Victoria's high value upland streams in the Great Dividing Range have been identified as suitable habitat for Didymo.

Didymo is made up of millions of microscopic cells that can't be seen until a large colony has formed – by which stage it's almost impossible to eradicate. A single live cell is all that is required for Didymo to establish and spread. The cells attach to rocks and submerged plants, multiplying quickly to form massive algal blooms that can completely smother riverbeds or lake edges. These algal blooms adversely affect water quality, aquatic invertebrates and fish stocks and are a hazard for hydro power generation, irrigation and recreation.

On the South Island of New Zealand, Didymo is causing major concern for fisheries managers and recreational fishers. Didymo is likely to cost New Zealand between \$58 million and \$285 million over an eight-year period⁴. There is a significant risk that Didymo could establish and spread in Australia through transmission on watercraft, sporting or fishing equipment (such as fishing rods and nets, waders, kayaks, paddles, life jackets, water skis, wakeboards, wetsuits and hiking boots) from New Zealand. All such equipment must be thoroughly cleaned and dried and be presented to an Australian Quarantine and Inspection Service officer on arrival into Australia.

Border security and awareness raising activities are critical to prevent the establishment of Didymo in Australia as eradication will be impossible.



Didymo infestation smothering the bottom of a New Zealand river. Courtesy NZ Fish and Game

16.2 Framework for managing invasive species

Management of invasive species is complex and requires a high degree of co-operation between international, national, state and regional agencies.

16.2.1 International agreements

There are various international agreements that relate to the management of inland aquatic and riparian invasive species. For example, Australia is party to the Convention on Biological Diversity, which requires parties to prevent the introduction of, to control or to eradicate invasive species. Other relevant international agreements include the Convention on Wetlands of International Importance and the International Convention for the Control and Management of Ships' Ballast Water and Sediments.

16.2.2 National agreements and strategies

Intergovernmental agreements establish an agreed set of deliverables that enable all Australian states and territories to co-operate in managing invasive species. The National Intergovernmental Agreement on the Environment recognises that invasive species threaten the natural environment as well as agricultural and aquacultural production and acknowledges the need for a co-operative national approach to the management of invasive species. A new Intergovernmental Agreement on Biosecurity has been designed to strengthen the biosecurity system at a national level. It has been signed by all states and territories except Tasmania.

One of the Australian Government's key approaches to reduce the risk of invasive species incursions at the international border (that is, border security) is strict regulation of the importation of live organisms. This is regulated through the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and the *Quarantine Act 1908* (Cth).

While border security reduces the potential of entry of invasive species into Australia, preventing the spread of invasive species within the country is a significant challenge. The National Environmental Biosecurity Response Agreement (NEBRA) establishes national emergency response arrangements to address the impacts of new incursions of invasive species and diseases. The NEBRA is applicable to waterway-dependent species and is likely to influence invasive freshwater fish and freshwater aquatic invertebrate management in Victoria in the future. Other opportunities for establishing national cost-sharing arrangements for other elements of biosecurity, such as containment, may arise in the future.

National strategies, such as the *Australian Pest Animal Strategy*⁵ and *A Strategic Approach to the Management of Ornamental Fish in Australia*⁶, outline management frameworks to address the impacts of invasive vertebrate animals that may adversely affect waterways.

16.2.3 Victorian strategies

The Victorian Government's *Environmental Partnerships*⁷ provides the overarching strategic framework for maintaining and improving Victoria's most important environmental assets and functions. It recognises the need for coordinating action across government agencies and working with the community to integrate environmental programs and achieve multiple outcomes for land, water and biodiversity.

The *Biosecurity Strategy for Victoria* outlines actions to ensure Victoria is well positioned to meet future biosecurity challenges. It recognises freshwater habitats are a key area where biosecurity arrangements need to be strengthened.

The *Invasive Plants and Animals Policy Framework* (IPAPF)⁸ represents the Victorian Government's approach to managing existing and potential invasive species across the whole of Victoria. There are four modules to the framework that will outline specific actions for each invasive plant and animal group – weeds and vertebrate pests, marine pests, freshwater fish and invertebrates, and invertebrate pests.

Both the *Biosecurity Strategy for Victoria* and IPAPF state that invasive species management needs to be guided by risk assessment. To date, management has focused mainly on established species rather than minimising the risk of new species invasions or rapid response to new incursions and/or containment. However, prevention provides a higher return for investment than eradication, eradication is better than containment and containment is generally better than managing the impacts of invasive species across widespread areas (see Appendix 16.1). Prevention is a particular priority for invasive species in waterways, as water flow and the connectivity of aquatic environments means that invasive species are often impossible to eradicate once established.

16.2.4 Role of the Victorian Waterway Management Strategy

This Strategy sets out policy direction for issues affecting waterway health, including the threat from invasive species. Waterway managers (that is, catchment management authorities and Melbourne Water in the metropolitan region) have an important role in undertaking regional management activities to contain high risk established invasive species and in protecting high value rivers, estuaries and wetlands from the threats posed by invasive species. A framework for the management of invasive species in waterways is outlined in Table 16.1.

Table 16.1: Framework for managing invasive species in Victorian waterways.

Action	Goal	Strategic approach	Lead Victorian policy	Australian/State Government actions	Regional actions
Prevention and preparedness	Prevent new, high risk invasive species from establishing in Victoria or spreading to uninhabited Victorian catchments	Species (threat) based	<i>Biosecurity Strategy for Victoria</i> <i>Invasive Plants and Animals Policy Framework</i>	– Undertake pre-border and border security – Undertake risk assessments – Develop and implement reporting framework	– Support national and statewide programs aimed at preventing the introduction and establishment of new high risk invasive species in waterways – Support informed community effort in invasive species management in waterways – Surveillance monitoring in waterways
Eradication	Eradicate high risk invasive species in the early stage of establishment	Species (threat) based	<i>Biosecurity Strategy for Victoria</i> <i>Invasive Plants and Animals Policy Framework</i>	– Clearly identify agency roles and responsibilities for participating in emergency eradication responses – Develop and implement emergency preparedness and rapid response plans – Co-ordinate eradication activities at a national/state scales	– Eradicate all newly establishing populations of Regionally Prohibited Weeds and other identified high risk invasive species in waterways – Support national and statewide programs aimed at eradicating high risk invasive species in waterways – Support informed community effort in invasive species management in waterways – Surveillance monitoring in waterways
Containment	Contain high risk invasive species	Species (threat) based	<i>Victorian Waterway Management Strategy</i>	Department of Environment and Primary Industries engages with waterway managers, water corporations and communities on containment programs	– Prevent identified high risk established invasive species in waterways from spreading outside core infestation boundaries – Eradicate outlier infestations – Protect assets within core infestation – Support informed community effort in invasive species management in waterways – Surveillance monitoring in waterways
Asset based protection	Reduce the impact of established invasive species on assets	Asset (value) based and Species (threat) based	<i>Victorian Waterway Management Strategy</i>	Department of Environment and Primary Industries engages with waterway managers, water corporations and communities on community education, asset management planning, implementation, monitoring and reporting	– Assess the threat of invasive species on the values of waterways – Undertake appropriate management activities to reduce the impacts of invasive species on waterway condition – Support informed community effort in invasive species management in waterways – Surveillance monitoring in waterways

16.3 Using a risk-based approach for invasive species management in waterways

Risk assessments are required to identify which invasive species pose the greatest risk to waterways. The high risk species can then be targeted for management. Currently there are several national and Victorian lists of high risk invasive species (see Appendix 16.2) that can be used as guides.

Policy 16.1

A risk-based approach to prevention, eradication, containment and asset-protection will be used to manage invasive species in waterways.

Regional Waterway Strategies will consider both current and potential future risks, where known, of invasive species that affect the environmental condition of waterways.

Government intervention is only warranted to address high risk species that threaten significant environmental, social, cultural and economic values of waterways where benefit is expected to exceed cost. Generally, priority will be given to programs that prevent introduction or eradicate newly establishing invasive species over containment and programs to reduce the impact of established invasive species.



Thousands of juvenile carp at Dimboola Weir. Courtesy Greg Fletcher, Wimmera CMA

16.4 An holistic and integrated approach to invasive species management in waterways

The management of invasive species in waterways needs to be holistic and integrated with other waterway management activities, other pest plant and animal control work and fisheries management activities.

The Department of Environment and Primary Industries works in partnership with industry and the community to protect agriculture, the environment, the economy, health and the lifestyle of the community by stopping pests and diseases from entering, establishing and spreading within Victoria.

There are tens of thousands of invasive plants and animals that have the potential for negative impacts in Victoria. The Victorian Government manages the threat of invasive plants and animals by assessing the risk of each species entering and becoming established, then acting appropriately to manage those risks (those presenting the highest risk become the highest priority for management).

Stocking of both native and introduced fish species takes place in Victoria to improve recreational fishing opportunities. At the State level, the Translocation Evaluation Panel advises Fisheries Victoria on issues related to the translocation of live inland aquatic organisms (for example, fish) in accordance with protocols and guidelines. Regionally, stocking is dealt with through a consultative process involving regional input from land and waterway managers and recreational fishers. Policy regarding the stocking of recreational fish species can be found in Section 7.2.3.

There is currently limited understanding of how waterway management activities affect the establishment and spread of invasive species, including how activities designed to eradicate or reduce the impact of one invasive species can affect the establishment and spread of other invasive species. There is some evidence that control of invasive species can have unintended secondary consequences. For example, the removal of willows and the exclusion of stock from waterways may inadvertently promote the occurrence and rapid spread of other aquatic and riparian invasive plant species⁹. Additionally, the use of chemicals to control invasive species in waterways may adversely affect native plants and animals. Holistic management plans that consider the unintended consequences of waterway management activities at both a site and catchment scale are required.

Policy 16.2

An holistic and integrated approach to managing inland aquatic invasive species will be implemented through the regional Waterway Strategies. The approach will consider the:

- unintended consequences of waterway management activities, including environmental watering, on invasive species establishment and spread at both a site and catchment scale
- landscape-scale dynamics of the spread of invasive species
- where known, the predicted changes in distribution of invasive species affecting waterways.

Invasive species management in waterways will be linked to existing regional pest plant and animal strategic planning processes and other catchment and waterway management activities.

Effective invasive species management in waterways will be supported by strong community partnerships and co-ordination between agencies at federal, state and regional levels.

Victoria's water grid (the network of infrastructure used to store, transport and deliver water) poses new challenges for managing the spread and dispersal of invasive species. Regulated rivers provide suitable habitats for species to establish (such as dams, weir pools and irrigation channels). Increases in inter-basin water transfers also provide the potential for movement of species to new areas. Additionally, the effectiveness of environmental water delivery (see Chapter 8) is dependent on complementary onground management activities, including the management of invasive species.

Action 16.1: Assess the risks of inland aquatic invasive species spread through the Victorian water grid.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2016

16.5 Improved support mechanisms

For invasive species management in waterways to be effective, improved knowledge, better surveillance of key invasion pathways and broader industry and community awareness of the issues are required.

16.5.1 Improved knowledge and information systems

Knowledge about invasive species that affect waterways has increased in recent years. However, additional information on the risks and appropriate control techniques is needed. Better understanding of the pathways and mechanisms by which high risk species could be introduced to, or spread within, Victoria would help target activities to the regions most at risk. There is also a need for improved understanding of the potential impacts of climate change on the distribution of invasive species.

Better information management systems are required to plan, deliver and capture data on invasive species management activities and to enable streamlined performance and investment reporting.

Policy 16.3

The Victorian Government will support research that informs invasive species management in waterways. Priority will be given to research into:

- impacts, current extent and potential distributions of high risk invasive species
- estimates of the economic costs of these impacts
- main pathways and mechanisms of spread of invasive species and methods for managing them
- options for eradication, control and containment of invasive species
- the potential impacts of climate change on the distribution of invasive species that affect waterways.

Action 16.2: Develop an information system for planning, delivering and recording invasive species management activities, results and outcomes that provides consistent data for performance and investment reporting.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2015

16.5.2 Better surveillance

Adequate surveillance is critical for early detection of invasive species populations. Successful eradication or containment is most likely when the population is still small. If a population goes undetected until it is of such a large size that containment is impossible, the costs of managing the incursion will be greatly increased. However, surveillance is expensive and needs to be targeted to high risk pathways.

Policy 16.4

Surveillance of high risk invasive species in waterways will be targeted to high risk pathways. Procedures and systems for reporting invasive species surveillance information will be strengthened.

Action 16.3: High risk pathways for the spread of invasive species in waterways will be identified.

Who: Department of Environment and Primary Industries, waterway managers, water corporations.

Timeframe: 2016

16.5.3 Greater community and industry awareness

An increased level of awareness by the community and industry of the invasive species that affect waterways is important to:

- prevent new incursions (for example, to reduce accidental introductions through aquarium releases or transporting invasive species on fishing gear and/or boats)
- increase the capacity for surveillance of new invasive species
- assist in control of invasive species.

Commercial industry and the community may have limited awareness of the threats posed by invasive species in waterways. They may also have poor knowledge of their roles in biosecurity protection, particularly in preventing the introduction of new species and limiting further spread. Awareness of aquatic invasive species is relatively low compared to widespread and clearly visible terrestrial pests (such as foxes, rabbits and blackberries), resulting in less community pressure to deal with aquatic invasive species.

However, some community groups (such as recreational fishing bodies, Fishcare Victoria, Waterwatch, EstuaryWatch, Landcare networks and approved hunting organisations) may be involved in invasive species management in waterways or have a strong interest in the issue. Recreational fishers and fishing groups acknowledge that new invasive freshwater fish introductions may affect fisheries and other valued assets. Fishcare Victoria performs a range of activities and events, including awareness raising of invasive freshwater fish issues primarily focusing on carp. 'Catch-a-Carp' days and 'Carp Musters' occasionally take place in regional areas, with the support of waterway managers. The Waterwatch program trains its co-ordinators to identify aquatic weed species and has initiated aquatic invasive species awareness raising activities

for communities. The Landcare network plans and actively undertakes projects to improve riparian vegetation, including invasive species management.

The participation and support of community groups in the management of invasive species is very important. Increasing community awareness of the importance of managing invasive species in waterways, particularly in preventing their release and minimising their spread, will have considerable benefits. The community can play a role in early detection and reporting of incursions, enforcement and monitoring, and support rehabilitation efforts. These groups also play a significant role in reducing the risk of spread through recreational activities (such as boating and fishing), by promoting good hygiene practices. There is a need to increase community awareness of the importance of managing freshwater invasive species particularly in preventing their release and minimising their spread.

Strong partnerships with industry are needed to foster a sense of shared issue ownership and encourage participation in management. Key industries include aquaculture, the aquarium trade, shipping and ports, plant nurseries, recreational and commercial fishing sectors, irrigators and agricultural industries. There may also be opportunities for commercial removal of some invasive species, for example carp are commercially harvested and used as garden fertiliser.

Policy 16.5

The Victorian Government will improve community and industry understanding and awareness of invasive species affecting waterways, and their management, through effective cross-agency and industry partnerships and programs aligned with broader biosecurity approaches.

Action 16.4: Develop education and awareness raising material on community and industry roles for invasive species management in waterways.

Who: Department of Environment and Primary Industries, waterway managers.

Timeframe: 2016



Mallee CMA raise community awareness of the impacts of carp at Catch a Carp Day. Courtesy Mallee CMA