PARLIAMENT OF VICTORIA

Environment, Natural Resources and Regional Development Committee

Inquiry into the management, governance and use of environmental water

Parliament of Victoria
Environment, Natural Resources and Regional Development Committee

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Committee functions

The Environment, Natural Resources and Regional Development Committee is constituted under section 10 of the *Parliamentary Committees Act 2003*.

The Committee's functions are to inquire into, consider and report to the Parliament on any proposal, matter or thing concerned with:

a. the environment

b. natural resources

c. planning the use, development or protection of land

d. the provision of services to rural and regional Victoria

e. the development of rural and regional Victoria.

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Contents

Terms of reference

Inquiry into the management, governance and use of environmental water

Self-referenced by the Committee on 5 June 2017:

That the Environment, Natural Resources and Regional Development Committee inquire into the Victorian Environmental Water Holder annual report 2015-16 and report, no later than June 2018, into the management, governance and use of environmental water in Victoria including, but not limited to —

1. the assessment of the role of environmental water management in preventing or causing 'blackwater' events;
2. how environmental water and environmental water managers interact with, and utilise, management tools such as carryover and whether the carryover of environmental water impacts on the availability of water for irrigators;
3. consideration of what barriers exist to the more efficient use of environmental water and how these may be addressed; and
4. assessment of fees and charges applied to environmental water and whether these differ from those imposed on other water users.

Chair's foreword

In recent years, there has been an increasing recognition of the importance of water for the environment. In addition to supporting our native flora and fauna, water for the environment provides recreational opportunities, amenity to local communities and good quality water for consumption. It is also important for Aboriginal cultural values.

Changes in recent years have seen the government take a more active role in managing water for the environment. This includes setting aside larger amounts of water for environmental purposes and the construction of infrastructure to control where and when water flows.

However, water is a limited resource. It is therefore critical that water for the environment is used in the most efficient and effective way, to ensure that as much as possible is available for other users. It is also important that environmental water is managed in a way that achieves genuine environmental benefits and minimises adverse impacts on irrigators and communities.

This inquiry examined the management, use and governance of environmental water in Victoria. The Committee heard a lot of support from the community for environmental watering programs. However, there were also a number of areas for improvements that were identified.

The Committee has recommended changes designed to improve the capacity of Victoria's water managers to efficiently and effectively use environmental water. These include investing in infrastructure to provide real-time monitoring of water and tracking the outcomes of environmental watering actions.

The Committee also found that benefits could come from improved interactions between government bodies and the community. This includes reporting back to the community on the causes of significant environmental events in a timely manner, improving community understanding of environmental watering programs and seeking additional opportunities to incorporate community input into environmental watering decisions.

In making these recommendations, the Committee noted that the Government has signalled its intention to make improvements in a number of these areas through existing plans and strategies. The issues identified in this report provide opportunities for improvements in several areas and I anticipate that these will be incorporated into future plans.

Environmental water is a large and complex topic. There were some areas that it was not possible to explore in the scope of this inquiry. Water management is about balancing competing demands and aiming to get that balance right. This may be an area that future parliaments wish to look into further.

This inquiry involved travel to a variety of places around Victoria to meet with stakeholders and to see areas with active environmental water management. I would like to thank the many individuals who met with the Committee or supported our visits. I would also like to thank all of the people and organisations who produced written submissions to the inquiry and gave their insights at public hearings. The Committee and I are very grateful for people's willingness to contribute their time, experience and expertise.

I would also like to thank my fellow Committee members for the time they have devoted to this topic and for the collaborative manner in which this inquiry has been conducted. Finally, I would like to express my gratitude to the Committee's secretariat for its hard work supporting the Committee and for undertaking a significant volume of work in a short time frame.

Josh Bull MP
Chair

Executive summary

In June 2017 the Environment, Natural Resources and Regional Development Committee formally resolved to undertake an inquiry into 'environmental water' (that is, water used for environmental purposes), using its power to self-refer inquiries. The terms of reference for the inquiry included investigating:

- 'blackwater' issues
- management tools such as carryover
- fees and charges associated with environmental water
- the barriers to the more efficient use of environmental water.

Environmental water management in its current form is relatively new in Victoria and is constantly evolving. The Committee heard that there is still much to be learnt, both in terms of the most efficient ways to use environmental water and in terms of the most effective way to engage with the community.

There were calls for additional research and monitoring of the environmental, social and economic impacts of environmental watering programs. Submitters and witnesses advocated for greater transparency in relation to the details of environmental watering programs, the rationale for the programs and the charges paid by environmental water holders. The Committee also heard calls for improved community consultation, to take advantage of local knowledge and to understand local priorities.

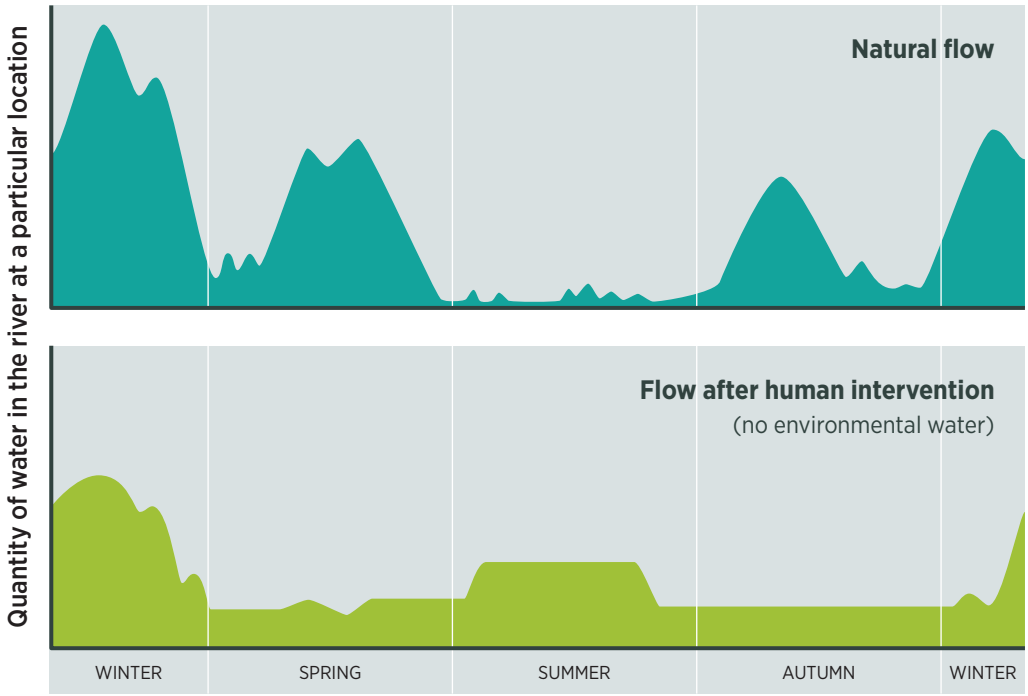
Environmental water and its uses

Water is a shared resource which is essential for agriculture, communities and the environment. Changes in recent decades, especially the last 10 years, have altered the way that water is shared between different users.

Human interventions in our river systems through irrigation, consumption and infrastructure have greatly changed the flow of waterways. As a result, the timing, intensity and location of water flows can differ markedly from natural conditions, as illustrated below. This can cause problems for the flora and fauna dependent on waterways.

Environmental water is water that is primarily used to achieve environmental objectives in waterways and wetlands. In particular, it is used to sustain healthy ecosystems and mitigate the negative environmental effects of human intervention on waterways.

In the last 20 years, governments have become more actively involved in the management of environmental water. Portions of the water stored in reservoirs and flowing through waterways have been allocated to the environment. The Victorian Environmental Water Holder commenced operations in 2011, with responsibility for managing the State's environmental water holdings.



Source: Environment, Natural Resources and Regional Development Committee, adapted from Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.11

However, concerns have been raised about the way this water is managed, the environmental outcomes achieved by these programs and the impact of these programs on local communities.

Blackwater: causes and issues

'Blackwater' is a term used to describe water that contains a high level of dissolved carbon. The increased carbon levels are caused by the break-down of organic matter such as leaf litter, bark, grass and fertiliser from farms that has been swept into a waterway during a flood.

If dissolved carbon levels become too high, this can lead to a proliferation of microorganisms. These mircoorganisms can consume the dissolved oxygen in the water, which can cause death for aquatic life such as fish and crustaceans. These are referred to as 'hypoxic blackwater' events.

Hypoxic blackwater events are caused by multiple factors, including the length of time between floods, the type and amount of organic matter in the water and the temperature. Recent major hypoxic blackwater events in Victoria occurred during floods in the summer of 2010-11 (after the 'Millennium Drought') and in 2016. In both cases, the blackwater events were due to flooding caused by large volumes of rainfall after long periods without floods (which had caused large amounts of organic matter to build up). These events caused considerable deaths of aquatic species and affected local communities through lost tourism and recreational opportunities.

Environmental water has been recognised as a direct cause of a hypoxic blackwater event in one instance in 2015. However, in the majority of cases, blackwater is caused by natural events, such as heavy rainfalls, and not environmental water. In fact, environmental water has the potential to prevent or mitigate hypoxic blackwater events in some circumstances.

The need for transparency for fees and charges paid by environmental water holders

Water corporations charge for the storage, management and delivery of water. Like other users, environmental water holders must pay water corporations for these services.

The Committee found that there was a general confusion about charges on environmental water. The framework for environmental water fees and charges is complex. Charges vary depending on whether the water is held as an entitlement or in shares and based on what services and rights are associated with the water.

In August 2017, the Department of Environment, Land, Water and Planning released the *Environmental Water Charges: Information Paper*. This contains a comprehensive examination of environmental water charges. The Government intends to build on this work to develop a policy framework for environmental water charges. This is a step in the right direction, and the Committee anticipates that the Department will consider the issues that were raised in this inquiry as part of that process.

Current management of environmental water

Environmental water has the potential to bring a range of benefits to the environment and to Victorian communities. However, these benefits may be reduced if water is not managed properly. Using environmental water efficiently can also reduce the amount of water required to achieve environmental outcomes, meaning that more water may be available for irrigators.

Key issues relating to the management and use of environmental water raised by submitters and witnesses included:

- the timing of environmental water flows, including the use of 'carryover' from one year to the next
- how 'spilled water' should be factored into environmental water allocations
- the impact of water trading
- potential infrastructure that could assist environmental water
- the potential benefits of overbank flows
- the need to limit potential negative consequences of environmental water use.

Through all of these issues, submitters and witnesses emphasised the importance of balancing the needs of the environment with the needs of irrigators and local communities. Monitoring the impacts of environmental watering programs on all

stakeholders is essential to ensure that an appropriate balance is occurring and that unintended negative consequences are avoided. Additional research and monitoring may also enable more efficient use of environmental water.

Room for improvement

Throughout the inquiry, the Committee heard suggestions about ways to improve the management of environmental water. These suggestions related to three broad areas:

- additional research and monitoring, to identify more efficient and effective ways to use environmental water and to reduce negative impacts
- increased transparency, so that the community can understand what is being done, the reasons behind particular decisions and what is being achieved
- greater opportunities for community input, so that water managers can gain the benefits of local knowledge and understand stakeholders' needs.

The Committee notes that these issues have been identified by the Government and that the Government, environmental water holders and catchment management authorities have committed to making improvements in most of these areas. The Committee supports further work on these matters and encourages all relevant bodies to maintain a continuous learning and improvement approach.

Glossary

Allocation	The amount of water actually available to an entitlement holder to use or trade in a particular **water season**.
Blackwater	Water that contains a high level of carbon compounds from decayed organic matter such as leaf litter. In severe cases, it may lead to low levels of **dissolved oxygen** in the water (see **hypoxia**).
Carryover	When users keep their unused water allocation from the end of one water season and add it to their **allocation** for the next season.
Dissolved oxygen	Free oxygen gas molecules (O_2) in water used by plants and animals living in the water for respiration. Does not include oxygen that forms part of the water molecule (H_2O) itself.
Entitlements	Rights to take, use or have water delivered under specific conditions. Includes the **environmental water reserve**.
Environmental water	Water that is set aside in storages (such as reservoirs and dams) or waterways, which is used to manage the health of the environment, plants and animals. Also referred to as 'water for the environment'.
Environmental water reserve	The legally recognised amount of water set aside for environmental needs.
Headworks	A structure to control the flow of water at the head or diversion point of a waterway.
Hypoxia	A deficiency of oxygen. In hypoxic blackwater events, there are dangerously low levels of **dissolved oxygen** in the water, which can lead to deaths of fish and other aquatic life.
Levee	An embankment use to prevent overflowing water flowing into an area such as land beside a waterway.
Regulated waterway	A system where water flows are controlled by infrastructure (such as storages) rather than flowing naturally.
Regulator	A structure used to control whether or not water flows at a particular point (for example, to hold water in a wetland for certain periods).
Spilled water	Water in a reservoir or storage that is released when an inflow is expected and there is not enough space to store it.
Tributary	A stream or river that flows into a larger river or lake.
Water season	The period used to measure water resources (from 1 July to 30 June).
Water shares	An ongoing **entitlement** to a portion of the water available in a system.
Water trading	The change of ownership of water, through buying, selling or administrative transfers.
Weir	A low dam used to stop and raise the water level.

Further definitions can be found in the Victorian Water Register's Water Dictionary <http://waterregister.vic.gov.au/about/water-dictionary>.

Findings and recommendations

4 Management and use of environmental water

5 Improvements in environmental water management

1 Introduction

1.1 Background to the inquiry

In June 2017 the Environment, Natural Resources and Regional Development Committee formally decided to undertake an inquiry into 'environmental water' (that is, water used for environmental purposes), using its power to self-refer inquiries. The terms of reference for the inquiry specified several key aspects of the management, governance and use of environmental water to be investigated. These included the problem of 'blackwater', management tools such as carryover, fees and charges associated with environmental water and the barriers to more efficient use of environmental water.

The full terms of reference can be seen at the beginning of this report.

This inquiry reflects the importance of water in Victoria. Water is essential for human habitation, for agriculture, for industry and for the environment. Changes in recent decades, especially the last 10 years, have altered the way that water is shared between different users.

There is considerable community interest in environmental watering programs. Concerns have been expressed about the way this water is managed, the environmental outcomes achieved by these programs and the impact of these programs on local communities.

These concerns are reflected in this inquiry.

1.2 What is environmental water?

> *'Historically, high levels of water extraction for non-environmental uses often resulted in changes to natural water regimes, and insufficient water to maintain the condition and environmental values of waterways. Considerable effort has been made to achieve a better balance. The Victorian Government has undertaken significant work since 2005 to protect water specifically for the environment ...'* [1]

Environmental water is water that is primarily used to achieve environmental objectives in waterways and wetlands. In particular, it is used to sustain healthy ecosystems in and around water systems.

In the last 20 years, Victorian governments have become more actively involved in the management of environmental water. Environmental water managers have been given rights to portions of the water stored in reservoirs and rights to other water

1 Victorian Government, *Submission 39*, p.3

(such as water in excess of other users' entitlements).[2] The Victorian Environmental Water Holder began operation in 2011, with responsibility for managing environmental water holdings across the State.[3]

Recent years have also seen the construction of infrastructure designed to store and direct water for environmental purposes. This infrastructure can be used to control where environmental water flows and when it is released.

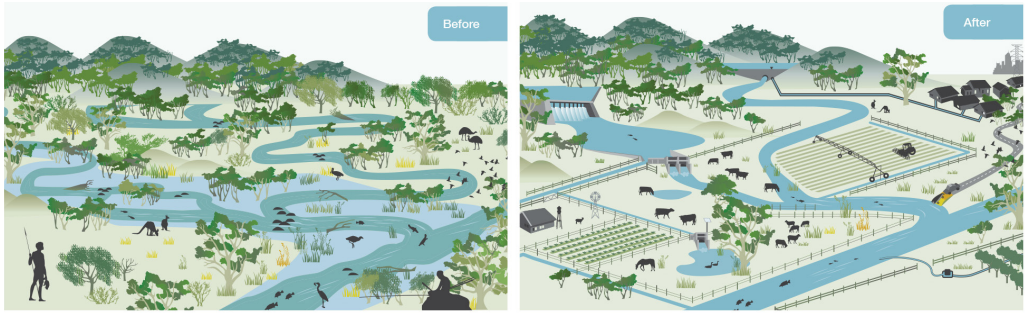
1.3 Why is environmental water management needed?

1.3.1 The impact of human interventions on river systems

> *'Many of Victoria' s rivers and wetlands have been modified as the population has grown to provide water important for towns, industry and food production. In some rivers, up to half of the water that would have naturally flowed is removed each year for urban consumption, irrigation and industry. Additionally, water may be stored and released for consumptive use at a time that does not provide the greatest environmental benefits (for example, irrigation releases are highest in summer, but many plants and animals need high flows in spring). As a result, these waterways are not able to function as they would have naturally, and it is now necessary to actively manage their flows.'* [4]

Environmental water management is needed because a variety of human interventions have disrupted the natural flow of water through catchments (see Figure 1.1). Irrigation, household consumption and industrial activity remove water from water systems, reducing the amount that flows through rivers and supports natural ecosystems. Flood mitigation infrastructure, such as levees, prevents water from reaching places which would otherwise be inundated during floods.

Figure 1.1 Waterways and wetlands before and after the construction of infrastructure



Source: Victorian Environmental Water Holder

Infrastructure such as reservoirs, weirs and channels alter the timing, intensity and location of water flows (see Figure 1.2). The flows of some rivers have been altered so that the highest flows now occur in summer, whereas naturally they would occur in winter. Temperature profiles can also be changed by the release of cold water from storage in summer.

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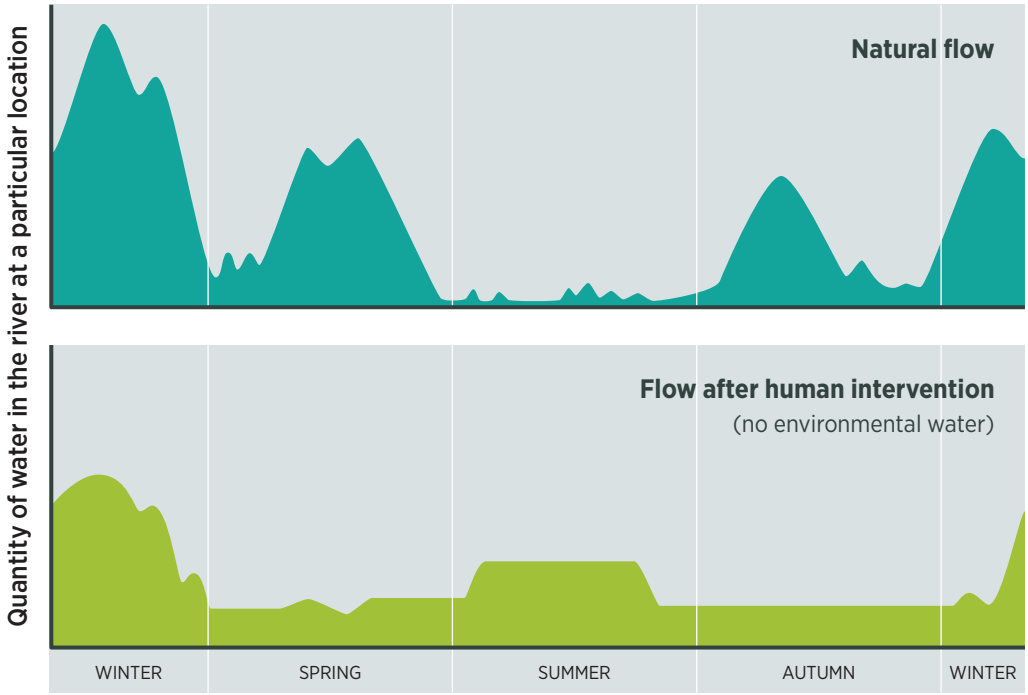
2 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.264

3 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), pp.264, 268

4 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.1

Figure 1.2 Typical river flows before and after human intervention



Source: Environment, Natural Resources and Regional Development Committee, adapted from Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.11

In some areas, the removal of vegetation in and around rivers has also changed the flow of rivers and increased salinity.[5] In other areas, there has been an expansion of trees, bringing different changes.[6]

Human interventions have also reduced the extent to which rivers flood. Dr Darren Baldwin, an expert in water quality and ecosystem function,[7] explained that, under natural conditions, 'most of our flood plains would have flooded every year'. He told the Committee:

> ... floods are a natural part of the way our lowland rivers function. By taking those floods out of the system we have caused a number of issues, one of which relates to blackwater. When the flood plain floods, it is a source of food to basically fuel the river. So dissolved organic carbon, which comes off the flood plain, is one of the two major sources of energy for the river system. The other one is algae. That carbon is taken up by microorganisms, which in turn are eaten by bigger organisms, which in turn ultimately make their way up to become food for fish.[8]

This is of particular relevance to the issue of blackwater, which is discussed further in Chapter 2 of this report.

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5 John Bentley, *Submission 3*, p.1; Murray-Darling Basin Authority, *Salinity* <https://www.mdba.gov.au/managing-water/salinity>, viewed 26 April 2018

6 Keith Greenham AM, *Submission 5*, p.2; Rodger Schifferle, *Submission 15*, p.1; Kerang Lakes Land and Water Action Group, *Submission 20*, p.15

7 Dr Baldwin is a scientist specialising in how natural and human perturbations change the way energy and nutrients are processed in aquatic environments. He has been a Principal Research Scientist with the Murray-Darling Freshwater Research Centre and is the principal of environmental consultancy firm Rivers and Wetlands. He is also an adjunct research professor at Charles Sturt University.

8 Darren Baldwin, *Public Hearing,* 5 December 2017, p.47

Environment Victoria noted the fundamental mismatch between human needs from river systems and natural flows in Australia:

> Australia's unique climate makes our river systems the most variable in the world. Under natural conditions our rivers either have abundant water spread out on the floodplain or virtually no water at all. 'Average' rainfall years are few and far between, and are becoming even rarer as the climate changes. Yet we people and our cities, animals and crops require water all year, every year.
>
> This basic mismatch between a society that demands water constantly and a climate that supplies it only occasionally poses huge challenges for our government and water managers. The consequences for our rivers, creeks and wetlands have been disastrous.[9]

Human intervention in Victoria's river systems is widespread. The Commissioner for Environmental Sustainability has found that:

> Almost all rivers and catchments in Victoria, and almost all larger streams, have been modified to some degree. A history of works designed to store, drain, control and change the direction and speed of water as it moves through the landscape has extensively degraded flow regimes and reduced the volume of water available to the environment. Changes to flow regimes place pressure on river, wetland and floodplain ecosystems and their biodiversity. Drought, combined with current levels of extraction compounds pressures on flow regimes ...
>
> Major storages (dams), weirs and levees are the most common cause of alteration to flow regimes. At least one major on-stream storage has been constructed in 19 of Victoria's 29 river basins, affecting most major rivers throughout Victoria. The level of water extraction is another significant impact on flow regimes, with large proportions of the total surface water in several of Victoria's river basins extracted for consumption, particularly in dry years. Other activities impacting on flows are channel modification (including that to decrease the duration and frequency of flooding, e.g. de-snagging, straightening, and the construction of artificial levees), and changes in land use.[10]

As an example of the impact of water consumption, Dr Darren Baldwin noted that the Murray River downstream of the Darling had a flow of approximately 17,000 gigalitres per year before the construction of reservoirs and other infrastructure. He indicated that now this has been reduced to approximately 5,000 gigalitres, as 12,000 gigalitres are taken out of the system each year (including for irrigation and drinking).[11]

As a result of these and other factors (including the drought from 1996 to 2010), studies of Victoria in 2010 found that:

- only 23 per cent of major rivers and tributaries were in 'good' or 'excellent' condition
- in 21 of 29 river basins, less than half of the river length had riverside vegetation in 'good' condition
- 56 per cent of high-value wetlands were in 'good' or 'excellent' condition

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9 Environment Victoria, *Submission 23*, p.1

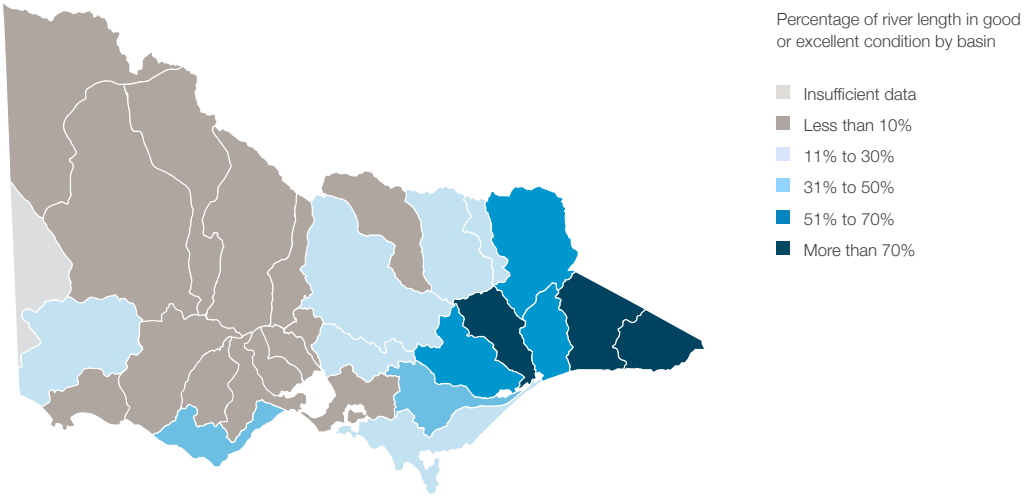
10 Commissioner for Environment Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.126

11 Darren Baldwin, *Public Hearing,* 5 December 2017, p.47

- 51 per cent of non-high-value wetlands were in 'good' or 'excellent' condition.[12]

Figure 1.3 shows the extent of river health in Victoria in 2010.

Figure 1.3 The health of Victorian river systems, 2010



Source: Infrastructure Victoria, *30-Year Infrastructure Strategy* (2016), p.197

1.3.2 Environmental water as a way to mitigate human impacts

> ***'The once extensive forests of the Upper Moorabool Catchment have been removed, its wetlands drained and its base flows dramatically reduced through high levels of ground water extraction. Natural flows have been highly modified in terms of both volume and regimes. Environmental allocations are an attempt to redress some of the consequences of these extreme modifications.'*** [13]

Environmental water programs are intended to mitigate the impact of human use on the ecosystem and improve the condition of rivers and wetlands. To do this, the Victorian Environmental Water Holder has been given responsibility for managing a large quantity of water across the State. This includes:

- rights to a portion of the water held in storages (such as reservoirs), which the environmental water holder can release when needed to meet environmental objectives
- obligations on water authorities to provide minimum 'passing flows' at certain locations—that is, there must be certain minimum volumes of water at these points before water can be taken out of the system for other uses
- water left over after limits on consumption have been reached (referred to as 'above cap' water).[14]

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12 Commissioner for Environment Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.128

13 People for a Living Moorabool, *Submission 36*, p.8

14 Victorian Government, *Submission 39*, p.4; North East Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 10, p.3

The Victorian Environmental Water Holder is an independent body established under the *Water Act 1989*. Its objectives are to preserve and improve the environmental values and health of water ecosystems.[15]

The Victorian Government explained:

> The management of environmental water in Victoria does not aim to return waterways to a 'natural' pre-European condition, but rather is targeted at supporting priority aquatic environmental values for community benefit now and into the future. Managers of environmental water must also consider what benefits can be provided for Aboriginal, recreational, and economic outcomes.[16]

FINDING 1: Victorian ecosystems have been negatively impacted by a number of human interventions in river systems. Human interventions have changed the timing of water flows, reduced the frequency of flooding and removed water from waterways for irrigation, industry and human consumption. Environmental watering programs attempt to mitigate the impact of these interventions.

1.4 The benefits of environmental water

'Water for the environment is water for everyone. Healthy rivers and wetlands support vibrant and healthy communities. They sustain people by supplying water for towns, farms and industry. They also contribute to local farming, fishing and tourism activity. Healthy rivers and wetlands make cities and towns more liveable and support the physical and mental wellbeing of their communities. They provide places for people to play, relax and connect with nature and sustain Aboriginal communities who have a continuing connection to Country.' [17]

Environmental water provides a variety of benefits both to the natural ecosystem and to the human population.

Water is essential for ecosystems to thrive. Environmental water can provide sustenance to native plants and animals, especially birds and fish. Environmental water can be used to flood certain areas, which is needed by some plants, such as river red gums, for seeds to germinate. Certain fish species require flooding as a cue for spawning.[18] Flooding can also be important for allowing fish and plants to move from one area to another and to maintain food chains.[19] Water flows can prevent some invasive plant species from becoming established in river beds.[20] Environmental water can be used to support the environment to recover from droughts and to build resilience in preparation for future droughts.[21]

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15 *Water Act 1989*, s.33DC

16 Victorian Government, *Submission 39*, p.5

17 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.1

18 Victorian Recreational Fishing Peak Body, *Submission 31*, p.1; Michael Burgess, Executive Officer, Victorian Recreational Fishing Peak Body, *Public Hearing*, 10 November 2017, p.2; Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing,* 25 October 2017, p.3

19 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.260; Commonwealth Environmental Water Holder, *Submission 7*, p.2; Victorian Recreational Fishing Peak Body, *Submission 31*, p.1

20 Chris Bromley, *Submission 29*, p.2; Victorian Government, *Submission 39*, p.5

21 Commonwealth Environmental Water Holder, *Submission 7,* p.2

The environmental impact of water flows is not restricted to waterways. There are also benefits for the estuaries, bays and oceans into which environmental water flows.[22]

In addition, environmental water is useful for the human population. Water can be important for the amenity of certain towns.[23] Tourism activities, such as boating, fishing and hunting, require healthy water flows. Water supports cultural values and activities of the Aboriginal population.[24] As Environment Victoria explained:

> The state government is subjected to requests for environmental water delivery for a wide range of recreational and community purposes from trout fishing and duck hunting to tourism operators wanting water delivery during school holidays to communities desperate to stop their lake from drying out during drought.[25]

The North East Catchment Management Authority noted the importance of environmental water for tourism in some of the towns in the north-east of Victoria:

> These destinations are extremely popular for river based activities such as swimming, canoeing/kayaking and angling. The popularity of these towns over the summer period is akin to any coastal town. These towns cater very well to the summer influx, and are highly reliant on these holiday-makers for their livelihood. In turn, the towns and holiday makers are reliant on flows in the upper Ovens River. There has been considerable investment to ensure the upper Ovens River retains summer flows through the Upper Ovens Water Management Plan, and the off-stream water storage at Freeburgh. There is however still a considerable risk to these towns and their livelihood if EWR [the environmental water reserve] should diminish, or the water quality is compromised through events such as bushfire.[26]

Healthy waterways are also important to provide good quality water for irrigation and human consumption.[27]

In addition, environmental water can provide benefits such as reducing salinity in some systems, stabilising river banks, preventing blue-green algae blooms and restoring groundwater supplies.[28]

The Committee heard that evaluations of the use of environmental water have shown benefits to fish, birds and native vegetation.[29] Environmental water in the Murray-Darling Basin is believed to have reduced the salinity of waterways by removing approximately 1 million tonnes of salt each year.[30]

Environment Victoria told the Committee that environmental water:

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22 Yarra Riverkeeper Association, *Submission 22*, p.2; Michael Burgess, Executive Officer, Victorian Recreational Fishing Peak Body, *Public Hearing*, 10 November 2017, p.2

23 See especially Friends of Lake Wallace, *Submission 12*, p.2

24 See especially Murray Lower Darling Rivers Indigenous Nations, *Submission 24*; Federation of Victorian Traditional Owner Corporations, *Submission 26*

25 Environment Victoria, *Submission 23*, p.3

26 North East Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 10, p.5

27 Goulburn Valley Environment Group, *Submission 4*, p.2

28 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.260

29 Commonwealth Environmental Water Holder, *Submission 7,* p.2; West Gippsland Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 11, p.2

30 Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.4; Juliet Le Feuvre, Healthy Rivers Campaign Manager, Environment Victoria, *Public Hearing,* 5 December 2017, p.26

> ... played an absolutely vital role in mitigating the worst impacts of the Millennium drought when it was used to provide refuge habitat for fish, frogs, turtles and birds. For example, emergency watering in 2007 prevented the extinction of the Murray hardyhead in Victoria and brought struggling red gums at our internationally recognised Ramsar sites back from the brink.[31]

1.5 Water is a shared resource

> *'Water is the essential ingredient both for landscape health and for agriculture, recreation and tourism, both in urban and regional Victoria.'* [32]

It is important to recognise that there is only a finite supply of water. Using water for the environment therefore reduces the amount of water that can be used for other purposes.

Some submitters and witnesses to this inquiry questioned the amount of water going to the environment rather than being available for irrigators.[33] Others argued that more water should be made available for the environment rather than consumption.[34] Mr Stuart Simms from the Kerang Lakes Land and Water Action Group illustrated some of the trade-offs involved with using environmental water:

> We are living in a world of inevitable overpopulation and starvation, and what is Australia doing at the moment but methodically dismantling its ability to grow food? ... we are attempting to keep Lake Alexandrina [at the mouth of the Murray River] fresh, which historically was estuarine: the tides would bring saltwater in and it varied then from freshwater in great floods to saline of course when it relied on the sea water and the tides. About 750 000 megalitres of water evaporates out of that, and we are now trying to keep that fresh—750 000 megalitres. We can grow 1 tonne of wheat with a megalitre of water, so we have foregone the ability to grow three-quarters of a million tonnes of wheat by trying to keep Lake Alexandrina fresh.
>
> To go a step further, we can generate perhaps $2000 worth a megalitre of water through a grapevine or a fruit tree. If you equate your 750 000 megalitres of evaporation in Lake Alexandrina, that is $1.5 billion worth of production. I think the question here is: how far do we go with environmental flows and how far do we go looking after the food we are producing?[35]

Mr Neville Goulding, a farmer in the north of Victoria, similarly noted that:

> Approximately 28 gigalitres or $8.4 million of water was used in 2015 in the Gunbower forest. That water could have produced $14 million of milk or $140 million if used for horticulture. It could have created 1800 jobs.[36]

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31 Environment Victoria, *Submission 23*, p.3 (with sources)

32 Yarra Riverkeeper Association, *Submission 22*, p.1

33 See, for example, Keith Greenham AM, *Submission 5*, p.5; Keith Greenham AM, *Public Hearing,* 13 October 2017, pp.28-9; Stuart Simms, President, Kerang Lakes Land and Water Action Group, *Public Hearing,* 13 October 2017, p.9; Neville Goulding, *Public Hearing,* 13 October 2017, p.21

34 Friends of Lake Wallace, *Submission 12*, p.3; People for a Living Moorabool, *Submission 36*, p.9

35 Stuart Simms, President, Kerang Lakes Land and Water Action Group, *Public Hearing,* 13 October 2017, p.9

36 Neville Goulding, *Public Hearing,* 13 October 2017, p.21

Reductions in farming opportunities were seen as a major problem by some submitters and witnesses, especially in communities that are already experiencing population loss (see Section 4.8.3 of this report).

While a contrast is often drawn between irrigators and environmental groups who may be competing for the same water, the Victorian Farmers Federation cautioned that this contrast should not be overstated:

> Irrigators as key stakeholders have a keen interest in the attainment of environmental outcomes because our ecosystems are interdependent. Environmental outcomes have a direct correlation to factors such as water quality which directly affect irrigators. Beyond water quality, irrigators are also the backbone of our rural communities, like everyone else, they want to avoid environmental failures such as blackwater and see effective environmental water delivery.[37]

There can also be times when the needs of the environment conflict with recreational and tourism needs. For example, the Committee was told about the negative impact on recreational users of Lake Eppalock and Lake Eildon (and tourism operators dependent on those users) when the water level was reduced to meet environmental and consumptive needs.[38]

However, the Committee also heard about times when environmental watering plans were adjusted to meet community needs. For example, Ms Julia Reed from the Department of Environment, Land, Water and Planning explained:

> So while the view is to make sure the water is delivered to achieve the environmental objective, where it is possible the water will also be adjusted to provide a recreational or a social outcome where it can, with the primary objective still being for the environment, but things like the water can be held in a weir pool to provide the right flows for a rowing regatta or delay a fresh so people can get in for a fishing competition.[39]

Mr Denis Flett, chairperson of the Victorian Environmental Water Holder, told the Committee:

> We realise that water for the environment is water for everyone and we are serious about that, and the government has told us that while we are primarily about ecological outcomes, we must wherever and whenever possible also seek shared benefits, which really is the goal of water resource management — getting the optimal benefits for society, public and private good.[40]

The Water and Catchment Legislation Amendment Bill 2017, which is currently before the Legislative Council, includes amendments to require the value and use of waterways for social, recreational and Aboriginal purposes to be considered in decisions and strategies, including by the Victorian Environmental Water Holder.

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37 Victorian Farmers Federation, *Submission 30,* p.3

38 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, pp.9-10

39 Julia Reed, Senior Manager, Environmental Water, Department of Environment, Land, Water and Planning, *Public Hearing,* 5 December 2017, p.8

40 Denis Flett, Chairperson, Victorian Environmental Water Holder, *Public Hearing,* 5 December 2017, p.12

Overall, the Committee notes that there are multiple stakeholders with an interest in Victoria's water and that there can be competing demands at times (especially during droughts). Water management can involve prioritising and balancing these needs.

A number of participants in this inquiry expressed concerns that climate change may reduce the amount of water in river systems and require more use of water to support the environment. The Committee notes that predictions about future changes to rainfall in northern Victoria are unclear. Dr Celine Steinfeld, from the Wentworth Group of Concerned Scientists, noted that predictions for 2030 range between an 11 per cent decline and a 5 per cent increase in rainfall.[41] The Committee notes the possibility that rainfall may decrease, which may intensify the competition for water in the future.

> *'It is not about everything for the environment; it is not about everything for agriculture. It is a matter of how we can work together to get good environmental outcomes without destroying the agriculture industry, which is basically all Victoria has got. We do not have the big mines or iron ore or anything else around here, so it always gets back to agriculture, of which irrigated agriculture is a big portion.'* [42]

It is beyond the scope of this inquiry to determine what proportion of Victoria's water should be used for environmental purposes and how much should be available for other uses. This inquiry is restricted to how the water that is set aside for the environment is managed. Nonetheless, the Committee notes these debates about how water should be distributed. In recognition of this, the Committee has adopted two key principles that should underlie all decisions about environmental water:

- water is a limited resource which is important to the environment, irrigators and communities
- water is a shared resource and all decisions about it should consider and balance the needs of all stakeholders.

These principles have informed the Committee's recommendations in this report.

FINDING 2: Water is a limited resource which is required by the environment, irrigators and communities. All decisions about how water should be used or managed must consider and balance the needs of all stakeholders.

1.6 Other work underway

This is not the only inquiry currently looking at environmental water or water use more generally. Other work underway includes:

- a Commonwealth parliamentary inquiry into the management and use of Commonwealth environmental water[43]

41 Celine Steinfeld, Policy Analyst, Wentworth Group of Concerned Scientists, *Public Hearing,* 5 December 2017, p.66

42 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, p.42

43 Parliament of Australia, *Inquiry into the Management and Use of Commonwealth Environmental Water* <https://www.aph.gov.au/Parliamentary_Business/Committees/House/Environment_and_Energy/EnvironmentalWater>, viewed 23 May 2018

- a Commonwealth parliamentary inquiry into the integrity of the water market in the Murray-Darling Basin[44]
- a South Australian royal commission looking at the Murray-Darling Basin Plan and associated matters[45]
- a 'Long Term Intervention Monitoring Project' evaluating the contribution of Commonwealth environmental water over five years in the Murray-Darling Basin.[46]

The Committee also notes that there are a number of Victorian Government policies which have been released in recent years relating to environmental water. In particular, *Water for Victoria* and *Our Catchments, Our Communities* were both released in 2016 and contain a number of commitments to change the way that environmental water is managed.

As a result, environmental water management is currently changing and will continue changing in near future. This report reflects environmental water management as it currently is, though it notes the Government's stated commitments. The Parliament may wish to review environmental water management again at a later date to understand the responses to current changes and to assess the implementation of the Government's commitments.

1.7 The Committee's approach to this inquiry

In undertaking this inquiry, the Committee received submissions from 39 organisations or individuals. This included one submission from the Victorian Government which contained a further 15 submissions from government bodies in the appendices.

The Committee conducted public hearings with selected submitters and other stakeholders in Kerang, Shepparton, Bendigo, Colac and Melbourne, including several videoconferences with interstate experts.

The Committee also undertook site visits to locations in the vicinity of Gunbower National Park and Shepparton to see environmental water infrastructure and areas where environmental watering has taken place.

Further details about the Committee's evidence-gathering process can be found in Appendix 1 of this report.

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44 Parliament of Australia, *The Integrity of the Water Market in the Murray-Darling Basin* <https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Rural_and_Regional_Affairs_and_Transport/MurrayDarlingPlan>, viewed 23 May 2018

45 Murray-Darling Basin Royal Commission, *Murray-Darling Basin Royal Commission* <https://www.mdbrc.sa.gov.au>, viewed 23 May 2018

46 Commonwealth Department of the Environment and Energy, *Long Term Intervention Monitoring Project* <https://www.environment.gov.au/water/cewo/monitoring/ltim-project >, viewed 24 May 2018

2 Blackwater

2.1 Overview

Blackwater events are a naturally occurring phenomenon associated with waterways that have occurred throughout history. Smaller-scale blackwater events can be beneficial to ecosystems as they provide nutrients to aquatic life. However severe events (known as 'hypoxic blackwater') can lead to death of fish and other aquatic life. Environmental watering is an important process to prevent and mitigate severe blackwater events.

Although the majority of blackwater events are caused by floods, the Committee heard concerns that environmental watering is contributing to the severity of blackwater events. It is important that monitoring is in place to ensure that blackwater events are appropriately managed and environmental water is best used to prevent and mitigate the impacts of severe events where possible.

2.2 What is blackwater?

'Blackwater' is a term used to describe water that contains a high level of dissolved carbon. The increased carbon levels are caused by the breakdown of organic matter such as leaf litter, bark, grass, fertiliser from farms and other vegetation that has been swept into a waterway during a flood. The affected water appears darker, often similar to the colour of black tea.

2.2.1 Causes of blackwater

In Victoria, blackwater events are generally caused by rainfall and flooding that inundate land that has accumulated large amounts of organic matter. The severity of blackwater events depends on a number of natural and human-influenced factors. These include:

- the type and amount of organic matter in the water
- the area being inundated, particularly the time between flood events
- the heat of the water
- seasonality and weather
- the duration of the event.[47]

47 Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), p.2; Victorian Government, *Submission 39*, pp.8-9; Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), pp.469-80

Smaller-scale blackwater events can have a positive impact on the health of waterways and are an essential part of the natural ecosystem. They can provide carbon and nutrients to water bugs, which are eaten by fish, birds and other animals.[48] In addition, smaller-scale blackwater can be associated with healthier and more productive river ecosystems.[49]

In its submission, the Victorian Government described how moderate levels of dissolved carbon in water benefit the ecosystem:

> The EPA [Environment Protection Authority] recognizes that the input of organic material to rivers and streams is a natural process which is important for the functioning of a healthy ecosystem. The input of 'normal' amounts of organic material can be broken down in the aquatic environment without any harmful effects, and brings useful carbon and other elements into the aquatic ecosystem. Bacteria in the water break down the organic material into inorganic compounds and carbon dioxide, in a natural process that uses up oxygen from the water but does not reduce those oxygen levels by any significant degree.[50]

Blackwater events from flooding can occur in many waterways at the same time and span large areas.

Severe blackwater events can cause the levels of dissolved oxygen to become critically low, endangering aquatic life. These are known as hypoxic blackwater events and are discussed in Section 2.2.2 below.

2.2.2 Hypoxic blackwater events

> ***'The blackwater event was very heartbreaking for an organisation that is very focused on river health and fish. To see Murray cod floating down the system through that blackwater event over Christmas was a heartbreaking event for many, many people. So we do not want to repeat those exercises.'*** [51]

Although blackwater events are a naturally occurring phenomenon, severe events can cause environmental problems. Water contains dissolved oxygen which is used for respiration by aquatic animals. During a blackwater event, the level of dissolved oxygen can become low as a result of increased numbers of microorganisms consuming the additional carbon in the water.

The Victorian Environmental Water Holder explained:

> Floods that wash very large quantities of organic material into waterways increase the amount of available food and can trigger a rapid increase in the abundance of bacteria and other micro-organisms. Large numbers of bacteria and micro-organisms can consume oxygen at a faster rate than it can be replenished. In extreme cases, large numbers of bacteria and micro-organisms can use up virtually all of the

48 Victorian Government, *Submission 39*, p.8

49 Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), p.5

50 Victorian Government, *Submission 39*, p.10

51 Chris Norman, Chief Executive Officer, Goulburn Broken Cachment Managment Authority, *Public Hearing*, 24 October 2017, p.25

available oxygen in the water, which means that fish and other aquatic animals suffocate. Blackwater events that cause severe oxygen depletion and fish deaths are called 'hypoxic' blackwater events.[52]

Box 2.1 describes hypoxic blackwater in detail.

BOX 2.1: Hypoxic blackwater

Water contains levels of 'dissolved oxygen', which are free-moving molecules of oxygen gas (O_2) within the water. Dissolved oxygen levels do not include oxygen that forms part of the water molecule (H_2O).

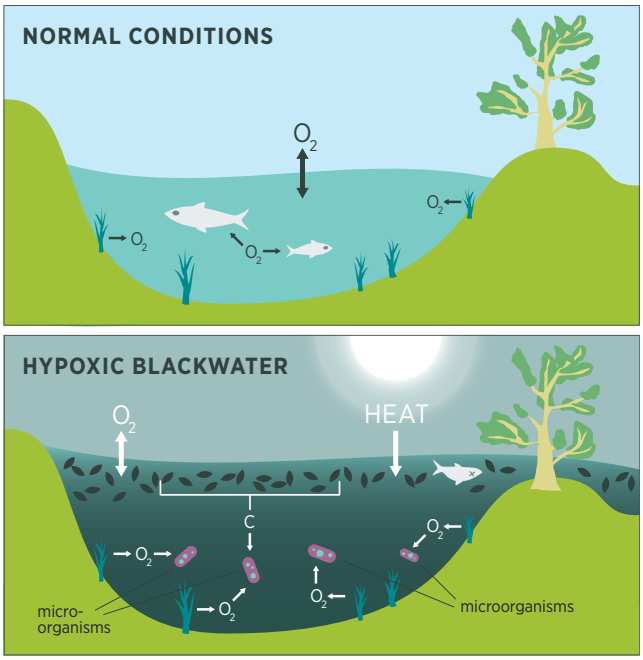
Blackwater contains a high level of dissolved carbon from broken-down leaf litter and other organic matter. Microorganisms in the water consume the dissolved carbon (C) and dissolved oxygen. When there are large amount of carbon in the water, the population of microorganisms can increase, leading to an increased rate of dissolved oxygen consumption. At times the microorganisms consume the dissolved oxygen at higher rates than it can be replenished through absorption from the atmosphere or photosynthesis.

This process can be exacerbated if it occurs during hot weather, as the heat increases the number of microorganisms and their respiration rate.

If the level of dissolved oxygen in blackwater reaches dangerously low levels, the water can become hypoxic (low in oxygen). Lack of oxygen can cause widespread death of marine life, including fish and crustaceans.

Dissolved oxygen levels lower than 4-5 milligrams per litre are considered dangerously low for aquatic life.

Figure 2.1 Hypoxic blackwater



Source: Environment, Natural Resources and Regional Development Committee

52 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.7

Although blackwater events are a naturally occurring phenomenon, hypoxic events can occur more frequently in a water system that has been modified by human interventions (such as reservoirs) than under natural conditions. The Victorian Environmental Water Holder stated reservoirs and water storages affect the risk of blackwater in two ways:

- a significant reduction in the frequency of medium-sized floods, which would clear away organic matter from the land around waterways on a more regular basis
- delaying the timing of downstream floods, causing the floods to occur in warmer weather.[53]

Similarly, Mark Stacey, Immediate Past President of the River Basin Management Society, stated that blackwater events were now occurring more frequently than under natural conditions. He attributed this to fewer higher flows due to constructed reservoirs, explaining:

> What that means is that we have organic matter accumulating on the flood plain, which gets to higher loads than it previously would have. Also the higher flows that do occur typically occur later in the season now, when the weather is warmer, so as a result when organic material is washed into the channel the microbial activity happens faster and we are more prone to getting blackwater events. I use the phrase 'the system is more primed' for blackwater as a result of a reduction in high flows, and then when they occur there is the greater potential for that primed system to really kickstart and cause a blackwater event.[54]

Dr Darren Baldwin, a research consultant who has worked on blackwater issues since 1997, discussed how changes to natural river systems had affected when floods occur, and the impact of this on blackwater events:

> The other thing we have managed to do is change the time when floods happen. So in rivers like the Murray River and the Goulburn River we would naturally have had floods occurring with the winter rains and the snowmelt, so our main flood peaks would have been in late winter and early spring. Now we store that water within reservoirs, and high flows now in our river systems occur during summertime. Then if we get unusually wet summers, as we did in 2010 and 2016, we get hypoxia, because the water is much warmer. The reason the warmer temperatures lead to hypoxia is that the microbial respiration doubles—the rate it is taken up doubles—approximately for every 10-degree rise in temperature. Also the number of bacteria increase. As well as that, the rate at which that carbon can get leached out of the material increases. So by taking our floods out of the system we have built up a lot of carbon in the system, which is then periodically washed in, and it is periodically washed in in the warmer parts of the year. It is those times of the year when you are most likely to get hypoxia.[55]

In addition, the Victorian Environmental Water Holder stated that large intervals between flood events are the greatest risk factor for hypoxic blackwater events:

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53 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.7

54 Mark Stacey, Immediate Past President, River Basin Management Society, *Public Hearing*, 5 December 2017, p.34

55 Darren Baldwin, *Public Hearing*, 5 December 2017, p.47

Under natural conditions, river floodplains across most of Victoria would have been flooded to varying degrees in most years and multiple times in very wet years. Hydrological models show that even during the Millennium Drought, sections of the floodplains along the Murray, Goulburn, Campaspe and Loddon rivers would have experienced small to medium floods nearly every year. By preventing these floods, leaf litter and other organic material accumulates on the floodplain and with each passing year the risk of a hypoxic blackwater event increases.[56]

2.2.3 Red gums

Research has shown that river red gums increase the risk of blackwater, as debris from the trees contains a high level of carbon. In addition, at elevated levels, compounds leached from red gum leaves can be directly toxic to native fish.[57]

The Committee received evidence from individuals who believed current environmental watering practices for red gums are inappropriate and should be reviewed.

In his submission, Mr Barry Bishop believed that the process used to sustain river red gums increases the risk of blackwater events. Accordingly Mr Bishop requested a remodel of the 'flash flooding and … flash draining process' used to sustain river red gums.[58]

Similarly Mr Keith Greenham AM considered that environmental watering of red gums forests in all seasons has a similar effect on water quality to flash flooding. He believed that returning these contaminated flows into waterways must be avoided.[59]

The Committee acknowledges these concerns and believes that further monitoring of current environmental watering practices should address these issues (see Section 5.2.2 of this report).

2.2.4 Effect of agriculture

In its submission, the Commonwealth Environmental Water Holder noted that there was limited research into the impacts of agricultural land use on blackwater events. However, it noted that a review of a major blackwater event in 2016 (discussed in Section 2.3.2 of this chapter) indicated that nutrients from agricultural land may have contributed to the severity of the event.[60]

The Committee did not receive further evidence on this issue. However the Committee highlights this research gap and believes this should be addressed in the future (see further discussion of future research in Section 5.2.3 of this report).

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56 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.7

57 Commonwealth Environmental Water Holder, *Hypoxic Blackwater Events and Water Quality*, p.1; Sally Hladyz, Susanne C. Watkins & Darren S. Baldwin, *Current Understanding of Blackwater Events Relating to the Edward-Wakool River System*, report prepared for the Murray Catchment Management Authority (2009), p.8; Rodger Schifferle, *Submission 15*, p.2; Rodger Schifferle, *Public Hearing*, 13 October 2017, p.30

58 Barry Bishop, *Submission 8*, pp.2-3

59 Keith Greenham AM, *Submission 5*, pp.3-5

60 Commonwealth Environmental Water Holder, *Submission 7*, p.3

FINDING 3: Hypoxic blackwater events are caused by multiple factors, including the length of time between events, the type and amount of organic matter in the water, and temperature.

2.3 Blackwater events in Victoria

Blackwater events have been recorded in Victoria for over 100 years. In its submission, the Murray-Darling Basin Authority provided newspaper articles describing apparent blackwater events in Victoria as far back as 1865.[61]

Two major hypoxic blackwater events have occurred in Victoria in the last decade. These were caused by floods in 2010-11 (following the 'Millennium Drought') and in 2016. Both events spanned large areas and affected multiple waterways. The primary contributing factor to both these blackwater events was the extremely long period between large-scale floods in the affected areas.[62] The two events are discussed in detail in Sections 2.3.1 and 2.3.2 of this chapter.

In total, the Victorian Environmental Water Holder has been notified of eight blackwater events since it was established in July 2011. Of these, six were caused by rainfall and flooding, one by fire and one by environmental water. These are summarised in Table 2.1.

Table 2.1 Blackwater events in Victoria since July 2011

Date	Location	Cause
March 2012	Lower Broken Creek	Heavy rain and widespread flooding
Summer 2014-15	Upper Broken Creek	Fire in catchment
December 2015	West branch of Loddon River	Environmental watering
February 2016	Unregulated tributary into Goulburn River	Localised rainfall in Pranjip Creek
November 2016	Murray system	Widespread rainfall and flooding
December 2016	Mullaroo Creek	Widespread rainfall and flooding
January 2017	Goulburn River	Localised storm in Seven Creeks catchment
January 2017	Lake Meran	Natural floods in Sep-Oct 2016

Note: Only relates to regulated river systems.
Source: Victorian Environmental Water Holder in Victorian Government Submission, *Submission 39*, Appendix 2, p.8

Four blackwater events are discussed in more detail in Sections 2.3.1–2 and 2.5.3–4 of this chapter.

61 Murray-Darling Basin Authority, *Submission 13*, p.2
62 Murray-Darling Freshwater Research Centre, *Submission 28*, p.2

2.3.1 2010-11 event—Murray-Darling Basin

> *'... the millennium drought was followed by unprecedented rainfall across much of Victoria. Unseasonal spring and summer rain washed years' worth of accumulated organic matter into the river systems and resulted in a major blackwater event in the Murray-Darling Basin that extended over 2,000km and continued for several months.'* [63]

From 1998 to 2010, south-eastern Australia experienced an extended drought period, often referred to as the 'Millennium Drought'. At this time, flows in the Murray-Darling Basin were at record low levels.

The drought was broken in September 2010 by above-average rainfalls. This caused a series of major uncontrolled floods in the rivers of the southern Murray-Darling Basin, which caused significant damage to properties and infrastructure and led to a major hypoxic blackwater event that lasted until April 2011.[64]

Research has indicated that human modifications to the water systems also contributed to the severity of the event.[65]

The high flows caused simultaneous blackwater events in the Murray, Goulburn-Broken, Edward-Wakool, Murrumbidgee and Loddon rivers.[66] At its peak, blackwater extended along approximately 1,800 kilometres of the Murray River and throughout all major waterways of the southern Murray-Darling Basin.[67]

The blackwater event resulted in widespread deaths of fish and other aquatic life. However, the extent of the death varied depending on the species of the fish. The overall number of deaths was lower than expected given the severity of the event.[68]

A range of environmental water strategies was used to mitigate the effects of the blackwater. These included:

- dilution flows
- physical re-aeration of water using paddle wheels, pumps or regulator structures
- diverting blackwater into shallow off-channel storage for re-aeration and dilution.[69]

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63 Environment Victoria, *Submission 23*, p.6

64 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.470

65 Darren S. Baldwin, Matthew J. Colloff, Simon M. Mitrovic, Nick R. Bond & Ben Wolfenden, 'Restoring Dissolved Organic Carbon Subsidies from Floodplains to Lowland River Food Webs: A Role for Environmental Flows?', *Marine and Freshwater Research* 67(9) (2016) (included in Darren Baldwin, *Submission 35*, Attachment 2), p.1389

66 Bureau of Meteorology, *Murray-Darling Basin: Water Overview* <http://www.bom.gov.au/water/nwa/2011/mdb/contextual/wateroverview.shtml>, viewed 8 March 2018

67 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.470; Darren Baldwin, *Devices for Blackwater* (2016), p.1

68 Environment Victoria, *Submission 23*, p.6

69 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.470

Researchers noted that there has been little evaluation of whether these strategies can successfully mitigate the negative impacts of blackwater.[70]

2.3.2 2016 event—Murray River system

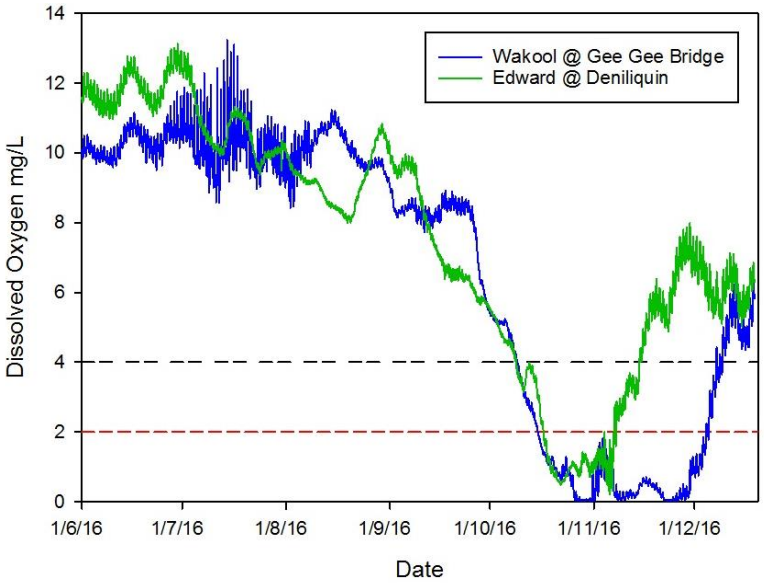
In 2016 widespread floods caused by record-breaking rainfall caused a hypoxic blackwater event in the Murray River system, as well as damaging properties and infrastructure. The excessive rainfall caused uncontrollable floods that inundated areas of floodplain that had not been underwater for 20 years, including during the 2010-11 floods. As a result, there was a substantial amount of leaf litter and carbon contained in the soil in these areas.[71]

The Institute for Land, Water and Society noted that leaf litter might have been exacerbated by record heat in autumn 2016.[72]

The blackwater event was particularly severe in the Edward-Wakool system. Billabong Creek and the Murrumbidgee and Lachlan rivers were also impacted.[73]

During this time, the dissolved oxygen concentration level in the rivers reached critically low levels (see Figure 2.2). This resulted in substantial fish deaths.

Figure 2.2 Dissolved oxygen concentrations in the Edward and Wakool rivers from June to December 2016



Source: Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), p.3

70 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.470

71 Murray-Darling Freshwater Research Centre, *Submission 28*, p.2

72 Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), p.2

73 Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), p.1

Environmental water was released in an attempt to mitigate the hypoxic blackwater. According to the Commonwealth Environmental Water Holder, over 300 gigalitres of environmental water was used across a number of waterways as refuges for fish and other aquatic life.[74]

In addition, there was considerable effort by local communities, individuals and water management agencies to provide refuges for native fish and freshwater animals. However, it was not possible to fully mitigate the impacts of the event because it extended over such a large area.[75]

The Commonwealth Environmental Water Holder conducted a review of environmental watering actions used during the 2016 event. The report (released in 2017) made 10 recommendations to improve the effectiveness of environmental watering in future, which are summarised in Box 2.2.

BOX 2.2: Recommendations from the Commonwealth Environmental Water Holder's review of environmental water used in the Murray-Darling Basin

The Commonwealth Environmental Water Holder made 10 recommendations in its review:

- developing a blackwater response plan
- identifying new approaches to manage environmental water during low oxygen conditions
- fish tracking and identifying valuable habitats that may provide protection for aquatic biota
- identifying 'hot spots' and assessing vulnerability and risk
- implementing a strategic water quality monitoring network
- further research into river metabolism and dissolved organic carbon and macronutrient inputs
- improved modelling for larger-scale blackwater events
- implementing climate adaption actions
- introducing a dedicated program to engage indigenous groups, local communities and the pastoral and tourism industries
- implementing a risk framework.

Source: Commonwealth Environmental Water Holder, *Blackwater Review* (2017), pp.9-13

74 Commonwealth Environmental Water Holder, *Submission 7*, p.8

75 Institute for Land, Water and Society, *Answers to Some Questions about the 2016 Hypoxic Blackwater Event in the Southern Murray-Darling Basin* (2016) (included in Institute for Land, Water and Society, *Submission 33,* Attachment 1), pp.3-4

2.4 The impact of blackwater events

> *'The fish were the most visible floating on the surface, there were millions of them. The Crayfish all walked out of the water and died or were taken by birds and foxes. As the water receded, the shrimp and other aquatic life could be seen all dead lying in the toxic mud left behind. Many birds also died and all the wading birds left because there was no food left in the water.'* [76]

Hypoxic blackwater events can last up to months at a time, causing substantial deaths for fish and other aquatic life such as crustaceans. In some cases thousands of fish have died, washing up on shores.

Figure 2.3 shows severe fish deaths caused by a blackwater event at Lake Meran.

Figure 2.3 Fish deaths caused by a blackwater event at Lake Meran, 2017

Source: Concerned Lake Meran Community Members, *Submission 27*, Attachment 1, p.4

In addition to the environmental impacts, blackwater can have economic and social impacts on communities. This includes:

- lower recreational opportunities such as fishing and boating, causing a loss of tourism for the communities

76 Andrew Ash, *Submission 40*, p.1

- the costs of treating water for consumption.[77]

Mr Andrew Ash, a resident of Swan Hill, described the impact the of the 2010-11 blackwater event on the local community:

> Along with the fish went our fishing industry, visiting anglers just stopped coming.
>
> Some locals sold their boats and took up golf.
>
> Several stores closed their door or reduced staff. Local Motels, Hotels, Caravan Parks and Petrol Stations were all severely affected.
>
> Many locals suffered severe stress and some local farmers were reduced to tears watching their local streams turn to rivers of death.[78]

Mr Ash stated that similar impacts occurred after the 2016 blackwater event.[79]

The Wimmera Catchment Management Authority similarly described the potential impacts of blackwater event on local communities:

> Widespread fish deaths would be a massive blow to events like the Horsham Fishing Competition (March Labour Day Weekend) and Jeparit Fishing Competition (Easter Weekend). These events are great occasions for the towns, attracting many visitors that boost the local economy and community groups benefit from the funds raised by the hard-working committees.[80]

2.5 The role of environmental water in blackwater events

2.5.1 Preventing and mitigating blackwater events

Because blackwater events involve large amounts of water and are caused by extreme weather events, they are difficult to manage once they have occurred. However, environmental water and related infrastructure can be used to prevent hypoxic blackwater events or to mitigate their impact by:

- reducing the amount of organic material in between major floods
- timing environmental water flows to reduce risk
- using small 'freshening' flows to provide refuges for fish and other aquatic life during blackwater events
- maintaining refuges in wetlands and tributaries and fish passages to these refuges during blackwater events
- containing small to medium blackwater events by storing or diverting affected water.[81]

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77 Victorian Government, *Submission 39*, p.8
78 Andrew Ash, *Submission 40*, p.2
79 Andrew Ash, *Submission 40*, p.2
80 Wimmera Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 12, p.3
81 Victorian Government, *Submission 39*, pp.9-10

In its submission, the Victorian Environmental Water Holder noted that environmental water has been used to prevent and mitigate blackwater events since 2011:

> Of the eight blackwater events reported since the VEWH's [Victorian Environmental Water Holder's] establishment ... five had their effects mitigated using environmental water. Several other potential blackwater events have been prevented through early identification, monitoring and the judicial use of environmental water before the events had a chance to take hold. It should be noted that environmental water is only likely to be effective at mitigating or preventing small blackwater events, it cannot reduce the risk of very large hypoxic blackwater events.[82]

The holder also provided three examples of where environmental water has limited blackwater occurrence. These are detailed in Box 2.3.

BOX 2.3: Environmental water use that has limited blackwater occurrences

The Victorian Environmental Water Holder provided some examples of where environmental water is believed to have prevented or mitigated blackwater events:

Gunbower Forest

Since 2010-11 parts of Gunbower Forest have regularly received environmental water. As a result, these parts of Gunbower Forest have not accumulated significant levels of leaf litter and therefore the risk of a localised hypoxic blackwater event is low.

Hattah Lakes

Many of the Ramsar-listed Hattah Lakes have received environmental water regularly over the last few years (most have received water in four out of the past six years). As a result, most of the Hattah Lakes have not accumulated significant levels of leaf litter.

Natural flows and environmental water (through pumping) in September and October 2016 provided much of the water that was in Hattah Lakes. The environmental water was good quality and flowed in before the arrival of low dissolved oxygen water with the 2016 flood. During the flood all water flows at Hattah were maintained and the lakes were connected with the river. Fish are able to detect areas with higher oxygen concentrations and it is likely that some fish moved from the Murray River into Hattah Lakes during the hypoxic blackwater event. The fish that moved into Hattah Lakes survived the blackwater event and were important in recolonising the Murray River once the blackwater event passed.

Barmah-Millewa Forest

The forest has been watered three out of the past four years, helping to reduce carbon loads in some parts of the forest. However, due to rules and agreed delivery constraints, water cannot be delivered in the volumes required to regularly flush large areas of the forest. About 60,000 megalitres a day for 30 days is required for this, whilst only 15,000 megalitres can currently be delivered with managed flows.

Source: Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p. 9

82 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.8

However, the Victorian Environmental Water Holder noted that the effectiveness of environmental watering actions to mitigate a blackwater event after the onset of the event is limited. It stated that these actions are only effective when:

- the volume of environmental water is large compared to the blackwater
- the stored environmental water is not affected by the blackwater events
- the environmental water can be released into the affected area in a short enough time.[83]

When a smaller amount water is available, environmental water use during blackwater events is generally limited to creating refuges for affected aquatic life.[84]

Ms Juliana Reed, Senior Manager, Environmental Water at the Department of Environment, Land, Water and Planning, discussed some limitations at a public hearing:

> There always will be blackwater though. There is always going to be organic material entrained, and there will be tributaries, for example, where we cannot deliver environmental water. You can only deliver the held environmental entitlements if you have got a storage to deliver it from. So when you have the unregulated tributaries, you cannot just clear the organic stuff off those. When that builds up after a drought it is a problem. That happened in Seven Creeks, for example. There was a big high flow at Seven Creeks a year or so ago. A localised but quite nasty little blackwater event occurred, and the CMA [catchment management authority] were all over that and looking at mitigation. So we cannot prevent it entirely. We do believe we can reduce the risk. We cannot push environmental water way up into the higher levels of the flood plain, but we can help with our environmental works programs, where we can mimic a flood event without actually requiring a flood in the river.[85]

2.5.2 The role of environmental water in causing blackwater events

> ***'Hypoxic blackwater events are not a new occurrence. There have been at least six hypoxic events in the mid-Murray (downstream of the Barmah Choke) since 1990, five of which occurred before the Basin Plan was finalised and before any significant delivery of Commonwealth environmental water. It is clear that these events are not caused by environmental water.'*** [86]

The vast majority of hypoxic blackwater events are a result of floods caused by heavy rainfalls. However, the Committee heard concerns from some stakeholders about environmental watering causing hypoxic blackwater events.

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83 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.9

84 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.470

85 Juliana Reed, Senior Manager, Environmental Water, Department of Environment, Land, Water and Planning, *Public Hearing*, 5 December 2017, p.10

86 Commonwealth Environmental Water Holder, *Submission 7*, p.3

The Committee is aware of one hypoxic blackwater event in 2015 that was caused by environmental water. This has been acknowledged by the Victorian Environmental Water Holder and is discussed in Section 2.5.3 of this chapter. Another event, in 2017, has also been attributed by some stakeholders to the mismanagement of environmental water (see Section 2.5.4).

The Victorian Government described in its submission how environmental water is used to create small-scale blackwater events that attempt to mimic natural processes:

> We recognise that a specific outcome of an environmental flow may be to inundate floodplains to improve overall ecosystem functioning by bringing organic material into the stream, and that this has the potential to create blackwater events. However, we view this as a management response mimicking a natural process with the aim of improving overall environmental health, and would not take any actions as a result. We would, however, fully expect that these risks are considered in environmental flow planning and that communications, response and any other appropriate support actions are in place to manage the consequences of any risks if they are realized.[87]

The Victorian Environmental Water Holder recognises blackwater as a possible negative outcome from environmental watering, and takes steps to avoid this.[88]

The Murray-Darling Freshwater Research Centre dismissed claims that environmental water contributed to the major hypoxic blackwater events in 2010-11 and 2016:

> There is no scientific evidence to suggest environmental watering made a contribution to hypoxic blackwater during either of these events. In fact, relative to rainfall induced runoff, environmental water delivered during 2016 was a minor proportion of total discharge throughout the [southern connected basin], being used during floods primarily to try and create local refuge areas with greater oxygen concentrations. As such, the water was delivered via irrigation channels, was of high quality, and is believed to have successfully created local-scale respite from the events ...[89]

Mr Chris Norman, Chief Executive Officer of the Goulburn Broken Catchment Management Authority stated that hypoxic blackwater events in the Goulburn Broken catchment were caused by floods:

> In recent years a number of regulated and unregulated waterways across the Goulburn Broken catchment have experienced hypoxic blackwater events, meaning there is insufficient dissolved oxygen in the water, that threatens the survival of aquatic fauna or results in their death. These hypoxic blackwater events have not been caused by environmental water management, but rather have been caused by unseasonal rainfall and flooding events, washing large amounts of organic material from the flood plain and surrounding agricultural land into these waterways.[90]

Similarly, the Mallee Catchment Management Authority stated environmental watering has not caused blackwater events within the Mallee catchment region, as:

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87 Victorian Government, *Submission 39*, p.11

88 Victorian Environmental Water Holder, *Seasonal Watering Plan 2017-18 — Section 1: Introduction* (2017), p.16

89 Murray-Darling Freshwater Research Centre, *Submission 28*, p.2

90 Chris Norman, Chief Executive Officer, Goulburn Broken Cachment Managment Authority, *Public Hearing*, 24 October 2017, p.19

- environmental watering is often undertaken at discrete wetland sites where there is little leaf litter present
- environmental water returned to the Murray River following an environmental water delivery has been carefully managed to ensure water with low dissolved oxygen is not released in an uncontrolled manner.[91]

Based on the evidence submitted to the inquiry, the Committee considers that environmental water is generally not the cause of hypoxic blackwater events.

2.5.3 2015 event—Loddon River

Since the Victorian Environmental Water Holder was established in 2011, there has only been one blackwater event acknowledged as being the result of environmental watering. This occurred in 2015 in the Loddon River and resulted in the death of three carp.

At a public hearing, Mr Denis Flett, Chairperson of the Victorian Environmental Water Holder, explained:

> In that incident it coincided with the hottest of the weather in that summer, and three dead carp were found. What happened as a result of the learning from that was that the importance of the summer fresh for ecological outcomes was still understood, but we made sure that it does not coincide with the hottest weather—that was the chief learning. It was repeated again in similar circumstances in 2017, and it was held much earlier and probably prevented a similar event that may have occurred. It was really in that case a shift of the timing, mainly—that was the learning.[92]

Similarly, the North Central Catchment Management Authority discussed the lessons learnt from the event:

> In the summer of 2015 a summer fresh was in the Loddon River delivered during the hottest days of the month. The watering caused a small scale toxic blackwater event that killed three carp at Canary Island-Leaghur Road. The CMA [catchment management authority] investigated the event to understand the likely cause and had adapted its management responses accordingly. This was tested in 2017, when under similar summer conditions and deteriorating water quality, the North Central CMA timed the delivery of a summer fresh prior to predicted hot weather to successfully mitigate against a potential toxic blackwater event.[93]

The Committee notes the impact of this event and reiterates the need for ongoing monitoring and assessment of the use of environmental water to inform future practices (see further discussion in Section 5.2 of this report).

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91 Mallee Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 8, p.5

92 Denis Flett, Chairperson, Victorian Environmental Water Holder, *Public Hearing*, 5 December 2017, p.3

93 North Central Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 9, p.3

2.5.4 2017 event—Lake Meran

The Committee heard concerns from members of the Lake Meran community about a local blackwater event that occurred in January 2017, resulting in the death of thousands of fish.

The Concerned Lake Meran Community Members detailed the event in its submission:

> On the weekend of the 8th and 9th of January 2017 the Lake Meran community and recreational users of the lake witnessed a black water event which had devastating consequences that resulted in hundreds of thousands of fish dying with the very unfortunate loss of many native fish. With community input a large cleanup exercise on the public foreshore areas took place. The remaining rotting fish and stench left Lake Meran very unattractive for recreational use thus bringing the recreational season to a premature halt.
>
> ...
>
> Over a period of six months neither the EPA [Environment Protection Authority] nor NCCMA [North Central Catchment Management Authority] has come forth with any report or findings relating to this event. Several requests have been made as to such a document. Only a few comments in newspapers and a short presentation on social media revealed that authorities claimed that this was a naturally occurring event and was purely as a result of floodwater entering the lake a few months earlier with high levels of mobilised organic matter.[94]

The Victorian Environmental Water Holder attributed the blackwater event to floods in September and October 2016.[95]

However the Concerned Lake Meran Community Members disputed that the event was caused solely by the floods, noting that the floods had occurred several months earlier.[96] At a public hearing, Mr Stephen English, a member of the organisation, told the Committee:

> The time frame between when the flood took place and when the fish died was quite large, so we have some serious doubts about the connection. Put it this way: the fish were quite happily swimming in the floodwater a couple weeks after the flood event—quite happily swimming in that water. It was only when the first hot weekend came along that it was triggered.[97]

Mr English also noted that, in contrast, blackwater events in the Wakool and Edward rivers causing fish deaths had coincided with the timing of the 2016 flood events, rather than being delayed.[98]

Mr John Pike believed the event was caused by the management of water levels:

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94 Concerned Lake Meran Community Members, *Submission 27*, p.1

95 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.8

96 Norman Condely, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.15; Stephen English, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.15

97 Stephen English, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.18

98 Stephen English, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.15

> ... mismanagement of water levels under new practices has allowed excessive vegetation growth which, when inundated with floodwater, subsequently decomposed over the following months causing major deoxygenation during hotter weather. Refusal to respond to repeated requests for findings of the investigations into the events seems to show a total lack of accountability of authorities involved. This would appear as a defence of a highly flawed plan and questionable management practices.[99]

The Committee acknowledges the concerns of the community members and the need for the Government to engage with local communities in the management of environmental water. This includes providing explanations for incidents such as 2017 blackwater event at Lake Meran to communities in a timely manner. Further potential improvements to community engagement are discussed in Section 5.4 of this report.

FINDING 4: Although environmental water directly led to a hypoxic blackwater event in one instance, it is generally not the cause. In fact, environmental water has the potential to prevent or mitigate hypoxic blackwater events in some circumstances.

FINDING 5: Events such as hypoxic blackwater can be significant and distressing to local communities. It is therefore important for government bodies to provide clear and detailed explanations for such events to affected communities in a timely manner. This did not occur with the 2017 Lake Meran blackwater event.

RECOMMENDATION 1: That the Government require relevant agencies to provide detailed reports to the community in a timely manner (in real time where possible) on the causes of significant environmental events such as hypoxic blackwater.

2.6 What can be done to prevent blackwater?

The Committee heard a number of suggestions about additional actions that could be implemented to prevent blackwater events.

Multiple submitters and witnesses called for more frequent flooding to remove organic matter from the areas around waterways and prevent it building up.

Mr Ken and Ms Jill Hooper, individuals who made a submission, told the Committee:

> Black water events caused by the breakdown of forest litter (leaves branches etc.) and vegetation, are reduced by more frequent flooding as the build-up of forest litter is not so great. I have observed that exotic plants gain a greater dominance over native plants during longer periods without flooding, thus leaving a large seed bank residue.
>
> ...
>
> More frequent flooding not only reduces the accumulation of forest litter but promotes a denser more diverse population of native understorey plants which are part of the biodiversity which the use of environmental water is designed to enhance.[100]

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99 John Pike, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.14

100 Ken and Jill Hooper, *Submission 25*, p.1

The Murray-Darling Freshwater Research Centre suggested identifying areas likely to contribute high levels of organic matter and undertaking more regular inundation as a blackwater prevention measure.[101]

Environment Victoria agreed, noting the constraints on delivering environmental water to floodplains:

> More frequent environmental watering can reduce the level of build-up. Water should be delivered during cool weather and before peak litter accumulation is reached. Increased flow can also be used to dilute floodplain discharge in receiving channels. However there are many constraints to the delivery of environmental water to floodplains ... and until these are dealt with the full benefits of environmental water as a risk management tool will not be realised.[102]

The Victorian Government noted that the potential for more frequent flooding is limited as releases of environmental water can only target parts of large floodplains or river systems.[103] In addition, controlled overbank flooding may be required, but this is currently prevented to avoid damage to private property.

The Goulburn Broken Catchment Management Authority told the Committee that:

> Environmental water management could play an effective role in reducing the risk of blackwater events if constraints to the delivery of overbank flows along our large waterways such as the Goulburn and Murray Rivers were addressed. This would allow more frequent inundation of their floodplains reducing the build-up of organic material.[104]

Similarly, the Yarra Riverkeeper Association stated:

> The current problems with 'blackwater' events that may occasionally follow from environmental flow releases are the result of restrictions on overbank flows and the lack of sufficient environmental water to release adequate flows, both of which prevent adequate flushing of excess organic matter in the system.[105]

Overbank flows also have the potential to provide other benefits such as connecting waterways to floodplains and wetlands. However, they cannot take place until an appropriate way to manage the impacts on private property can be established. This is explored further in Section 4.7 of this report.

Alternatively, the Committee heard suggestions about using controlled burning to reduce the amount of litter on riverbanks. However, Dr Darren Baldwin cautioned against the use of burning:

> In terms of burning, that has been suggested as an alternative a number of times. It has not been studied, although we have put in applications for funding on a number of occasions to look at it. But what we do know from fires in the upper catchment is that when you do flood burnt land, the water quality issues are quite severe

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101 Murray-Darling Freshwater Research Centre, *Submission 28*, p.3

102 Environment Victoria, *Submission 23*, p.6

103 Victorian Government, *Submission 39*, p.9

104 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, p.2

105 Yarra Riverkeeper Association, *Submission 22*, p.3

> downstream. You still have residual carbon, you tend to get a lot of turbidity because of the loss of vegetation and you also get noxious products associated with burning. So unless there was a clearer indication that it is not detrimental, I would not be recommending burning without some ongoing and real studies of it.
>
> The other thing I should mention is that there have been attempts to burn some of the flood plains, particularly some of the wetlands. They are really hard to start. Under natural conditions prior to European settlement most of the riverine flood plains would have been wet for a large amount of time, so large fires would have been difficult to put through somewhere like Barmah-Millewa forest, for example.[106]

The Victorian Farmers Federation believed efficient monitoring was important in managing environmental water used in blackwater prevention:

> Managing environmental flows is a complex exercise. Although, our systems are typically regulated, often water is covering significant distances to reach the desired target. For this reason, frequent monitoring of water sources, and collaborative reporting are essential for managing blackwater. The sooner the issue can be identified, the sooner environmental flows, if appropriate, can be directed.[107]

The Committee acknowledges that preventing and mitigating blackwater events is a complex process. In addition, controlled use of environmental water as a method to address blackwater is a relatively new and evolving process. As such, it is important that blackwater management is evaluated and reported on an ongoing basis.

Recommendations relating to monitoring, research and reporting can be found in Chapter 5 of this report.

Some stakeholders believed that the Government should improve communication with local stakeholders and give more consideration to local knowledge in environmental water management. For example, the Murray Darling Association believed local knowledge was essential in environmental water management for blackwater events:

> The MDA [Murray Darling Association] is of the position that environmental watering could be further informed by local government through the MDA. Such local knowledge—informed by decades of observations and experience—is essential in ameliorating the incidence and impacts of blackwater events.
>
> Additionally, inclusion of local government through the MDA—along with local land services, catchment management authorities and CEWO [Commonwealth Environmental Water Office] local engagement officers—in the planning for environmental watering invites greater public confidence in environmental watering.
>
> Environmental watering absolutely must consider local knowledge as the best way of avoiding unintended consequences inherent in blackwater events ...[108]

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106 Darren Baldwin, *Public Hearing*, 5 December 2017, p.49

107 Victorian Farmers Federation, *Submission 30*, p.5

108 Murray Darling Association, *Submission 38*, p.2

Mr John Pike, a resident of Lake Meran, spoke at a public hearing about the local blackwater event that occurred in 2017 (see Section 2.5.4), which he attributed to mismanagement of water levels. He believed that greater consideration should be given to historic local knowledge and management in the future.[109]

A review of environmental watering methods used in the 2010-11 blackwater event emphasised the need for effective collaboration with local communities:

> ... adaptive management occurs through collaboration among organisations and stakeholders, and through the timely provision of local knowledge and expertise. Difficult management decisions are more likely to be taken when there is necessary data available and when there is participatory decision making. Public acceptance and participation is pivotal to achieving effective and enduring natural resource outcomes.[110]

The need for community consultation and engagement more generally in relation to environmental water is discussed in Chapter 5 of this report.

109 John Pike, Concerned Lake Meran Community Members, *Public Hearing*, 13 October 2017, p.14

110 Robyn J. Watts, R. Keller Kopf, Nicole McCasker, Julia A. Howitt, John Conallin, Ian Wooden & Lee Baumgartner, 'Adaptive Management of Environmental Flows: Using Irrigation Infrastructure to Deliver Environmental Benefits During a Large Hypoxic Blackwater Event in the Southern Murray-Darling Basin, Australia', *Environmental Management* 61(3) (2018), p.479

3 Fees and charges

3.1 Overview

Water corporations charge for the storage, management and delivery of water. Like other users, environmental water holders must pay water corporations for these services.

The Committee found that there was a general confusion about charges on environmental water. Key agencies—including the Victorian Environmental Water Holder—stated that environmental water users pay charges at the same rate as other users. However, since environmental water is used and managed in a different way to other water, the structure of charges differs. This makes it difficult to compare the charges paid by environmental water holders with those paid by other users.

3.1.1 Policy framework

Water for Victoria is the Government's key policy for water use. It establishes four principles for determining environmental water charges:

- prices for services to environmental water holders will reflect costs
- prices are to reflect the level of services received
- prices are to provide signals for efficient and sustainable use of water infrastructure
- prices will not deter environmental watering.[111]

In August 2017, the Department of Environment, Land, Water and Planning released the *Environmental Water Charges: Information Paper*. This was a result of an earlier discussion paper sent to stakeholder organisations and a workshop in June 2017.

The information paper contains a comprehensive examination of the charges applied to environmental water in Victoria, with the intent to develop a policy framework on environmental water charges.[112]

The information paper details the historical reasons behind the inconsistencies in environmental water charges:

> The framework for providing water for the environment developed in the three parallel streams of institutional arrangements, specification of entitlements and charging arrangements. These streams evolved at different rates at different times over the past 30 years. It is not surprising that some inconsistencies and anomalies are now evident in the framework for determining environmental water charges.[113]

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111 Department of Environment, Land, Water and Planning, *Water for Victoria*, (2016), p.55

112 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.i

113 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.65

The Committee understands that the new policy framework is pending the outcome of this inquiry and further public consultation,[114] and anticipates the Government will consider the issues raised in this report.

3.2 Structure of fees and charges

The framework for environmental water fees and charges is complex. Charges vary depending on whether the water is held as an entitlement or in shares and based on what services and rights are associated with the water. In addition, charges vary between water corporations. Historical price negations have led to different charges for environmental water holders compared to other water users. In some cases, environmental water attracts a lower rate, whilst in others it is charged more.

3.2.1 Environmental water charges

In Victoria, all water users pay charges based on the water access rights they hold and infrastructure services they receive.[115] Water resource charges—including for environmental water—are paid to the water corporation that manages the resource.

In practice, environmental water incurs three main types of charges:

- storage charges (payments made to water corporations relating to the costs of operating headworks and storage systems)
- delivery charges (associated with using infrastructure to deliver water where it is required)
- resource management charges (reflecting costs associated with broader administration and reporting).[116]

3.2.2 Entitlements and shares

Environmental water charges differ depending on whether the water is held in entitlements or shares.

Where environmental water is held as an entitlement, the charging arrangements are specified in agreements negotiated when the entitlement was established. Entitlements may specify no charges, payments for certain services or full charges for headworks and delivery. As a result, charges vary between environmental water entitlements, and also vary from those paid by other water users.[117]

In some cases, the conditions in entitlements have been agreed because the water in the entitlement was recovered through infrastructure projects paid for by the Government.[118]

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114 John Lind, Senior Manager, Economic Management, Department of Environment, Land, Water and Planning, *Public Hearing*, 5 December 2017, p.13

115 Australian Competition and Consumer Commission, *Submission 34*, p.3

116 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.54

117 Victorian Government, *Submission 39*, p.23

118 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.55

Environmental entitlements are part of the environmental water reserve, which is the proportion of water allocated for environmental needs by the Minister for Water under the *Water Act 1989*.

Where environmental water is in shares, it attracts the same charges as other users. Charges for water held in shares are set by the relevant water corporation and are regulated by the Essential Services Commission.

The Victorian Environmental Water Holder has water in entitlements and shares. Holding water in shares allows the water holder to manage water resources flexibly and move environmental water to where it is most needed (see further discussion in Section 4.5 of this report).[119]

Under the Water Act, the Commonwealth Environmental Water Holder cannot hold water in entitlements. As a result, all water is held in water shares.

In addition, as delivery is not linked to a portion of land, delivery charges are typically negotiated with water corporations on a case-by-case basis.[120]

3.2.3 Goulburn-Murray Water pricing

Goulburn-Murray Water has different pricing for water shares held by 'water users' (associated with land) and 'non-water users' (not associated with land):

- for non-water users, charges in a particular river basin reflect the headworks costs specific to that basin
- for water users, charges reflect the average headworks costs in all the northern river basins, with a single price across all basins.[121]

Environmental water holders are defined as 'non-water users'.[122] As a result, they pay different rates to irrigators classed as 'water users'. The effect of this system in 2016-17 was that:

- the Commonwealth Environmental Water Holder and the Murray-Darling Basin Authority paid less for water shares than they would if they were irrigators (as they hold large volumes of Murray and Goulburn water)
- the Victorian Environmental Water Holder paid more than if it were an irrigator (because it holds more water shares in the more expensive Loddon and Campaspe basins).[123]

The Department of Environment, Land, Water and Planning in its pricing issues paper noted that:

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119 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.15

120 Victorian Government, *Submission 39*, p.23

121 Victorian Government, *Submission 39*, p.23

122 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), pp.60-1

123 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.61

> While the difference in approach has some effect on the total charges paid by the Victorian and Commonwealth water holders, the more significant issue could be that Goulburn Murray Water has established different tariffs for essentially the identical water products based on who owns the entitlement.[124]

3.2.4 Different rights and service levels

There are also differences between the charges paid by environmental water holders and the charges paid by others because environmental water holders often do not hold the same rights or receive the same services as other water users. For example:

- water held by the Victorian Environmental Water Holder is delivered on an 'interruptible' basis—that is, environmental water delivery may be reduced or stopped to meet the needs of irrigators or other users—and hence may pay lower fees than users with non-interruptible supplies
- environmental water holders have some entitlements with no guaranteed storage space in a reservoir and accordingly do not pay headworks charges.[125]

Where environmental water is delivered through natural waterways (such as rivers), the environmental water holder is not expected to pay delivery charges. This may also lead to differences in charges compared to irrigators, who may use channels and other infrastructure.[126]

Box 3.1 provides some further examples of how in some instances the charges for environmental water differ from regular users.

In its submission, Goulburn-Murray Water detailed its supply arrangements with the Victorian Environmental Water Holder:

> GMW [Goulburn-Murray Water] currently uses a supply by agreement with the VEWH [Victorian Environmental Water Holder] to provide environmental water delivery services in the Goulburn Murray Irrigation District. The agreement gives the VEWH a different level of service compared to irrigators with fully interruptible deliveries, at a fee based only on delivery share prices. This approach is consistent with the Victorian Waterway Management Strategy that requires environmental water managers to pay applicable charges for the costs incurred by storage and system operators such as GMW while storing and delivering environmental water. GMW is eager to use the experiences from the agreement negotiations and conversations with other customers as the basis for transparent and equitable ongoing tariff arrangements, as expected under *Water for Victoria*.[127]

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124 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.61

125 Victorian Government, *Submission 39*, p.23; Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.66

126 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), pp.56-7

127 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 14, p.11

BOX 3.1: Examples of different charges applied to environmental water

Reliability differences

Price discrepancies can result from variations in the amount of water made available for environmental water in low-reliability circumstances. The Murray-Darling Basin Authority told the Committee:

> The Living Murray low-reliability entitlement valleys caps are an example where there are differences in cost between an environmental water product and an equivalent product owned by other licence holders.
>
> In this situation, [environmental water holders] are paying the same price as other licence holders for a product that is effectively receiving less than half the available allocation of other lower reliability entitlement holders.[(a)]

Delivery charges

The Department of Environment, Land, Water and Planning has noted that:

> Up to 40,000 ML is delivered by the Murray Valley and 20,000 ML by the Shepparton irrigation distribution systems. These flows are delivered when there is spare capacity in the distribution network. The cost of delivering this water if standard charges were applied would be in the order of $3.5M per year.
>
> Rather than apply these standard fees, Victorian Environmental Water Holder has a contract with Goulburn-Murray Water for the delivery of environmental water through the distribution infrastructure at a variable cost per year dependent on delivery location consistent with clause 18.3 of the environmental entitlements.
>
> The Victorian Environmental Water Holder paid about $570,000 in 2015-16 to Goulburn-Murray Water to use its distribution system to deliver water for the environment in Gunbower Forest and Broken Creek.[(b)]

(a) Murray-Darling Basin Authority, *Submission 13*, p.7

(b) Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.57

The Murray-Darling Basin Authority noted that differences were a result of the complex history of pricing environmental water. It considered the main issue to resolving charge discrepancies was in defining obligations versus services:

> An obligation is attached to the right to harvest water and should not attract a charge as this water is providing a public benefit service ... In contrast a service should attract a fair charge corresponding to the level of service provided.
>
> Where the service provided is the same as a consumptive user, then the same fees and charges should apply (principle of no discrimination based on end-use of water). Where the service provided is not the same as a consumptive user, then [an] individual service agreement needs to be put in place. This approach recognises that there are occasions where environmental water managers are seeking a different service from consumptive users and therefore fees and charges need to reflect the cost of providing that different service.[128]

128 Murray-Darling Basin Authority, *Submission 13*, p.6

The Victorian Farmers Federation believed that irrigators were effectively 'subsidising' environmental water holder due to the discrepancies in charges.[129] At a public hearing, Mr Richard Anderson, Water Council Chair of the Victorian Farmers Federation, explained:

> There is a huge anomaly, especially in the north of the state, between the storage fees of the environmental water holder and the irrigators. Irrigators on the major systems effectively are subsidising the environmental water holder's storage fees by 20 per cent. It get backs to the old days prior to environmental water entitlements. It gets back to basin pricing versus system pricing, and basically the environmental water holders—in particular the commonwealth, with the volume they have got—are being subsidised to the tune of about 20 per cent. It goes back to prior to the unbundling, when water was always attached to land. Now we have got 40 per cent of the water not attached to land, so they get basin price and they are being heavily subsidised by irrigators who still have the water attached to their land. It is an issue. I am not sure that the irrigation sector should be subsidising the Commonwealth Environmental Water Holder—or the Victorian Environmental Water Holder, for that point—on behalf of the rest of the constituents within Victoria and certainly in the basin.[130]

3.2.5 Commonwealth Environmental Water Holder rates

Historical pricing arrangements have also led to different charges for the Victorian and Commonwealth environmental water holders. This is primarily because the Commonwealth Environmental Water Holder cannot hold water in entitlements under the *Water Act 1989*.

In its submission, the Commonwealth Environmental Water believed that modifying existing Commonwealth entitlements is contrary to the public interest:

> The expectation is that the Commonwealth's water entitlements held for environmental use will not be enhanced or diminished relative to like entitlements held and used for other purposes, except by agreement to facilitate improved environmental watering. This includes changes to fees and charges, access to allocations, and the capacity to use, trade, and carryover, compared to like entitlements held for other purposes, including irrigation. Any rule changes that disadvantage the Commonwealth's holdings compared to equivalent entitlements held by other users could devalue this public asset and would be contrary to Basin States' commitments under the 2013 IGA [Inter-governmental Agreement].[131]

It further stated:

> State and Commonwealth agencies that regulate fees and charges should consistently apply the rules to facilitate and support an effective water market. Any changes to state government licencing arrangements, including fees and charges that disadvantage the Commonwealth's holdings compared to equivalent entitlements held by other users could devalue this public asset and would be contrary to Basin States' commitments under the 2013 IGA [inter-governmental agreement]. Changes

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129 Victorian Farmers Federation, *Submission 30*, p.9

130 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing*, 5 December 2017, p.43

131 Commonwealth Environmental Water Holder, *Submission 7*, p.4

> would detrimentally impact my ability to effectively manage the Commonwealth's portfolio, compromising environmental outcomes and necessitating further water recovery to meet Basin Plan objectives.[132]

Similarly, the *Environmental Water Charges: Information Paper* found:

> The current differences in water charges paid by the VEWH [Victorian Environmental Water Holder] and the CEWH [Commonwealth Environmental Water Holder] reflect the different contractual arrangements between the governments and the water corporations. These arrangements should not be over ridden by general pricing principles that have been developed to apply water entitlements that provide private goods and services.[133]

FINDING 6: Charges paid by environmental water holders differ from those paid by other water users for a variety of reasons, including historic agreements, pricing structures, varying rights associated with the water and the use of different infrastructure. In some cases, environmental water holders pay more than irrigators in the same river system and in other cases they pay less.

3.3 Improving environmental water charging arrangements

3.3.1 User pays or impactor pays

'... the established independent regulatory process is focussed on pricing regimes for traditional water users rather than pricing for environmental water needs. These issues need further investigation, discussion and deliberation to ensure equitable outcomes for all.' [134]

The Committee received mixed opinions from stakeholders on whether the charges for environmental water should differ from other users.

Some believed that environmental water holders should pay higher rates, as the changes to water allocations resulting from environmental water programs have negatively affected other water users.

Other stakeholders argued that environmental water is required to mitigate the impacts of human interventions to enable irrigation (see Section 1.3 of this report) and accordingly irrigators should subsidise environmental water charges. This is referred to as 'impactor pays' or 'beneficiary pays' pricing.

Several environmental groups advocated that environmental water should be charged at a lower rate than regular water users, on a beneficiary-pays basis.[135] For example, the River Basin Management Society noted the public benefit provided by environmental water:

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132 Commonwealth Environmental Water Holder, *Submission 7*, p.7

133 Department of Environment, Land, Water and Planning, *Environmental Water Charges: Information Paper* (2017) (Victorian Government, *Submission 39*, Appendix 1), p.60

134 Environment Victoria, *Submission 23*, p.9

135 For example, see Yarra Riverkeeper Association, *Submission 22*, p.3 Friends of Lake Wallace, *Submission 12*, pp.2-3 Goulburn Valley Environment Group, *Submission 4*, p.3 People for a Living Moorabool, *Submission 36*, p.8

> Where 'discounted' fees and charges are currently being applied to environmental water, this has generally been in recognition of the considerable investment that government has already made through water recovery programs i.e. the water cost was paid upfront rather than on an ongoing basis.
>
> Under the current arrangements, the fees and charges associated with environmental watering in Victoria are paid from State revenue and are therefore shared across the general tax-paying community. An argument may well be made that local water users receive a disproportionately high benefit from the environmental watering program (e.g. through the maintenance of ecosystem services in their water supply system), and that it would be fairer to impose a greater share of the environmental watering fees and charges on other local water users, in turn reducing the financial burden of these fees and charges on the general community.[136]

Mr Mark Stacey, Immediate Past President of the River Basin Management Society, further argued:

> ... there is a pretty important principle that needs to be applied when setting fees and charges, and that is a beneficiary-pays principle. That would say that users who seek private benefits from the water and users who seek public benefits from the water would naturally have different fees and charges associated with those. It is appropriate for public benefits to be financially supported by the public, and we would very much advocate that we want to avoid an arrangement where we are selling off environmental water to cover the fees and charges associated with environmental watering programs, because that essentially takes quite a backward step.[137]

Goulburn-Murray Water also supported a beneficiary-pays approach:

> A beneficiary pays model could theoretically be appropriate in the GMW [Goulburn-Murray Water] region, particularly as the Murray-Darling Basin Plan will generate sustainable consumptive water use. Any on-going environmental impact and remediation effort has been accepted by governments as appropriate to achievement of an optimal triple-bottom-line outcome, and implicitly leads to a situation in which appropriate government funding is provided via general taxation to ensure community expectations are delivered.
>
> The current state of the environment is a legacy resulting from society preferences over time, with the benefits from improvements to the environment being enjoyed by society as a whole and as a public good. This suggested approach matches the beneficiary pays model recommended by GMW.[138]

In contrast, Mrs Jan Beer and Mr Ken Pattison, individuals who made a joint submission, discussed the financial impacts of environmental water of irrigators in the Goulburn Murray Irrigation District:

> Removing irrigation water for environmental use from the Victorian irrigation districts and leaving behind the on-going costs of this acquired water has had a devastating financial effect on individual irrigators, their communities and the Goulburn Murray Irrigation District. Thousands of farmers are now confronted

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136 River Basin Management Society, *Submission 17*, p.6

137 Mark Stacey, Immediate Past President, River Basin Management Society, *Public Hearing*, 5 December 2017, pp.34-5

138 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.12

> with paying delivery shares despite have very little or no water left and also with paying increasingly higher Goulburn Murray Water fees as GMW attempts to remain sustainable with an ever decreasing resource. Fixed fees make up a larger percentage of GMW'S income than water delivery and the EWH [environmental water holder] pays for only a small percentage of these fixed fees as it utilises mainly the main river channel for delivery but pays very little for this service.[139]

Their submission also highlighted Goulburn-Murray Water's submission to a Senate Select Committee on the Murray Darling Basin Plan in 2016. This submission noted that, due to the size of environmental water entitlements:

- environmental water entitlements have the potential to distort water markets due to changes in water resource availability and obligations
- environmental water cannot be accommodated at a minimal marginal cost by adapting delivery schedules to suit the operation of the water system.[140]

Further, other stakeholders considered that environmental water should be treated and charged at the same rate as regular users (referred to as 'user pays' pricing). In its submission, the Australian Competition and Consumer Commission considered that environmental water holders should be treated as regular water users, including 'paying appropriate and transparent charges for water infrastructure services provided for held environmental water'.[141]

The Commonwealth Environmental Water Holder also supported equal charges for environmental water:

> I pay for services used on a 'user pays' basis and support non-discriminatory behaviour consistent with the principles set out in the National Water Initiative. This is particularly pertinent when considering that I hold a significant public asset (currently worth over $3.2 billion) and I am required to manage this asset in an efficient, effective and accountable way according to the requirements established under the *Public Governance, Performance and Accountability Act 2013*.
>
> Environmental water users should not be required to pay more for services compared to other water users, pay for services not used, or be required to subsidise other network customers. I support the role of independent pricing regulators (the Essential Services Commission in Victoria) to determine fair and transparent pricing of water entitlement and river infrastructure use, fees and charges.[142]

Similarly, the Kerang Lakes Land and Water Action Group stated:

> Collectively Environmental Water Holders are essentially Australia's largest single irrigator. Whilst they choose to apply water in a manner that does not generate any actual monetary value they should pay the same fixed and variable water costs as irrigators. This will require the relinquishment of large volumes of water onto the water market breaking the price monopoly, creating more capacity in storages reducing the likelihood of spill determinations and spreading the cost recovery base to all water users.[143]

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139 Jan Beer and Ken Pattison, *Submission 9*, p.3

140 Goulburn-Murray Water, cited in Jan Beer and Ken Pattison, *Submission 9*, p.4

141 Australian Competition and Consumer Commission, *Submission 34*, p.3

142 Commonwealth Environmental Water Holder, *Submission 7*, p.7

143 Kerang Lakes Land and Water Action Group, *Submission 20*, p.13

The Victorian Farmers Federation supported addressing these discrepancies, recommending water users' fees are reduced to align with non-water users' fees in the Goulburn-Murray system (see Section 3.2.3 of this report).[144]

This reflects a similar recommendation by the Australian Competition and Consumer Commission made during its review of the Water Charge (Infrastructure) Rules 2010. The Commission recommended a 'non-discrimination rule' requiring water corporations to:

- levy the same charge for an infrastructure service for all water users, unless there is a reasonable basis for the difference
- offer the same infrastructure service to all users unless there is a reasonable basis not to.[145]

The Committee believes that these issues should be carefully considered by the Victorian Government during development of the environmental water charges policy framework.

3.3.2 Improving transparency

> *'This lack of information about the fees paid by environmental water holders, together with some lack of clarity about the requirements on infrastructure operators to publish information on these charges, has made it difficult for the ACCC [Australian Competition and Consumer Commission] to enforce the Commonwealth water rules in this area and to improve the quality and comprehensiveness of information available on the fees and charges paid by environmental water holders.'* [146]

A key issue raised during the inquiry was the lack of transparency and data about how much environmental water holders are paying in charges.

The Australian Competition and Consumer Commission's submission to the inquiry made a series of observations and recommendations on environmental water charges. It acknowledged that the lack of clarity about fees had caused stakeholder concerns about inequitable treatment for environmental water holders.[147]

The Commission noted that the Victorian Environmental Water Holder publishes some information on infrastructure fees in its annual report. However, it considered:

> ... this information is not necessarily sufficient to assess whether it pays the same charges for water harvesting, storage, delivery, trade and other services as other water users or to assess the extent to which 'users pays' principles are being implemented.[148]

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144 Victorian Farmers Federation, *Submission 30*, p.9

145 Australian Competition and Consumer Commission, *Submission 34*, pp.3-4

146 Australian Competition and Consumer Commission, *Submission 34*, p.3

147 Australian Competition and Consumer Commission, *Submission 34*, p.3

148 Australian Competition and Consumer Commission, *Submission 34*, p.3

It further noted the Water Charge (Infrastructure) Rules 2010 require water corporations in the Murray-Darling Basin to publish details of water charges. However, on a recent review of the rules, the Commission found these details are not always published, particularly for environmental water charges.[149]

The Victorian Environmental Water Holder's annual report contains financial information on fees paid during the year. However, it does not provide further information outside whether the fees were for storage or delivery. In addition, the report does not distinguish between the charges allocated to entitlements or water shares.

To address these issues, the Australian Competition and Consumer Commission recommended that the Government require water corporations in Victoria to:

- include environmental water charges on their schedule of charges and provide details about the charges
- levy the same charge for infrastructure services provided to environmental water holders and other customers, unless there is a reasonable basis for different charges.[150]

In the Committee's view, implementing these recommended changes would address the issues stakeholders raised regarding transparency. More transparent reporting would also allow for ongoing monitoring and analysis of charges to determine whether further reviews are required in the future.

The Committee notes that an action under *Water for Victoria* is to ensure clear and transparent charging arrangements.[151] Providing appropriate information on environmental water charges would address a number of the concerns raised during this inquiry.

149 Australian Competition and Consumer Commission, *Submission 34*, p.3

150 Australian Competition and Consumer Commission, *Submission 34*, p.3

151 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.55

4 Management and use of environmental water

4.1 Overview

As noted in Section 1.4 of this report, environmental water has the potential to bring a range of benefits to the environment and to Victorian communities. However, these benefits may be reduced if water is not managed efficiently and effectively. Using environmental water efficiently can also reduce the amount of water required to achieve environmental outcomes, meaning that more water may be available for irrigators.

It is also important to identify ways to use environmental water that minimise negative side-effects on the environment, local communities and other water users.

Key issues relating to the management and use of environmental water raised by submitters and witnesses and discussed in this chapter include:

- the timing of environmental water flows, including the use of 'carryover' from one year to the next
- how 'spilled water' should be factored into environmental water allocations
- the impact of water trading
- potential infrastructure that could assist environmental water
- the potential benefits of overbank flows
- the need to limit potential negative consequences of environmental water use.

Overall, the Committee notes the importance of balancing the needs of the environment with the needs of irrigators and local communities. Monitoring the impacts of environmental watering programs on all stakeholders is essential to ensure that an appropriate balance is occurring and that unintended negative consequences are avoided. Additional research and monitoring may also enable more efficient use of environmental water.

Potential areas for more monitoring and research are discussed in Chapter 5 of this report.

4.2 The timing of environmental water flows

A key component of environmental water management is the storage of environmental water for release at a time best suited for environmental purposes. In some cases, environmental water is stored in and flows through the same infrastructure used by other water users (such as irrigators and households).

A number of stakeholders suggested to the Committee that this could result in problems for irrigators, due to capacity constraints. If water storages are holding environmental water, they have less capacity to store water for irrigators. Similarly, when environmental water is travelling down rivers and channels, these waterways have less capacity to carry water for irrigators.

Based on these and other concerns, the Committee heard a variety of views about the timing of environmental water use.

4.2.1 When should environmental water be released?

The timing of environmental water releases can be important to achieve the greatest benefit from their use. Mr Chris Bromley, a resident of central Victoria, explained:

> ... the timing of environmental flows is at least, if not more, important, than the actual amount of water being released. It is essential that these releases be made at times that will maximise the advantages to native species, particularly in relation to their breeding cycles.[152]

Using environmental water to create high water flows in late winter and early spring can be important for ecological reasons, such as stimulating the breeding cycles of native fish and platypuses. Creating high water flows at this time of year makes the flow pattern more closely resemble natural flow patterns (see Figure 4.1 below). It also helps to mitigate blackwater events by removing organic matter from the floodplain when temperatures are lower (see Section 2.5.1 of this report).

Figure 4.1 How environmental water changes the timing of water flows

Source: Environment, Natural Resources and Regional Development Committee, adapted from Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.11

152 Chris Bromley, *Submission 29*, p.1

There can also be benefits to releases at other specific times of the year. For example, 'pulses' of environmental water in summer can be useful to assist fish movement, increase the levels of dissolved oxygen in water and reduce salinity levels.[153]

Several participants in this inquiry expressed concern about environmental water releases reducing waterway capacity for other users.

> *'As an irrigator it is paramount that water is available when I require it. Pasture production relies on watering when required as huge production losses can occur with stressed pastures.'* [154]

The Victorian Farmers Federation explained the importance of irrigation water to farmers. The organisation argued that access to irrigation water at key times of the growing season is important 'for the socio-economic sustainability for our local businesses and communities'. It called for the needs of irrigators to be recognised and considered in developing environmental watering plans.[155]

The Commonwealth Environmental Water Holder explained that he adopts a 'good neighbour' policy that generally reduces such conflicts. However, he noted that competition for space may still occur:

> ... I generally provide environmental water outside the irrigation season which helps to mitigate delivery risks and can benefit irrigators by freeing up channel capacity during periods of peak demand. In the event of channel capacity becoming limited, I can be flexible about how and when environmental water is ordered, to minimise any potential impact on others. However, at times of critical environmental need, I may need to assert my right to access my share of channel capacity, just as the previous owner of the water would have done.[156]

The Victorian Government similarly told the Committee:

> ... where there is competition for available channel capacity, and the timing of delivery is critical to meet other use requirements (e.g. peak irrigation demand), environmental managers will delay delivery of environmental water when timing of supply for the environment is not critical.[157]

Nonetheless, Goulburn-Murray Water noted that competition for channel capacity between environmental water holders and other users had occurred previously in its catchment:

> GMW [Goulburn-Murray Water] observed a river capacity event in 2012, when an environmental flow in the Goulburn River downstream of Lake Eildon coincided with a rapid increase in irrigation demand following unseasonably warm weather. The GMW river operators negotiated with the Goulburn Broken Catchment Management Authority (acting as the environmental water manager) and the GMW irrigation

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153 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.3; Victorian Recreational Fishing Peak Body, *Submission 31*, p.2; Melbourne Water in Victorian Government, *Submission 39*, Appendix 16, p.2

154 Neville Goulding, *Submission 2*, p.1

155 Victorian Farmers Federation, *Submission 30,* p.6

156 Commonwealth Environmental Water Holder, *Submission 7,* p.5

157 Victorian Government, *Submission 39*, p.16

> scheduling teams to share the available capacity. While the resolution affected both water users, this demonstrates that a long-planned water order could be affected by a very short-term demand.
>
> GMW is aware of the potential for similar capacity limitations to occur elsewhere in the Murray-Darling Basin water systems. Although, environmental water managers adopt a 'good neighbour' approach and adjust their watering events, there is a potential that this could compromise the effective use of environmental water.[158]

Goulburn-Murray Water suggested that conflicts may become more common as the demand for environmental water increases.[159]

Mr Neville Goulding, a farmer from northern Victoria, believed that the current arrangements were reasonable:

> The way it is at the moment, irrigation has the use of the water when they want to use it and environment fits in with that. A key message from [North Central] CMA [Catchment Management Authority] at the moment is: yes, we want the environmental water, but we will use it when it does not impact on productivity out of the consumptive pool. It is terribly important. I do not have an issue with the costs at the moment, providing I can get my water when I want it, and the environment looks after us in that respect.[160]

As noted in Section 1.5 of this report, the Committee considers that recognising and balancing the differing needs of all water users (including the environment and irrigators) should be a key principle underlying environmental water management. The evidence presented to the Committee suggests that this occurs with respect to waterway capacity. The Committee considers it important that this approach continue.

4.3 Carryover and its impacts

> ***'Carryover rules allow for the efficient achievement of environmental outcomes under the [Murray-Darling Basin] Plan. Without this capability, additional water recovery would be required, with its associated economic and social impact on rural communities.'*** [161]

In some systems, water holders (including environmental water holders) are permitted to 'carry over' unused water allocations from one water season to the next in some circumstances. This means that the carried-over water is stored in the dam from one water season to another. This is an important tool for both environmental water holders and irrigators.

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158 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.8

159 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.8

160 Neville Goulding, *Public Hearing,* 13 October 2017, p.24

161 Victorian Government, *Submission 39*, p.16

4.3.1 The benefits of environmental water carryover

The River Basin Management Society explained that:

> Environmental water holders use carryover with careful planning to respond to:
>
> - Dry periods, when annual water allocations would be insufficient to achieve ecological objectives. In drought times carryover is absolutely vital, to stretch available water out over a few years and meet critical water needs to keep fish populations and other values alive.
> - Wet periods, when natural watering (i.e. from rainfall) is sufficient to meet ecological objectives, and water in the environmental account can be reserved for future.
> - Circumstances where there is difficulty in delivering the full planned flow event due to operational constraints, and the flow event therefore needs to span multiple water years.
> - Circumstances where environmental watering is required early in the season, before allocations have been made available (e.g. as a preventative action to address a blackwater threat).[162]

As noted in Section 4.2.1 of this chapter, environmental water is often used in late winter or spring. However, the water season each year finishes on 30 June. Carryover allows environmental water to be held over for those additional months from June until spring. It also resolves administrative problems from the fact that the year's allocations may not have been determined by late winter or early spring when environmental water holders wish to use the water.

Carryover can be used by environmental water holders to build up larger quantities of water. These can be important to achieve long-duration watering events or to provide repeated watering. These are sometimes required for ecological reasons.[163]

In addition, carryover is important as a way to manage risk. As the Commonwealth Environmental Water Holder explained, 'Water that is reserved in good years can be used to mitigate the risk of environmental damage during drier periods.'[164] The Mallee Catchment Management Authority illustrated this benefit:

> Perhaps the best example of this was during 2015-16, when the Mallee region experienced a very dry season, with no allocation made to the Wimmera-Mallee wetland environmental water entitlement. Despite this, carryover from previous years meant there was still environmental water available in 2015–16. Deliveries were made to 24 wetlands in the Mallee area, in spring 2015 and autumn 2016, with some wetlands receiving water once and others receiving water twice. Due to the dry conditions, watering was mostly of smaller parts of the wetlands to provide drought refuge in the landscape.
>
> Many different animals (such as lace monitors, kangaroos, wallabies, turtles, carpet pythons, ducks, grebes, stilts and other waterbirds, frogs, yabbies and eastern longnecked turtles) used the Wimmera-Mallee wetlands in 2016–17. Vegetation (both

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162 River Basin Management Society, *Submission 17*, p.4; see also Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.14

163 Victorian Government, *Submission 39*, p.13; Denis Flett, Chairperson, Victorian Environmental Water Holder, *Public Hearing,* 5 December 2017, p.11

164 Commonwealth Environmental Water Holder, *Submission 7,* p.4

> submerged in the wetlands and on the banks, including nardoo, water milfoil and water ribbons) has responded well at the wetlands that were watered or naturally filled (via above average rainfall in winter 2016-17) and is contributing to the improved environmental conditions at these wetlands.[165]

The Victorian Environmental Water Holder provided further examples of situations in which carried-over water had been critical to meet environmental objectives.[166]

Carryover reduces the amount of water required to achieve environmental objectives. Without carryover, environmental water managers would need to purchase more water from other sources or would need to recover water through other means to achieve the same outcomes.[167]

4.3.2 The impact of environmental water carryover

'By carrying over large volumes of water, environmental water holders are significantly reducing dam capacity to collect and store inflows and increasing the risk of irrigators losing their carried over water in spillable water accounts.' [168]

Some submitters and witnesses were concerned that the environmental water carryover could reduce the amount that irrigators could carry over. When an inflow of water to a reservoir or storage is expected and there is not enough space to store it, a portion of the previously stored water is 'spilled' to make room for the new water (that is, the water is released from the storage to flow through the system). This spilled water is deducted from carried-over allocations (including those of both irrigators and environmental water holders). The presence of carried-over environmental water increases the risk of a spill, which will result in both environmental water holders and irrigators losing some of their carried-over water.

The Kerang Lakes Land and Water Action Group noted the importance of carryover for farmers (and the significance of its loss):

> Carryover as a risk management tool intended to provide some level of continuity to irrigators; especially horticulturalists with permanent plantings and livestock producers with decades of selective breeding genetics to preserve, to extend the critical decision making timeframes beyond seasonal weather patterns ensuring the survival of plantings and livestock during drought and dry spells.[169]

The Committee heard that the total volume of stored environmental water is relatively small. The Commonwealth Environmental Water Holder indicated that 'On average, the volume of Commonwealth environmental water held in all major storages accounts for less than 5 per cent of total capacity.'[170] Similarly, the Victorian Environmental Water Holder told the Committee:

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165 Mallee Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 8, p.8 (with sources)

166 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.12

167 River Basin Management Society, *Submission 17*, p.4; Victorian Government, *Submission 39*, p.17; Amber Clarke, Director, Waterway Programs, Department of Environment, Land, Water and Planning, *Public Hearing,* 5 December 2017, p.3

168 Kerang Lakes Land and Water Action Group, *Submission 20*, p.14

169 Kerang Lakes Land and Water Action Group, *Submission 20*, p.14

170 Commonwealth Environmental Water Holder, *Submission 7,* p.4

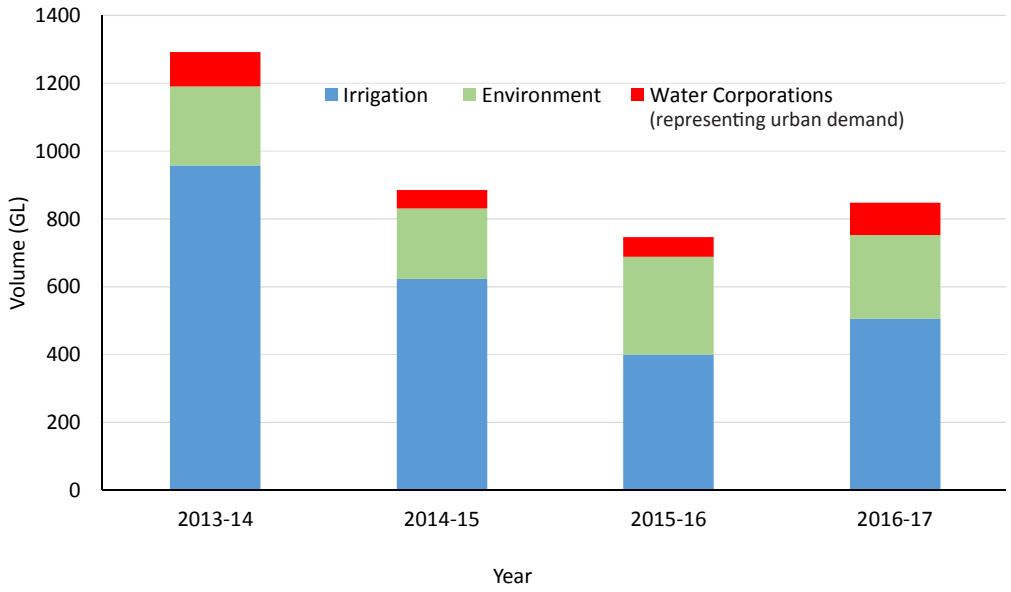
> On average the VEWH [Victorian Environmental Water Holder] carries over between 100 and 200 gigalitres per year in Victoria. The VEWH's carryover is only a minor component of the total volume of water carried over in Victoria each year. For example, in the Murray, Goulburn and Campaspe systems, the volume of water that the VEWH carried over from 2015-16 represented 6.1 per cent of total carryover by all water users. In the same year VEWH carryover represented less than 1 per cent of the 7,070 gigalitres of storage available to Victoria in Dartmouth Dam, Lake Hume, Lake Eildon and Lake Eppalock. More broadly, carryover by all environmental water holders in northern Victoria (i.e. VEWH, CEWH [Commonwealth Environmental Water Holder] and MDBA [Murray-Darling Basin Authority]) is significant, but less than held by irrigators.[171]

The Australian Competition and Consumer Commission told the Committee:

> Data from the Victorian water accounts shows that as an individual user, VEWH's [the Victorian Environmental Water Holder's] use of carryover under its bulk environmental entitlements is substantially smaller than aggregate carryover by water share holders. Despite carryover being an important tool for VEWH, in 2013-14 and 2014-15 VEWH's share of carryover in the Goulburn and Vic Murray Basins has totalled at most 16 per cent of the total amount carried over by all water users. More broadly, of the 856 GL carried over by all water users in the Goulburn and Murray system, 247 GL (28 per cent) was carried over by environmental water holders (including CEWH [Commonwealth Environmental Water Holder] and VEWH).[172]

Figure 4.2 shows the volume of water carried over for the environment compared to other uses.

Figure 4.2 Water carried over, broken down by purpose, since 2013-14



Source: Environment, Natural Resources and Regional Development Committee, adapted from Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.14 (with sources)

171 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.14 (with sources)

172 Australian Competition and Consumer Commission, *Submission 34*, p.5 (with sources)

Despite comprising a relatively small portion of carried-over water, environmental water can still have an impact on other water users. Mr Rob Rendell from environmental consulting firm RMCG stated that carryover has led to more water being spilled.[173] The Victorian Farmers Federation noted several instances where environmental water had been carried over and a spill had occurred.[174] Such spills mean that water carried over by both environmental water holders and irrigators is lost.

On the other hand, water carried over by irrigators also reduces the amount that environmental water holders can carry over and increases the risk of carried-over environmental water being spilled. People for a Living Moorabool therefore advocated for carryover provisions to only be available to environmental water holders in the Moorabool system (except in extreme circumstances), as the group considered the system to be particularly stressed as a result of water being extracted for agriculture.[175]

Overall, the Victorian Government told the Committee:

> Victoria's carryover rules have been developed to provide for the equitable treatment of all water users. These rules have been reviewed several times to evaluate their effectiveness. These reviews have demonstrated that the carryover of environmental water does not impact on other users.[176]

Mr Richard Anderson from the Victorian Farmers Federation told the Committee:

> Once we start segregating and saying, 'This type of water share has these rights, and this one has those rights', all you do is add to that confusion and mismatch of types of entitlements that are out there. So there are carryover provisions on water shares on most of the systems where they allow carryover. There has under the previous government been a review of the carryover rules. There were a couple of minor amendments to those carryover rules, but they are pretty much well understood now.[177]

Attaching the same rights to environmental water as to other water entitlements may also be important to enable trading on the water market (see Section 4.5 of this chapter). As Environment Victoria told the Committee, 'If the characteristics of environmental water holdings were changed, for example with respect to carryover rules, this would make trade between different sectors extremely difficult.'[178]

Based on the evidence received, the Committee does not see a need for changes to carryover provisions.

FINDING 7: Environmental water holders have access to a number of tools to control when environmental water is released. This includes access to storages and waterways also used by other users and the right to 'carry over' unused water allocations from one year to the next. These tools and rights are important to achieve the best environmental outcomes with environmental water.

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173 Rob Rendell, Environmental and Agricultural Consultant, RMCG, *Public Hearing,* 5 December 2017, pp.19, 20

174 Victorian Farmers Federation, *Submission 30,* p.7

175 People for a Living Moorabool, *Submission 36*, p.6

176 Victorian Government, *Submission 39*, p.12

177 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, pp.41-2

178 Environment Victoria, *Submission 23*, p.7

FINDING 8: While environmental water storage and release do impact on the availability of water for irrigators at times, environmental water holders consider the needs of irrigators as well as the environment and try to minimise the impact on irrigators where possible.

4.3.3 How should environmental water usage differ when there is a shortage?

Different conflicts can arise when there is a shortage of water. At such times, environmental water holders and irrigators may be competing for allocation of the water rather than waterway or storage space.

The Committee heard varying views on how environmental water allocations should be treated when there is a shortage of water. Some submitters and witnesses considered that a portion of environmental water shares should be made available to irrigators during a shortage. For example, Mr Neville Goulding argued:

> ... when it is a dry year the environment knows how to handle itself, whereas farmers really need water during dry times to maintain stocking numbers and production, as in dairy or in the case of permanent plantings, so it would be great to have environmental water available for consumptive use during dry times, but during wet periods it would be great to take advantage of it to add environmental water on top of natural flows to get those areas that don't get water normally to be flooded.[179]

Mr Barry Bishop argued that this approach would more closely follow nature and would be beneficial to irrigators:

> ... in a wet season, when generally the forest would be flooded, the environmental water managers could flood the forests and therefore that would be fine, and they could utilise the water market from producers who in a wet year may want to temporarily trade some of their water—a good arrangement. On the reverse, in a dry year, when the forest historically would never be flooded, the environmental water holder has plenty of water and they can trade that back into the productive sector, which would make a much more balanced approach to both the environment and the productive sector.[180]

In response to this idea, however, Mr Simon Casanelia from the Goulburn Broken Catchment Management Authority told the Committee:

> In relation to trying to decide whether we could use more water in wet years versus using less in dry years, that is factored into it. But I guess, like farmers, during wet years a lot of the flows that we wish to provide with environmental water are sometimes met. Again, during those dry times when rivers, regulated rivers in particular, are far more stressed because of the regulation, we need environmental water to maintain the health of them, so there are limited opportunities perhaps in providing the scenario that you are putting forward.[181]

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179 Neville Goulding, *Submission 2*, p.1

180 Barry Bishop, *Public Hearing,* 13 October 2017, pp.33-4; see also Barry Bishop, *Submission 8,* p.2

181 Simon Casanelia, Environmental Water and Wetlands Manager, Goulburn Broken Catchment Management Authority, *Public Hearing,* 24 October 2017, p.21

The Committee notes that, under current arrangements, environmental water allocations are automatically reduced when there is less rainfall. The largest source of environmental water is 'above cap' water (that is, water left over after limits on consumption have been reached). This water source is the first affected by climatic variations, meaning that the volume of environmental water available automatically decreases when there is less rainfall.[182] All water shares in storages (including environmental water and irrigation water) are reduced proportionally when less water is available, meaning that this water source is also reduced when there is a shortage. There is already, therefore, a substantial reduction in environmental water when there is less water to go around.

The Committee also heard arguments that it is important for environmental water shares to have the same rights as other users in order to facilitate water trading (see Section 4.5 of this chapter). Putting conditions on environmental water shares limiting their use during dry periods may significantly limit environmental water holders' capacity to trade their allocations.

In addition, when there is a water shortage, the Minister for Water has the power to intervene and alter water rights, including environmental water rights.[183] This can be used to assist irrigators to get a larger share of water when necessary.

4.4 Spilled water

As discussed in Section 4.3.2 of this chapter, water managers sometimes release certain amounts of stored water (called a 'spill') to make additional capacity in storages when inflows of water are anticipated. Water released in spills flows through the river system.

When a spill occurs, the spilled water is deducted from the pool of carried-over water (where carryover is permitted). The spilled water is deducted from the accounts of both environmental water holders and irrigators.

Some submitters and witnesses argued that spilled water should be deducted from environmental water accounts in the first instance.[184] They argued that the environment receives a benefit from the spilled water, whereas irrigators do not. For example:

> Whilst we understand the VEWH [Victorian Environmental Water Holder] requires flexibility in managing their resources, we need to acknowledge the benefit the environment receives regardless of the timing of release. Any spilled water ultimately flows to the environment, and to the desired area at the discretion of the environmental water holder.[185]

The Victorian Farmers Federation considered that spills should be aligned with environmental watering priorities where possible and then deducted from environmental water accounts, rather than from both environmental water and irrigators' accounts:

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182 North East Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 10, p.3

183 *Water Act 1989*, s.33AAA

184 Kerang Lakes Land and Water Action Group, *Submission 20*, p.16

185 Victorian Farmers Federation, *Submission 30,* p.7

> ... organised spills [to make space for anticipated inflows] often mirror the environmental water priorities and at a time which is similar to their seasonal watering plans. For this reason, the VFF [Victorian Farmers Federation] propose the inquiry consider managing regulated releases to correspond with environmental watering events and this water should be drawn from their seasonal determination because it is water excess to their entitlement. This approach continues to allow environmental water holders to manage environmental water at a time of their discretion.
>
> In the current framework, environmental water holders attain the benefit of regulated spills without cost of coming from their entitlement. This benefit comes at the expense of irrigators as the environmental water holder is using an inequitable share of dam space (when these spills are added to their entitlement).[186]

The organisation argued that environmental water holders should be offered a reduction in overall storage fees in compensation for this change.[187]

On the other hand, the Victorian Environmental Water Holder stated that the timing of water spills may not match environmental needs, so that there may be limited environmental benefits from a spill:

> The success of environmental watering in a waterway relies on the timing, magnitude and frequency of flow—much like how agriculture requires water to be applied at the right time and in the right amount. For benefits to occur—such as triggering fish to move to feed and breed—water must be released at a particular time, in a certain amount, for an adequate number of days ...
>
> To achieve environmental objectives the timing of environmental watering events is as critical as the volume delivered. For example, a high flow event in July will be less effective than a similar magnitude event in September because native fish and plants are cued to breed and grow in spring when conditions are warmer.[188]

It was also argued that it is important for environmental water to have the same rights as other water to enable it to be effectively traded on a market (see Section 4.5 of this chapter).

Dr Mark Bailey from Goulburn-Murray Water told the Committee:

> ... there are arguments on both sides. I think the key is to put that into the public arena. I do not know that it is necessarily being discussed enough and that there has been enough recognition of pros and cons from both sides of the argument going forward. I think it is worth doing that as we go forward.
>
> ... I think it would be good for the environmental water holders, the water corporations and the governments to actually come out and explain, 'This is how it's operating. This is the reason why it is', and perhaps invite comments about that. I think Water for Victoria, which is the currently strategy document, is offering those opportunities, but it needs to be explored a bit more.[189]

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186 Victorian Farmers Federation, *Submission 30,* p.8; see also Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, p.43

187 Victorian Farmers Federation, *Submission 30,* p.8; Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, p.43

188 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.11

189 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, p.15

Section 5.3 of this report contains further discussion of the need for greater communication with the public about environmental water policies and practices.

4.5 Water trading

> *'Together, carryover and trade have been demonstrated time and time again to provide a more efficient use of environmental water and therefore reduce the amount of water that will need to be set aside for environmental purposes to achieve a given level of environmental outcome.'* [190]

Water holders are permitted to buy and sell water rights. This includes permanently selling a water share to another person or selling a portion of a water allocation in a particular year.

This trade is one way to manage the competing demands for water from different users. Water is sold on a market where the price varies according to supply and demand. This is intended to encourage higher-value or more critical uses of water where water is more scarce and therefore more expensive. The ability to buy water can also be important for some users to manage times of water shortage.

Environmental water holders are also able to trade in the water market. The Victorian Environmental Water Holder regularly trades its water allocations to maximise environmental outcomes. There are two major types of environmental water trading:

- administrative trading between different environmental water accounts, which is designed to move allocations to where they are most needed
- trading between environmental water holders and the private sector, which can be used to sell water in systems where there is more than needed for environmental purposes and to purchase water in other systems or to invest in infrastructure.[191]

A number of submitters and witnesses to this inquiry discussed trade with the private sector.

4.5.1 Trade between environmental water holders and the private sector

Since 2011-12, the Victorian Environmental Water Holder[192] has purchased a total of 8,126 megalitres of water (see Table 4.1). The Victorian Environmental Water Holder has been much more active selling water, with a total of 57,178 megalitres of water sold since 2011-12.

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190 Mark Stacey, Immediate Past President, River Basin Management Society, *Public Hearing*, 5 December 2017, p.35

191 Victorian Environmental Water Holder, *Water Allocation Trading Strategy 2017-18* (2017), pp.5-6

192 Sometimes in conjunction with Melbourne Water

Table 4.1 Water purchased and sold by the Victorian Environmental Water Holder (megalitres)

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total
Water purchased[(a)]	–	860	1,031	629	302	5,304	**8,126**
Water sold	10,203	14,000	–	12,975	–	20,000	**57,178**

(a) Some or all of the water purchased in each year was co-purchased with Melbourne Water.

Source: Committee calculations based on Victorian Environmental Water Holder's annual reports, 2011-12 to 2016-17

The Commissioner for Environmental Sustainability explained that:

> Proceeds from the sale of water are used for future watering priorities for waterways and direct environmental outcomes in rivers and wetlands. This may include funding the delivery of environmental watering actions, purchasing water allocation at a different time—or in a different system, or funding works and measures to improve water-use efficiency.[193]

Sales of environmental water give irrigators access to additional water, providing potential social and economic benefits.[194]

> ***'The need to achieve value for money in its management decisions creates an incentive for the VEWH [Victorian Environmental Water Holder] to consider the marginal benefits of either using its water or using the funds generated by sale of the water. When the marginal benefit of selling the water and investing in an alternative activity is greater than using the water directly, it is reasonable to expect that the VEWH would sell. This capacity to sell water to achieve alternative benefits (such as infrastructure investment to improve efficiency of environmental watering, or investment in some of the many other elements of environmental health in aquatic ecosystems) extends the role of the VEWH beyond merely the provision of environmental water.'*** [195]

Some submitters and witnesses, however, were concerned that environmental water holders could manipulate water prices to their own advantage. They suggested that tools like carryover could be used to create a shortage in the water market and inflate prices to the detriment of irrigators.[196]

The Australian Competition and Consumer Commission noted that environmental water holders generally hold small proportions of total water shares, though they are often the largest individual user in a catchment. The commission recognised that, theoretically, environmental water holders could affect prices, but noted that a range of measures is in place to limit adverse impacts on the market.[197] The commission concluded that:

> The ACCC [Australian Competition and Consumer Commission] is not aware of any instances where specific trades undertaken by environmental water holders have materially impacted current prices, or where an environmental water holder has misused its market position as a dominant water user.[198]

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193 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.271

194 Name withheld, *Submission 18*, p.3

195 Commissioner for Environmental Sustainability, Victoria, *Victoria: State of the Environment* (2013), p.271

196 Kerang Lakes Land and Water Action Group, *Submission 20*, p.14; Stuart Simms, President, Kerang Lakes Land and Water Action Group, *Public Hearing,* 13 October 2017, p.7

197 Australian Competition and Consumer Commission, *Submission 34*, pp.9-10

198 Australian Competition and Consumer Commission, *Submission 34*, p.10

The Victorian Environmental Water Holder stated that it 'aims to avoid negatively impacting on other market participants',[199] noting that:

> When considering the volumes of water to sell or purchase, the method of market participation, and the prices considered, the VEWH undertakes an assessment of potential market impacts and takes steps to minimise those impacts.[200]

The Victorian Environmental Water Holder produces a trading strategy at the start of the financial year, providing a high-level overview of its intended strategy, to provide information to the market.

The Australian Competition and Consumer Commission did, however, note that environmental water holders' demand profile and trading strategies can differ from other users, so that there is some impact on the water market from environmental water activities.[201]

At a public hearing, the Committee explored the impact of trading by environmental water holders on the water market with Dr Mark Bailey from Goulburn-Murray Water:

> **Mr O'SULLIVAN** — Does their involvement in the water market have a positive or a negative impact on other irrigators who are looking to purchase water or sell water in that market?
>
> **Dr BAILEY** — I think at the scale at which they participate it is a relatively minor impact, if any. I think the fact that they actually do participate is viewed positively. I think there is a feeling that they should be participating more regularly from a number of irrigation customers.
>
> **Mr O'SULLIVAN** — Could they manipulate the price or have a negative impact on price as a result of doing that?
>
> **Dr BAILEY** — ... They have offered water through a water broker and used the services of the water broker to release water in relatively small parcels as opposed to trying to manipulate the market and drop prices, for instance, by putting a large amount of water into the market at any one particular time, or alternatively coming into the market to try and buy a large parcel of water at any one time.
>
> During the millennium drought, when the sales were occurring, it is probable that it had an inadvertent impact on the market. From the people that I know, I suspect that it was unintentional, but it actually did have an impact where people suddenly saw there was the potential to raise revenue for their business and for their families but with a relatively good price.
>
> **Mr O'SULLIVAN** — Conversely could the environmental water holder be accused of releasing water when prices are high and when irrigators need the water to sustain their crops and their plantings and so forth that without the water would die. Could the environmental water holder potentially have a negative impact in terms of driving the price up by being able to regulate how much water is in and out of that market at that time?

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199 Victorian Environmental Water Holder, *Water Allocation Trading Strategy 2017-18* (2017), p.5

200 Victorian Environmental Water Holder, *Water Allocation Trading Strategy 2017-18* (2017), p.18

201 Australian Competition and Consumer Commission, *Submission 34*, p.10

> **Dr BAILEY** — There is a potential for that to occur, yes. But the volumes that I have seen to date that have been sold in the southern-connected basins—so particularly affecting the Goulburn-Murray Water area—have been very, very small relative to the overall trading market. We talk about hundreds of gigalitres of water or thousands of gigalitres of water being sold. Last year, or it may have even been the year before, the commonwealth sold about 30 gigalitres of water in that market. The impact on that is probably negligible overall. There may have been a short-term impact on the market, and that was more a perception issue than a reality issue.[202]

Overall, the evidence received by the Committee does not suggest that there is a need to introduce additional restrictions in relation to environmental water trading. In fact, a number of submitters noted the importance of environmental water having the same rights and conditions as other water for the market to work effectively.[203]

This is also required by the *Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin*. The agreement includes a provision that environmental water 'be subject to no less favourable conditions, including with respect to fees and charges, access to allocations, capacity to use, trade, and carryover, than like entitlements held for other purposes.'[204]

FINDING 9: Trading water with the private sector is a valuable tool for environmental water holders, allowing them to buy and use water where and when it is most needed. It can also provide a source of additional water for irrigators. While there is a theoretical risk that environmental water holders' activity could distort the water market, in practice the impacts have been minimal.

4.6 Potential environmental water infrastructure

The Committee heard that additional infrastructure would enable more efficient and effective use of environmental water. With additional infrastructure, environmental water holders could have more control over when and where environmental water is used and could deliver environmental water to additional areas. Other infrastructure, such as fish gates, could enhance the environmental outcomes achieved with environmental water.

Both the Government's *Water for Victoria* policy and the Victorian Environmental Water Holder's corporate plan include intentions to invest in infrastructure associated with environmental water.

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202 Luke O'Sullivan MLC, Committee member, and Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, pp.13-14

203 Commonwealth Environmental Water Holder, *Submission 7,* p.4; Environment Victoria, *Submission 23*, p.7; Australian Competition and Consumer Commission, *Submission 34*, p.7

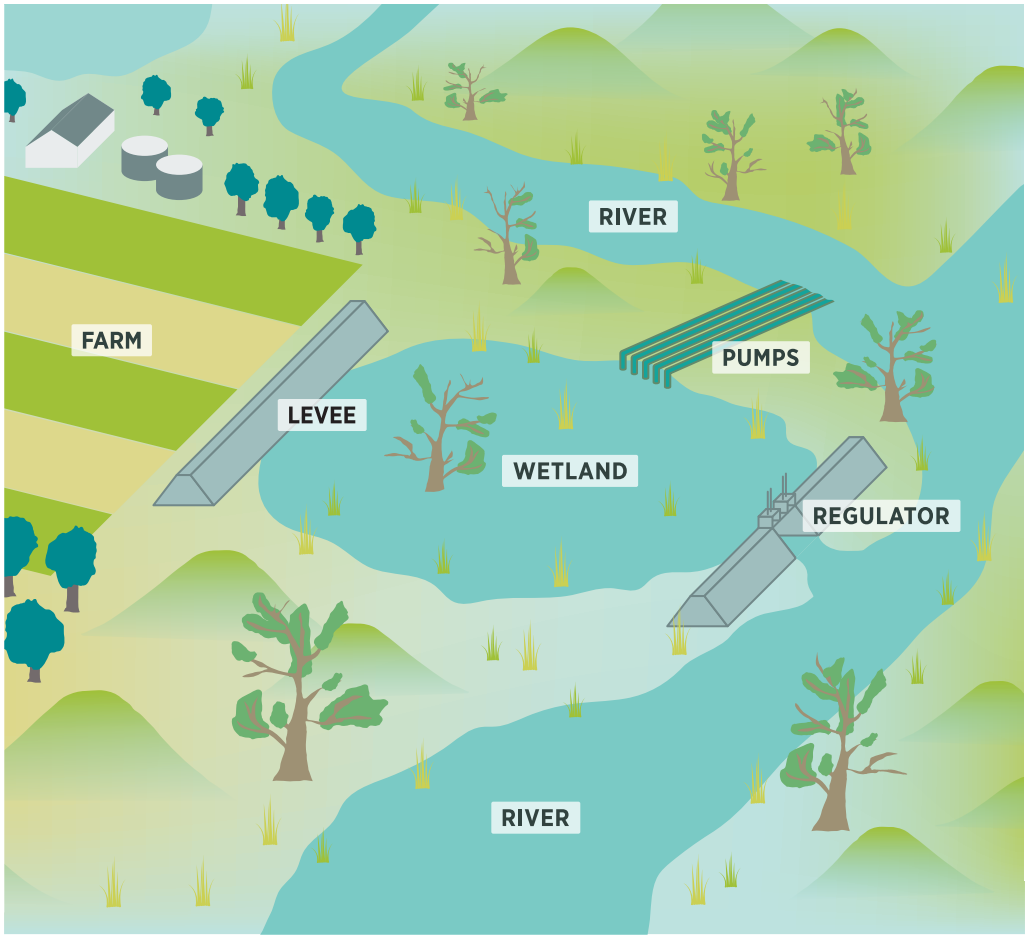
204 *Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin* (revised 2017), s.5.2; see also *Basin Plan 2012*, ss.12.07 and 12.08 with Australian Competition and Consumer Commission, *Submission 34*, p.7

4.6.1 Infrastructure to control the movement of water

> *'Decisions on investment in waterway management are underpinned by a principle of achieving the most effective long-term improvements in waterway condition, and the greatest community benefits, for the investment. Prioritisation frameworks are used to ensure that investment is directed to activities that provide the best outcomes for the cost.'* [205]

A range of different types of infrastructure can be used to control where environmental water goes and to connect river systems with wetlands (see Figure 4.3). Multiple submitters and witnesses to this inquiry called for additional investment in infrastructure connected with moving environmental water in order to achieve greater benefits with environmental water.

Figure 4.3 Infrastructure associated with environmental water



Source: Environment, Natural Resources and Regional Development Committee

The benefits of using infrastructure to control environmental water flows

The Victorian Government stated that infrastructure can be the best way to deliver water to areas in a number of circumstances:

205 Victorian Government, *Submission 39*, p.17

> ... Victoria is committed to the use of infrastructure works where this is the most efficient way to provide water to priority sites. Infrastructure works include channels, pumps, regulators and containment levee banks that allow environmental water delivery to be directly targeted at a site.
>
> There are a number of circumstances where environmental [infrastructure] works provide the best solution to providing water. They may be used when there is no other option, for example when wetlands have been cut off from natural flow paths by infrastructure such as roads or irrigation supply systems. They may also be used to provide or manage water in targeted parts of a floodplain to achieve the optimal frequency and duration necessary to achieve ecological outcomes. Using works to deliver and manage water on a site uses substantially less water than would be required through reinstating high flows that must flow over the river bank to reach a site.
>
> Using environmental works to provide water to a site can enable the achievement of environmental outcomes without risking inundation of private land. One of the foundation policies governing environmental water delivery across Victoria is that private land will not be flooded without the landholder's consent.[206]

Infrastructure can also be used to control water so that it is delivered to particular sites to provide refuges in a drought or so that it is kept out of specific sites to enable drying or to impede pest species.[207]

The Government has invested in a number of infrastructure projects related to environmental water in recent years. Box 4.1 provides an example of where infrastructure has been used to achieve environmental benefits. Further projects are under consideration as part of the Murray-Darling Basin Plan.[208]

The Committee heard calls for a variety of infrastructure projects, including:

- works to enable environmental water to be delivered to wetlands and waterways that cannot currently receive environmental water[209]
- works allowing greater control of the amount of water flowing in rivers at particular times[210]
- the removal or modification of levees, weirs and other infrastructure preventing water from flowing into floodplains[211]
- pipes from water storages to urban water systems, so that environmental water can be released without having to consider the impact on the quality of downstream urban water supplies.[212]

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206 Victorian Government, *Submission 39*, p.19

207 Victorian Government, *Submission 39*, p.20

208 Victorian Government, *Submission 39*, p.21

209 Goulburn Valley Environment Group, *Submission 4*, p.3; Greater Shepparton City Council, *Submission 21*, p.2; Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.3; Greg McKenzie, Manager Environment, Greater Shepparton City Council, *Public Hearing*, 24 October 2017, p.2

210 Chris Bromley, *Submission 29*, p.2

211 Goulburn Valley Environment Group, *Submission 4*, p.3; John Laing, *Submission 10,* p.2; Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.5; People for a Living Moorabool, *Submission 36*, p.7; Nicholas Aberle, Campaigns Manager, Environment Victoria, *Public Hearing,* 5 December 2017, p.26

212 Gippsland Water in Victorian Government, *Submission 39*, Appendix 13, p.2

BOX 4.1: Infrastructure in use at Hattah Lakes

Several submitters and witnesses identified the work at Hattah Lakes, in Victoria's north-west, as an example of infrastructure projects delivering positive outcomes with environmental water. Pumps, levees and regulators (see Figure 4.4) were constructed to enable water managers to flood the area. The infrastructure allows water managers to create these floods at a time of their choosing, even when the river system is not in flood.[a]

Figure 4.4 A regulator at Hattah Lakes

Source: Mallee Catchment Management Authority

The Mallee Catchment Management Authority explained:

> Significant investment in water management infrastructure, such as regulators, has been instrumental to continuing to improve the efficient delivery of environmental water in the Mallee. For example, the Mallee CMA coordinated the $32 million package of environmental works constructed at Hattah Lakes, as part of The Living Murray program. This infrastructure allows this internationally recognised system of freshwater lakes to receive environmental water, in line with ecological needs and water availability.[b]

The Victorian Government told the Committee:

> The works at Hattah Lakes are already delivering substantial environmental benefits. Environmental watering has improved the health of floodplain forests significantly since the millennium drought. More than 60% of black box communities are now in good health compared to 19% in 2008-09, and more than 63% of river red gums are in good health compared with 27% at the end of the drought. The Lakes have provided nursery grounds for hundreds of thousands of native fish, and are a haven for native birds, especially cormorant and darters, as well as several threatened species. The nationally listed migratory red necked stints

> have now been recorded at Hattah Lakes for the first time. Numbers of threatened Australasian shovelers have increased substantially since the introduction of environmental watering, with 220 individuals recorded in 2017.[(c)]

The Victorian Farmers Federation noted that infrastructure in this instance had enabled a balance between the environment's and irrigators' needs to be achieved:

> When we talk the about environmental infrastructure, the Hattah Lakes infrastructure has been a tremendous outcome for the environment and for irrigators because the amount of water required to run overbank flows every year for environmental purposes is physically impossible.[(d)]

(a) Victorian Government, *Submission 39*, p.21

(b) Mallee Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 8, p.4

(c) Victorian Government, *Submission 39*, p.21

(d) Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing*, 5 December 2017, p.42

The Committee heard that work on infrastructure for environmental water might also benefit other users. Environment Victoria suggested integrating environmental water considerations into work on flood protection infrastructure, noting that this would allow the pooling of funding from flood mitigation and environmental water budgets.[213] Mr Neville Goulding suggested that infrastructure which stored water in wetlands when there are unexpected rainfalls could later release the water for irrigation, providing benefits to both the environment and irrigators.[214]

The limitations of using infrastructure to control environmental water flows

One of the key benefits of using infrastructure for environmental watering is that it can reduce the amount of water required to connect a waterway to a wetland. However, the Murray Lower Darling Rivers Indigenous Nations told the Committee that there can be downsides to this approach:

> Manipulation of environmental water through infrastructure … can never function as an effective substitute for water recovery and adequate flows that connect river channels to floodplains and associated ecological assets. 'Efficient' use of environmental water must not be pursued as a substitute for real water recovery and an adequate portfolio of held environmental water.
>
> The use of floodplain infrastructure to maximize the 'efficiency' of environmental water delivery comes with a range of risks and potential impacts. Amongst these are impacts on Aboriginal cultural heritage values, as evidenced by major disturbance to burial sites during construction of the Koondrook-Perricoota Flood Enhancement Works in NSW. Such impacts are tangible constraints to the deployment of 'supply measures' and other associated infrastructure projects.

213 Environment Victoria, *Submission 23*, p.8

214 Neville Goulding, *Submission 2*, p.1

> MLDRIN [the Murray Lower Darling Rivers Indigenous Nations] strongly believes that an approach focused on achieving 'efficiency' through floodplain infrastructure risks replicating the very same problems that environmental water management is intended to address: namely the impacts of regulation, modification and exploitation of water resources. Floodplain infrastructure is costly and creates an ongoing cost to taxpayers through deterioration and maintenance work. Finally, its efficacy as a means to achieve environmental outcomes is largely unproven.[215]

Similarly, Ms Juliet Le Feuvre of Environment Victoria noted that a key benefit of environmental water is the removal of salt from river systems. However, she indicated that:

> ... there are certain things which only water can do. No amount of fiddling with the rules, no amount of building infrastructure to deliver it to specific spots—that will not solve all the problems. For those we actually do need a significant volume of water.[216]

Dr Terry Hillman AM, from the Wentworth Group of Concerned Scientists, called for a pause in infrastructure projects, pending further research on the effectiveness of infrastructure for environmental water:

> ... we are at the point in the development of infrastructure where we really should be testing and learning to understand what we have got. I do not think we have spent enough time on that, in particular where there are issues of risks involved and how we manage those risks. No doubt we will manage them, but we need to know how.
>
> For instance—and this ties back to blackwater and water quality—a number of these structures are designed to imitate small floods on the flood plain when there is not in fact a flood in the system, in other words just creating one and therefore saving the need to release a lot of water to produce that effect, which obviously is a sensible thing to try. One of the risks involved is the risk of creating blackwater incidents, particularly if this flooding happens in the summertime when the water is warm. Then it will pick up a lot of nutrients, and you will have blackwater fairly quickly. As we are operating this in a low river rather than a high river, as it would be if that was a release of water, we are releasing blackwater into a very low flow, and that creates considerable risks with the fish and large crustaceans in particular. That is just an example of a risk that we have not explored.
>
> I think it would be very useful to be able to sit back for a couple of years, look at the data that we have got and make sure that we can manage the risks that are entailed in those sorts of interventions. I am not saying for a moment that they are not useful and they will not be necessary in the future, but we just need to better understand the mechanisms that they depend on.[217]

The Committee believes that there are potential benefits to investment in infrastructure to assist with the movement and use of environmental water. The Committee also recognises that it is important to carefully assess the impacts of infrastructure projects to ensure that the best outcomes are achieved with the funds

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215 Murray Lower Darling Rivers Indigenous Nations, *Submission 24,* p.3

216 Juliet Le Feuvre, Healthy Rivers Campaign Manager, Environment Victoria, *Public Hearing,* 5 December 2017, p.26

217 Terry Hillman AM, Member, Wentworth Group of Concerned Scientists, *Public Hearing,* 5 December 2017, p.66

and that the desired environmental objectives are accomplished. Further discussion about the need for additional research and monitoring in relation to environmental water management can be found in Section 5.2 of this report.

FINDING 10: Infrastructure can reduce the amount of water needed to achieve environmental benefits in some situations. There is potential for more benefits to be gained by additional infrastructure. However, it is important for appropriate monitoring to be in place to ensure that infrastructure projects provide the best value for money, achieve the desired outcomes and avoid unintended consequences.

4.6.2 Making use of existing irrigation-related infrastructure

Some submitters and witnesses argued that there is potential for existing irrigation channels and levee banks to be used to achieve environmental outcomes. However, the Committee heard that actions to increase the amount of water available for environmental purposes (such as decommissioning channels and fixing leaks) may lead to some of these potential opportunities being lost if not done carefully.

Mr Ken and Ms Jill Hooper told the Committee that some irrigation channels are used to supply water to wetlands. They expressed concern about the decommissioning of channels that are no longer needed for irrigation, as this may leave water managers with no way to deliver environmental water to certain wetlands. It may lead to a situation where a potentially useful channel is decommissioned and then, some time later, new infrastructure is built to supply environmental water, at a greater cost than maintaining the old channel.[218]

They called for an immediate assessment of which channels designated for decommissioning could be used to supply wetlands, noting that:

> ... although there is willingness and expertise and some progress to date in the C.M.A. [catchment management authority] to address these issues, there is insufficient funding and staffing available.[219]

They also noted that, in some cases, if channels are repurposed for environmental needs, the Government may need to take ownership and bear the costs of maintaining these channels.[220]

In addition, submitters and witnesses noted that irrigation channels can be useful in themselves as habitats for native wildlife, such as frogs and remnant vegetation.[221] There may therefore be environmental benefits to maintaining these channels, regardless of whether or not they connect to wetlands.

Similarly, levee banks which are maintained for farming may also provide environmental benefits by raising water levels in certain areas. As noted in Section 4.7 of this chapter, high water levels can be important to achieve certain environment benefits. Levee banks make higher levels of inundation possible with less water.

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218 Ken and Jill Hooper, *Submission 25*, pp.2-3

219 Ken and Jill Hooper, *Submission 25*, p.5

220 Ken and Jill Hooper, *Submission 25*, p.8

221 Raelene Peel, Secretary, Kerang Lakes Land and Water Action Group, *Public Hearing,* 13 October 2017, p.10; Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, p.17

Mr Keith Greenham AM expressed concern that the decline in irrigation activity in northern Victoria may result in these levee banks no longer being maintained, to the detriment of the environment.[222]

The Committee also heard that channel leaks in some places provide water that supports small wetlands. These are being put at risk by works fixing the leaks or decommissioning the channels. The Goulburn Valley Environment Group and Mr John Laing noted that fixing leaks and decommissioning channels 'is having both a positive and a negative effect. The positive being the generation of environmental water and the negative being the devastation of local resilience reliant on these leaks.'[223]

Mr Laing cited work on Central Goulburn number 2 channel as an example:

> This channel has been leaking since the rural water corporation become Goulburn Murray Water in the early 1990's. Recent renewal of sections of this channel generated significant water savings, but it took out some mini wetlands that had supported several families of Rakali, thousands of frogs and numerous wetland bird species. The Rakali were all killed, the frogs had a similar experience and the wetland birds have had to move.[224]

Mr Laing called for a program to support landowners who are willing to maintain these small wetlands and provide them with small amounts of environmental water.[225] More generally, Mr and Ms Hooper noted that some private landowners may be willing to restore wetlands on their properties but may need financial support and information about wetland processes.[226]

Ms Louissa Rogers from the North Central Catchment Management Authority indicated that this was an area that the authority was exploring:

> There are a number of wetlands across that flood plain, all on private land. We are actually hoping to start up a project to go through there and meet these landholders and work out what they are wanting to do. We do not necessarily have to have them separated from their farming practice all the time—probably when water is in there, yes, but not all the time. We are really, really keen to actually get into that space ...[227]

Overall, the Committee recognises the potential environmental benefit of existing infrastructure such as channels and levees in some places. The Committee considers it important that environmental impacts be considered as part of plans to manage irrigation-related infrastructure.

FINDING 11: Infrastructure used for irrigation, such as channels and levees, can provide environmental benefits by supplying water to wetlands and supporting native wildlife.

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222 Keith Greenham AM, *Public Hearing,* 13 October 2017, p.30

223 Goulburn Valley Environment Group, *Submission 4*, p.3; John Laing, *Submission 10,* p.3

224 John Laing, *Submission 10,* p.3

225 John Laing, *Submission 10,* p.3

226 Ken and Jill Hooper, *Submission 25*, p.8

227 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.6

4.6.3 Infrastructure to achieve other environmental benefits

'Environmental water on its own cannot achieve everything; we need to have enabling and complementary measures.' [228]

A number of submitters and witnesses emphasised that complementary works and programs are required to get the best value from environmental water. For example, the North Central Catchment Management Authority explained:

> Water alone is not the only solution: The North Central CMA develops Environmental Water Management Plans for all of the systems it manages environmental water for. In the risk assessment of these plans we identify where actions such as including fish passage to facilitate juvenile dispersal and migration for spawning, screens to prevent fish losses to the irrigation system, riparian rehabilitation works to prevent sedimentation and provide terrestrial carbon inputs, instream woody habitat reinstatement, and pest plant and animal control.[229]

Similarly, the Goulburn Broken Catchment Management Authority advocated for:

> Developing and implementing complementary projects to protect and improve the condition of wetlands, rivers and floodplains (e.g. fencing to manage stock grazing, revegetating, re-snagging to improve instream habitat for native fish and invertebrates, restocking native fish, removing barriers to fish movement and controlling pest plants and animals). These complementary measures also reduce agricultural run-off to waterways, which contributes to hypoxic blackwater events.[230]

Infrastructure to assist fish populations was identified as important by multiple submitters and witnesses. The Victorian Recreational Fishing Peak Body called for:

> ... a range of complementary measures to e-water [environmental water] must be undertaken not limited to in-stream habitat restoration, improving riparian zones, removing barriers to fish passage, installing fish screens to pumps and channels and a control program for carp.[231]

A number of participants in this inquiry advocated for fish passageways, which enable fish to travel from one area to another. This allows the fish population to spread, increasing genetic diversity, and can enable fish to escape water areas when they dry out.[232] Catchment management authorities identified a number of projects currently being planned to reduce barriers to fish movement.[233]

However, environmental water can also provide benefits to pest animals to the detriment of the environment and native species. It is important for this problem to be managed. This may include barriers to prevent carp entering areas[234] or fencing to exclude pest animals on land (see further discussion in Section 4.8.2 of this chapter).

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228 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.3

229 North Central Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 9, p.5

230 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.4

231 Victorian Recreational Fishing Peak Body, *Submission 31*, p.2

232 Kerang Lakes Land and Water Action Group, *Submission 20*, pp.14, 16

233 North East Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 10, p.2; West Gippsland Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 11, p.3

234 Kerang Lakes Land and Water Action Group, *Submission 20*, pp.14, 16

Mr Neville Goulding noted the importance of infrastructure for tourists to facilitate visitors coming to areas improved by environmental water and bringing money to local economies. He identified infrastructure such as roads, boardwalks, signage, walking trails and cycling paths as important.[235]

The need for complementary works has been recognised in the Government's *Water for Victoria* policy:

> Environmental water must be managed together with other complementary works such as protecting drought refuges, improving habitat connectivity for fish, improving landholder management practices and stronger integrated catchment management. This will help achieve real improvements in waterway health, especially in a predicted drier and warmer future climate.[236]

This need is also recognised by the Victorian Environmental Water Holder in its corporate plan.[237] The Committee considers it important that complementary works continue to be a consideration in the planning of infrastructure work for environmental water.

FINDING 12: To maximise the environmental and social benefits of infrastructure for environmental water, it can be necessary to invest in complementary infrastructure works, such as fish passageways, fencing and facilities for tourists.

4.7 Overbank flows and easements

'It is extremely unfortunate that the current government would appear not to sanction the use of environmental water to achieve or contribute to overbank flooding. This position, reached because of the threat of legal action by a small number of vocal landowners, is severely restricting the Victorian Environmental Water Holder and waterway managers to achieve their mission. This means we are never going to be able to get the best possible gains from the use of environmental water.' [238]

The Committee heard repeatedly that there would be ecological benefits to releasing sufficient quantities of environmental water for the water to flow over riverbanks and flood the floodplain. For example, Goulburn Broken Catchment Management Authority noted a number of benefits that could come from overbank flows:

> Higher in-channel and overbank flows are required to connect the river to the floodplain. This is not only important to the health and survival of flood dependent plant and animal communities it also delivers organic material and nutrients to the in-channel environment, which sustains aquatic food webs. Higher flows are also important in promoting in-channel physical habitat diversity, stimulating native fish spawning and migration, and providing hydrological and ecological benefits to downstream waterways including the Murray River.[239]

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235 Neville Goulding, *Public Hearing,* 13 October 2017, p.22

236 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.54

237 Victorian Environmental Water Holder, *Corporate Plan 2017-18 to 2020-21* (n.d.), p.28

238 Terry Court, Vice President, Goulburn Valley Environment Group, *Public Hearing,* 24 October 2017, p.33

239 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.3

Overbank flows can be an effective way for environmental water to reach wetlands that are not connected to rivers or channels. In the absence of overbank flows, investment in pumps or other infrastructure would be required to enable environmental water to reach these wetlands.[240]

Overbank flows also have the potential to reduce the severity of blackwater events, as discussed in Section 2.6 of this report.

However, governments have been reluctant to allow overbank floods where they will inundate private land. Goulburn-Murray Water noted that the Victorian Government 'does not allow any water to deliberately flood private land or infrastructure.'[241] The Commonwealth Environmental Water Holder indicated that he has adopted 'good neighbour' and 'do no harm' policies and explained that, 'I have not and will not place water orders that would flood private land, without the consent of the landholder.'[242]

Mr John Laing told the Committee:

> The government has made it very clear that using environmental water to achieve or contribute to an overbank flood is not permitted, not because it wouldn't achieve the desired outcomes but because of the legal implications. This simple fact alone means we are never going to be able to get the best possible gains from the use of environmental water.[243]

Mr John Pettigrew (from the Environmental Farmers Network and Goulburn Valley Environment Group) advocated for purchasing easements to enable overbank flows. He noted that such an approach had been successful previously:

> Easements have to be purchased off these people. We did it on the Murray River from Hume down to Yarrawonga when the Yarrawonga Weir started walking downstream a few years ago. That was a very expensive exercise, but those easements are still in place today and they are achieving outcomes for irrigators and environmental flows. That has to be done on the Goulburn and other rivers in the basin, but we need the will to actually follow that through.[244]

Similarly, Environment Victoria argued that, in addition to allowing environmental water delivery, easements 'would also allow for the passage of minor flood events and reduce inconvenience to landholders.'[245]

However, Mr Richard Anderson from the Victorian Farmers Federation emphasised the difficulties that had been faced in establishing the easements in northern Victoria:

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240 Ross McPherson, *Submission 16*, p.2

241 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.6

242 Commonwealth Environmental Water Holder, *Submission 7,* p.5

243 John Laing, *Submission 10,* p.1

244 John Pettigrew, Water Spokesperson, Environmental Farmers Network**,** and Chair, Goulburn Valley Environment Group, *Public Hearing,* 24 October 2017, p.36

245 Environment Victoria, *Submission 23*, p.8

> It took us 25 years to negotiate the flood easements between Lake Hume and Yarrawonga, and that is only a very small section of the river. To do that across the state would cost a lot of money. You have got a negotiate them. It would cost a lot of money and would probably take 50 years, I suspect, rather than 25, in today's day and age.[246]
>
> I am not saying that cannot be done in the north. Certainly it can be done in the smaller systems in the south. It certainly can be done. But it is not going to be an easy exercise, and it will not be an easy trip politically no matter what side of politics you are on, I can so assure you.[247]

Ms Louissa Rogers from the North Central Catchment Management Authority stated that the organisation has been trying to work with landholders to reach agreements about overbank flooding onto private land. However, while there have been some successful discussions on this matter, she noted that this approach can only work where all affected landholders agree.[248]

The Committee considers that catchment management authorities should continue work with landowners about possible overbank floods and should further investigate the practicality of purchasing easements to allow overbank flooding.

FINDING 13: There are clear environmental benefits to floods which flow over riverbanks, including a reduced risk of hypoxic blackwater events. However, overbank flows also have the potential to damage private property. Government bodies have explored ways to achieve the environmental benefits while mitigating the impact on private landowners, such as the purchase of easements and negotiating agreements with affected landowners. Further work in this area would be worthwhile.

4.8 Negative and unintended consequences of environmental water

A number of submitters and witnesses expressed concerns about unintended negative impacts from environmental watering. Concerns included:

- damage to riverbanks and native vegetation
- increased pest animals and plants
- negative social and economic consequences for local communities.

These are all serious matters. The Committee considers it important that monitoring is in place to check for these and other potential negative effects of environmental water management. Monitoring and research are discussed further in Section 5.2 of this report.

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246 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, p.40

247 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, pp.42-3

248 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.7

A number of concerns were also raised about the Murray-Darling Basin Plan, especially plans to potentially allocate an additional 450 gigalitres to the environment compared to the initial plan targets. The Murray-Darling Basin Plan is outside the terms of reference for this inquiry and is being examined in more detail by a Commonwealth parliamentary committee and others (see Section 1.6 of this report). However, some of the key issues raised with the Committee about the plan have been noted in Boxes 4.2 and 4.3 later in this chapter.

4.8.1 Damage to riverbanks and native vegetation

Some submitters and witnesses expressed concern that environmental water flows were causing damage to riverbanks and hurting river red gums. For example, Mrs Jan Beer and Mr Ken Pattison told the Committee that environmental water flows were eroding riverbanks:

> ... landowners along the length of the Goulburn have been witnessing for a number of years, the slumping and erosion of the river bank which they believe is caused by the constant raising and lowering of water levels and the fact that large numbers of mature Red Gum trees on the banks are falling.[249]

They also believed that current environmental water practices have a detrimental effect on the health of red gums:

> The proposed frequency of overbank flows in the Goulburn River are based on outdated flood flow data from 1960-2014. Due to a drier climate cycle, we no longer receive 7-8 natural floods per decade. In the last 20 years we have, in the Upper Goulburn Catchment received 5 floods in the last 20 years This means that the current management of frequent environmental flows may well bring about the demise of red gum forests by not allowing them to naturally adapt to a drying climate. Against the above scientific and factual evidence the management of environmental water by the VEWH [Victorian Environmental Water Holder] must be called in to question.[250]

They noted a study which suggests that the amount of flooding needed to maintain river red gum health may be less than had been previously expected.[251]

Mr Gary Constantine, the proprietor of Eildon Bait and Tackle, told a similar story and suggested that community concerns had not been taken seriously by officials:

> Farmers from down the Goulburn river have reported that high water flows are not just eroding the banks but killing trees and causing them to collapse into the river course. One local farmer has been consulted by a rep from GMW [Goulburn-Murray Water] and a person believed to be in charge of the environmental for the last two years and has told them both how detrimental the flows are, only to have them try and say otherwise. River red gums that are used to the occasional flood are dying because flood conditions are being emulated far too frequently.[252]

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249 Jan Beer and Ken Pattison, *Submission 9*, p.2

250 Jan Beer and Ken Pattison, *Submission 9*, p.5

251 Tanya M. Doody, Matthew J. Colloff, Micah Davies, Vijay Koul, Richard G. Benyon and Pamela L. Nagler, 'Quantifying Water Requirements of Riparian River Red Gum (*Eucalyptus camaldulensis*) in the Murray-Darling Basin, Australia – Implications for the Management of Environmental Flows', *Ecohydrology* 8 (2015), pp.1471-87

252 Gary Constantine, *Submission 14*, p.1

The Victorian Farmers Federation also expressed concerns about red gums dying as a result of being inundated by water which heats up in summer.[253]

Parks Victoria noted the negative impact of past practices of summer watering on red gums at some sites, but indicated that water management practices had changed.[254] Mr Ross McPherson also suggested that environmental water management has improved in recent years and that some of these concerns were less of a problem now:

> The management of these flows has much improved, since the early flows which were too sustained and caused considerable bank-softening and tree falls. More recent flows have better emulated "natural" river flows (higher in winter and spring) and been more cogniscent of users along the river, including campers around the popular holiday times and fishermen around the opening of the cod fishing season.
>
> It seems to me the Environmental Water Holder is taking more notice from the CMA [catchment management authority] people "on the ground" as part of the this process and the current longitudinal study being carried out by the GBCMA [Goulburn Broken Catchment Management Authority] and Commonwealth EWH [Environmental Water Holder] is confirming the wisdom of this better EW [environmental water] management.[255]

Overall, the Committee considers potential damage to riverbanks and river red gums to be important things to watch for as part of monitoring and evaluation processes (see Section 5.2.2 of this report).

4.8.2 Pest animals and plants

Parks Victoria noted that environmental water can also benefit pest animals and plants and that complementary works and programs to manage these threats are important:

> While providing beneficial outcomes for water dependent environments, environmental water can also create conditions suitable for pest plants and animals to flourish, which unmanaged can impact the success of environmental watering actions (e.g. the invasion of an aquatic weed that displaces wetland plants).[256]

Mr Neville Goulding told the Committee that problems can be caused for farmers and motorists too:

> Kangaroos, with all the extra feed produced by the water out there, become too many, and when the feed gets short they head out to the farmers, so they are costing farmers and motorists dollars … We have got a good environment with our environmental water for turtles and fish, in particular the turtles, and foxes come along and not only eat the turtles but also eat the eggs, so we need to be able to control those.[257]

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253 Richard Anderson, Victorian Farmers Federation Water Council Chair, Victorian Farmers Federation, *Public Hearing,* 5 December 2017, p.45

254 Parks Victoria in Victorian Government, *Submission 39*, Appendix 4, p.3

255 Ross McPherson, *Submission 16*, p.2

256 Parks Victoria in Victorian Government, *Submission 39*, Appendix 4, p.4

257 Neville Goulding, *Public Hearing,* 13 October 2017, p.21

Multiple submitters and witnesses expressed concerns about the growth of carp populations as a result of environmental water. For example, the Murray Darling Association noted:

> The FRDC [Fisheries and Research Development Corporation] has reported that carp numbers in the Murray-Darling Basin trebled between 2004 and 2014, acknowledging that environmental watering is essential to the overall health of the system. However, the FRDC also acknowledges that carp benefit from water on the floodplain—including from environmental watering, with overbank watering sometimes encouraging additional spawning.[258]

The Government has recognised the need to manage pest animals as part of environmental water programs. In its policy document *Water for Victoria*, the Government committed to investing in 'integrated catchment management'. This is a holistic approach which includes looking not only at waterway and ecological health, but also more broadly at connected matters such as pest management.[259]

Parks Victoria told the Committee:

> Land managers, such as Parks Victoria, play a critical role in achieving the efficient use of environmental water by ensuring the external threats to achieving ecological outcomes are monitored and managed. These external threats are generally well understood, and actions to mitigate them are identified through Parks Victoria's Conservation Action Planning processes, as well as site based environmental watering plans developed by the Catchment Management Authorities.[260]

Parks Victoria noted that these complementary actions may need to increase as the environmental watering program increases.[261]

4.8.3 Economic and social impacts

> ***'In some districts, however, water recovery has compounded the many other economic pressures facing rural and regional Australia, and government has failed to support communities in these districts. Whilst individual irrigators have benefited from the buyback of water, less than one per cent of the $13 billion has been made available to assist communities adapt to a future with less water.'*** [262]

Concerns were also raised about the impact of larger proportions of water being reserved for environmental purposes rather than being used in agriculture. Mr Keith Greenham AM stated:

> Water Trading and unbundling of land and water ownership while in the short term was well intentioned in the National Interest it set the scene for long term decline in floodplain pasture based irrigation enterprises as operators retire or react to World commodity prices.[263]

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258 Murray Darling Association, *Submission 38*, p.3

259 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), pp.48, 50

260 Parks Victoria in Victorian Government, *Submission 39*, Appendix 4, p.4

261 Parks Victoria in Victorian Government, *Submission 39*, Appendix 4, p.5

262 Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.2

263 Keith Greenham AM, *Submission 5*, p.3

Dr Mark Bailey from Goulburn-Murray Water told the Committee that the purchase of water for the environment had led to a reduction of water in the Goulburn-Murray Irrigation District:

> I think we have seen, over time, certainly a loss of water out of the Goulburn-Murray irrigation district. A lot of that occurred with the commonwealth water buybacks when that was first established for the environmental water holder for the commonwealth. A lot of that occurred at a time of financial stress, so a number of the irrigators who sold entitlements, whether they sold all or a proportion of them, were experiencing a severe downturn in their market. It was a period of quite significant drought as well, so they were looking to try and purchase water to stay solvent in their business. A lot of people sold water out there. We have seen a decline of water that has been actually held within the Goulburn-Murray irrigation district, and that is people basically selling water going towards the temporary trading market to try and maintain their business going forward that have been paying off debts. Obviously a large proportion of that water has gone towards the environment.[264]

He further noted that the reduction in water for irrigation:

> ... is putting pressure on remaining irrigators in terms of the viability of the system into the future. As more and more water leaves, the fewer customers there are left to pay the bills for the maintenance of irrigation infrastructure, so there is a risk going forward that that will at some point perhaps become unviable.[265]

A report by RMCG consultants into the impacts of the Murray-Darling Basin Plan estimated that the water buy-back to date will result in a $202 million annual reduction in the gross regional product of the Goulburn-Murray Irrigation District and the loss of 1,140 jobs. At the same time, the report estimated that infrastructure investment associated with water-use efficiency programs had added $73 million to the gross regional product and created 710 jobs. However, the report noted that these effects are only temporary, as the current level of infrastructure investment will not be sustained indefinitely.[266]

The Wentworth Group of Concerned Scientists called for more work to be done by governments to manage the impact of water recovery on local communities. The group's recommendations include providing funding to affected communities to help them restructure their economies and working with local groups to recover water in a way that optimises regional development opportunities.[267]

Concerns about the potential impacts of an additional 450 gigalitres being allocated for the environment under the Murray-Darling Basin Plan were also expressed to the Committee, as set out in Box 4.3.

As with the other issues raised in this section, the Committee considers it vital that the social and economic impacts of environmental watering programs are monitored and responded to appropriately. This is discussed further in Section 5.2.2 of this report.

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264 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, p.12

265 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, pp.12-13

266 RMCG, *Basin Plan—GMID Socio-economic Impact Assessment: Final Report* (2016), pp.54-5

267 Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.5

FINDING 14: Some submitters and witnesses identified a number of potential negative consequences from environmental watering programs. Some noted damage to riverbanks and native vegetation. The risk of increased populations of pest animals and plants was raised. The Committee also heard concerns about negative social and economic impacts on local communities, including adverse impacts on farmers. It is important for all of these possibilities to be monitored as part of monitoring the outcomes of environmental watering programs.

BOX 4.2: Murray-Darling Basin Plan

The Murray-Darling Basin Plan came into effect in 2012. The Murray-Darling Basin Authority explained to the Committee:

> The whole idea of the plan is to end up with a healthy working basin. That is an easy phrase to use, but what we are after is a balance between environmental outcomes, industry and community outcomes and outcomes for Aboriginal people as well. We are not trying to change the basin to be something that it was prior to development. We are also not trying to maximise agricultural production. We are looking for a sustainable outcome, a healthy working basin, where the communities that depend on the water and the industries that depend on that water know that they have a future and know that they will be around not just in 10 or 20 years time but for all time to come.[a]

A key part of the plan is to reduce the amount of water taken out of the Murray-Darling Basin for irrigators. The plan sets a limit on the average amount of surface water that can be taken from the system (10,873 gigalitres per year). To achieve this, it is necessary to reduce the amount of water taken out of the system by farmers and others by 2,750 gigalitres per year (compared to 2009 levels). This will leave additional water in the system to be used for environmental purposes.[b]

The Committee heard a variety of views on the plan during this inquiry. Submitters and witnesses expressed a number of concerns, including that:

- the institutional arrangements are inadequate[c]
- increased water flow in the Goulburn River as a result of the plan will damage the river channel[d]
- provisions allowing environmental water to be offset with alternative measures may increase the risk of localised blackwater events[e]
- the reduction in water for agriculture has had significant social and economic impacts on local communities.[f]

Others were supportive of the plan. The Environmental Farmers Network argued that:

> ... the implementation of the Basin Plan as agreed and intended is critical to the ongoing health of our rivers. This health includes water quality, export of salt from catchments and a more natural occurrence of blackwater and algae events, critical also to all water users.[g]

Mr John Pettigrew from the network emphasised that the plan was the result of negotiations and balancing different interests:

> The basin plan was an agreed outcome by all parties at the time. Some people from the environmental area would say it was set far too low; from the irrigation point of view, they would argue it was set too high. I do not think we will ever know, or anyone could possibly say, what the correct balance should be. You can only go back to the way the whole plan was developed. I am not relaxed but I am confident that a reasonable job in achieving balance was achieved in the plan.[h]

Mr Phillip Glyde, Chief Executive of the Murray-Darling Basin Authority, recognised that there was some resistance to the plan in the community. He suggested that part of the problem is that the plan seeks a balance between economic, environmental, social and cultural uses of water and therefore does not satisfy any individual interest group.[i]

Ultimately, the plan is a complex issue that extends beyond the scope of this inquiry. The Committee notes that other bodies, including a Commonwealth parliamentary committee and a South Australian royal commission, are currently looking into certain aspects of the plan in more detail (see Section 1.6 of this report).

(a) Phillip Glyde, Chief Executive, Murray-Darling Basin Authority, *Public Hearing*, 5 December 2017, p.52

(b) Murray-Darling Basin Authority, *What's in the Basin Plan?* <http://www.mdba.gov.au/basin-plan/whats-basin-plan>, viewed 6 April 2018

(c) Australian Environment Foundation, *Submission 19*, pp.2-3

(d) Ross McPherson, *Submission 16*, p.2

(e) Terry Court, Vice President, Goulburn Valley Environment Group, *Public Hearing*, 24 October 2017, p.34

(f) Suzanna Sheed MP, Member for Shepparton, *Public Hearing*, 5 December 2017, p.18

(g) Environmental Farmers Network, *Submission 6*, p.2

(h) John Pettigrew, Water Spokesperson, Environmental Farmers Network, and Chair, Goulburn Valley Environment Group, *Public Hearing*, 24 October 2017, p.35

(i) Phillip Glyde, Chief Executive, Murray-Darling Basin Authority, *Public Hearing*, 5 December 2017, p.54

BOX 4.3: An additional 450 gigalitres?

As noted in Box 4.2, the Murray-Darling Basin Plan has set a target that no more than 10,873 gigalitres should be taken out of the Murray-Darling basin per year. In achieving this, the plan allows for an additional 543 gigalitres to be taken out if offset by supply projects which enable the same environmental outcomes to be achieved with less water. A package of projects expected to achieve the equivalent of 605 gigalitres was recommended by the Murray-Darling Basin Authority as part of the plan's sustainable diversion limit adjustment mechanism.[a]

The plan also allows for an additional 450 gigalitres to be recovered through efficiency measures if it can be done in ways that have 'neutral or no adverse socio-economic outcomes'.[b]

Concerns were expressed about the prospect of that 450 gigalitres being removed from the consumptive pool:

> I think it would have a very significant impact—quite a deleterious impact—on the Goulburn-Murray irrigation district. In terms of the availability of that water, from what I understand looking at all the documentation available at present, there is no area that it has been defined from … I suspect the vast majority of it would be sought from the Goulburn-Murray irrigation district. The Victorian entitlement framework provides very high reliability of the higher liability entitlements … If you were to compare them with the general security water in New South Wales, which has a much lower reliability, the best bang for buck would come from the 450 to be purchased out of Victoria. That is likely to perhaps sound the death knell for the Goulburn-Murray irrigation district going forward. It would be taking around about 40 to 50 per cent of current water out of the system as it is now. That is something that I think all of the industry across northern Victoria is very concerned about, as is Goulburn-Murray Water.[c]

> We say that the 450 represents the tipping point—that we have given up as much as we can … 450 is the tipping point and our community cannot bear it, so much more water will come out of our area [the Goulburn Murray Irrigation District] because we have the high-security water … If it is to happen, in no way must it ever come out of the consumptive pool.[d]

Mr John Pettigrew (from the Environmental Farmers Network and Goulburn Valley environment Group), argued that the 450 gigalitres was compensation for allowing the target to be reduced as a result of projects which achieve equivalent outcomes with less water.[e] Ms Juliet Le Feuvre from Environment Victoria argued that the 450 gigalitres was necessary to 'keep the river functioning as an ecosystem'. She indicated that the best science suggested that even more should be made available for environmental purposes, but that the agreed water recovery target for the Murray-Darling Basin Plan (including the 450 gigalitres) was a compromise.[f]

In December 2017, Dr Amber Clarke from the Department of Environment, Land, Water and Planning explained:

> ... there is a requirement if that water is recovered that it has neutral or positive socio-economic outcomes. We certainly know from our own socio-economic studies in Victoria that there are impacts and it is being felt by the community. The Murray-Darling Basin ministerial council has indeed commissioned EY [Ernst & Young] to do some further work in this area ... we would need to consider the EY findings prior to making a formal position on that 450.[g]

Ms Suzanna Sheed MP, Member for Shepparton District, indicated to the Committee some that she and other stakeholders were concerned about the processes involved in developing that report.[h]

The Ernst & Young report was published in January 2018 and found that:

> From the analysis and discussions undertaken, and assuming the recommendations in the report are implemented, there is sufficient evidence the 450 GL can likely be recovered from water efficiency projects on a neutral or positive socio-economic basis.[i]

A number of criticisms have been made of the report.[j]

(a) Murray-Darling Basin Authority, *Adjustment to Sustainable Diversion Limits* <http://www.mdba.gov.au/node/4479>, viewed 13 April 2018

(b) Murray-Darling Basin Authority, *Sustainable Diversion Limit Adjustment Mechanism* <http://www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits/sdlam>, viewed 13 April 2018

(c) Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing*, 24 October 2017, p.16

(d) Suzanna Sheed MP, Member for Shepparton, *Public Hearing*, 5 December 2017, p.21

(e) John Pettigrew, Water Spokesperson, Environmental Farmers Network, and Chair, Goulburn Valley Environment Group, *Public Hearing*, 24 October 2017, p.35

(f) Juliet Le Feuvre, Healthy Rivers Campaign Manager, Environment Victoria, *Public Hearing*, 5 December 2017, p.32

(g) Amber Clarke, Director, Waterway Programs, Department of Environment, Land, Water and Planning, *Public Hearing*, 5 December 2017, pp.5-6

(h) Suzanna Sheed MP, Member for Shepparton, *Public Hearing*, 5 December 2017, pp.18-19

(i) Ernst & Young, *Analysis of Efficiency Measures in the Murray-Darling Basin—Opportunities to Recover 450GL in Additional Environmental Water through Efficiency Measures by 2024, with Neutral or Positive Socio-Economic Impacts* (2017), p.21

(j) Andrew Miller, 'Pollies Blast EY Upwater Report', *Stock & Land*, 22 January 2018

5 Improvements in environmental water management

5.1 Overview

'Because the volume of held environmental water is less than the waterways need, it is critical that every drop of actively managed environmental water is delivered in a manner that will maximise environmental outcomes.' [268]

As discussed in the earlier chapters of this report, there are a number of challenges associated with the management, governance and use of environmental water. There is a need to minimise the risk of blackwater events and to mitigate them when they occur (see Chapter 2). It is important that the fees and charges paid by environmental water holders are reasonable and do not put an unfair burden on other water users (see Chapter 3). Water storage, release and trading, along with the associated use of infrastructure, must be done in the most efficient way to achieve the best possible outcomes. Water management decisions must also consider the needs of other water users and minimise negative and unintended consequences (see Chapter 4).

Submitters and witnesses to this inquiry identified three areas where improvements would help government bodies to achieve these goals:

- additional research and monitoring, to identify more efficient and effective ways to use environmental water and to reduce negative impacts
- increased transparency, so that the community can understand what is being done, the reasons behind particular decisions and what is being achieved
- working with the community to gain the benefits of local knowledge and to understand stakeholders' needs.

Government policies and water managers have also identified the importance of these improvements and have planned expanded efforts in these areas. The Committee encourages the Government to make these matters continuing priorities.

5.2 Increased research and monitoring

5.2.1 An evolving field

'I think we need to recognise that we are on an amazing learning curve here. Have we got the balance [of water uses] right? I do not think we have, but I do not think everyone agrees where the balance is anyway. We are learning at a rapid rate. This is pretty new technology for us, if you like. Farmers have been irrigating for 120 years;

268 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.11

> *we [the catchment management authority] have been irrigating for about eight to 10 seriously, so I am the first to recognise that we are continually learning in trying to get this right.'* [269]

The current approach to managing water for the environment in Victoria is relatively new. The catchment management framework now in place was established in 1997. The current catchment management authorities were established at that time too. The Commonwealth Environmental Water Holder was established in 2008 and the Victorian equivalent in 2011. The Committee was told that, as a result, these bodies are still learning how best to manage water in the Victorian context.

The work undertaken by these bodies has also grown and changed since their creation. The volume of environmental water held has increased significantly. There has been substantial investment in environmental water infrastructure, opening up additional options for ways to manage environmental water.

Submitters and witnesses emphasised that much has been learnt in recent years. However, they also indicated that the learning process with environmental water management can be difficult and that further work is required:

> Since the end of the drought, environmental managers have been able to use environmental water over a much wider range of climatic conditions and made really significant advances in understanding how to use it to best advantage. For example, timing of water releases is critical to creating the right conditions for golden perch to spawn in the Goulburn, and sometimes trial and error is the only way to learn.[270]

> Over time, we have seen water and catchment managers learn through good science and adaptive management how to deliver e-water [environmental water] more effectively and result in positive outcomes for our fish and quality of fishing. That said, managing flows and e-watering is very complex. Ongoing research is required to understand the effects of e-water and natural processes, including at different spatial scales and across a fish's life history.[271]

The need for further learning has also been recognised by the Government, with the Minister for Water telling the Committee that 'Victoria's framework for environmental water management recognises the importance of continued learning and improvement'[272] and the Government noting that it has 'a focus on continuous improvement.'[273]

A key source of learning is to understand and analyse the results of previous actions. For this to be possible, there needs to be a robust monitoring framework.

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269 Chris Norman, Chief Executive Officer, Goulburn Broken Catchment Management Authority, *Public Hearing,* 24 October 2017, p.21

270 Environment Victoria, *Submission 23*, p.3 (with sources)

271 Victorian Recreational Fishing Peak Body, *Submission 31*, p.2

272 Hon. Lisa Neville MP, Minister for Water, in Victorian Government, *Submission 39*, cover letter

273 Victorian Government, *Submission 39*, p.17

5.2.2 Monitoring the outcomes of environmental watering programs

Environmental outcomes

There are currently a number of projects in place to monitor and evaluate the environmental outcomes achieved with environmental water.[274] However, the Wimmera and Goulburn Broken Catchment Management Authorities noted limitations to these projects:

> There are a number of examples of programs aimed at linking the response of flora and fauna to environmental watering however they are comparatively modestly resourced when compared to the substantial funds expended in obtaining environmental water. They also have to deal with the complexity of a variety of confounding factors such as carp, livestock grazing and other flows (unregulated flows, water transfers etc.). Given sufficient time and resources more and more links will be able to be drawn between flows and ecological outcomes and there will be a commensurate increase in the effectiveness and efficiency of environmental watering.[275]

> ... a lot of these ecological responses we are going to see are long term. The thing is we need to have long-term monitoring programs, which require long-term funding commitments, which is always the challenge. At this point in time we have reasonable amounts of funding focusing on key areas within the catchment and across the Murray-Darling Basin to answer some of these questions that you raise, but it is not spread across all the sites where we deliver environmental water. We are going to have to infer that what we see in one particular region, or some sort of ecological response at a wetland or a river, we are going to see at another site. That is not ideal, but that is the limitation of the funding and the resources that we have.[276]

The Committee heard that previous monitoring projects had provided benefits. For example, the Goulburn Broken Catchment Management Authority told the Committee that monitoring programs have provided it with a better understanding of how to get golden perch to spawn and of the effectiveness of responses to blackwater.[277] However, the authority noted that funding for existing programs was not ongoing:

> Currently there are four key environmental water monitoring programs in place (Victorian Environmental Flow Monitoring and Assessment Program, Victorian Wetland Monitoring and Assessment Program, the Commonwealth Long Term Intervention Monitoring Project and The Living Murray environmental monitoring program for Icon Sites). However, these critical monitoring programs are not funded beyond 2019-20 and The Living Murray environmental monitoring program is only funded on an annual basis.[278]

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274 See, for example, Commonwealth Environmental Water Holder, *Submission 7,* p.2; Murray-Darling Fresh Water Research Centre, *Submission 28,* p.3

275 Wimmera Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 12, p.5

276 Simon Casanelia, Environmental Water and Wetlands Manager, Goulburn Broken Catchment Management Authority, *Public Hearing*, 24 October 2017, p.23

277 Mark Turner, River and Wetland Health Program Manager, and Simon Casanelia, Environmental Water and Wetlands Manager, Goulburn Broken Catchment Management Authority, *Public Hearing*, 24 October 2017, pp.24-5

278 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.4

Many submitters and witnesses advocated for improved monitoring. For example, the Wimmera Catchment Management Authority noted the value of monitoring water flows:

> Increasing knowledge around habitat comes through understanding the hydrology (volume and duration of flow) and hydraulics (velocity and cross-sectional area) of waterways. For example, certain fish and plant species need water to reach high on the bank or into anabranches and flood runners for certain periods of time at key periods during the year (e.g. late spring) in order to successfully breed.
>
> The streamflow gauge network across Victoria is vital to understand flow rates. Maintaining and idealling enhancing this network is important in terms of linking the environmental water releases with the flora and fauna outcomes. In the Wimmera, this has been complemented by the use of new technology such as Portable Automated Logger System (PALS) Units. PALS units are small, temporary installations that can provide real-time data around water levels and water quality on a reasonably cost-effective basis … These units were purchased to be used to provide data during floods. It would be beneficial to increase the utilisation of this technology through providing a framework for PALS unit use for environmental water monitoring.[279]

The Wentworth Group of Concerned Scientists called for a river monitoring program across the Murray-Darling Basin, measuring and reporting regularly on the overall condition of the river systems and progress towards specific objectives.[280]

The Committee also notes the need to monitor for unintended negative impacts on the environment resulting from environmental watering programs. As discussed in Sections 4.8.1 and 4.8.2 of this report, concerns have been raised about damage to riverbanks, reduced health of river red gums and increased pest animals and plants. The Committee considers it important for monitoring of environmental outcomes to identify whether or not these (or other) negative impacts to the environment have occurred, as well as looking for positive outcomes.

Social and economic impacts

> ***'It is relatively easy to find information that defends the importance and success of environmental watering, but extremely difficult to find any written documentation of damage caused.'*** [281]

As discussed in Section 4.8.3 of this report, a number of concerns were raised about the impact of environmental watering programs on local communities. Concerns largely centred around the effects of less water being available for irrigation in certain areas. This was seen as reducing local economies and employment opportunities. This can put pressure on towns in parts of Victoria that are already facing social and economic challenges. It may also increase costs for remaining irrigators, as the costs of maintaining irrigation infrastructure are spread among fewer farmers.

Concerns were expressed that any additional reductions in water for irrigators would be particularly damaging to some communities (see Box 4.3 in Chapter 4).

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279 Wimmera Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 12, p.5

280 Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.5

281 Jan Beer and Ken Pattison, *Submission 9*, p.2

The Committee considers it important for government bodies to monitor the social and economic impacts of environmental watering programs as well as environmental outcomes. Such monitoring will identify areas where the Government may need to provide communities with assistance to adapt to futures with less water. A better understanding of the impact of environmental watering programs on communities may also identify situations where policies may need to be modified to reduce unintended or unexpected negative impacts.

In addition, monitoring the social and economic impacts of different environmental watering actions could help to identify approaches that provide greater benefits to communities while still delivering the equivalent environmental benefits (such as locating wetlands in towns rather than more remote areas).[282]

Government plans

The Government has recognised the need for improved monitoring and evaluation. The *Water for Victoria* policy (released in 2016) notes the Government's intention to invest $20 million over four years in monitoring, evaluation and reporting for waterways and to:

> ... review and improve Victoria's existing waterway health monitoring programs to have a greater focus on monitoring the changes that result from management actions, including changes in social and economic indicators.[283]

Similarly, the Victorian Environmental Water Holder has indicated its intention to 'develop a clear framework and investment plan for monitoring, to ensure we increase knowledge for decision making and can source information to publically report on the outcomes of environmental watering in Victoria.'[284] The Government's policy *Our Catchments, Our Communities* also commits to developing consistent indicators to measure the state of catchments and to 'ensure the evidence base, including research and development and monitoring, evaluation and reporting, supports and informs planning and adaptive management.'[285]

The Committee acknowledges the Government's commitment to increased monitoring of environmental watering outcomes and encourages further action in this area.

FINDING 15: Monitoring the environmental outcomes achieved by environmental watering programs is important to achieve a better understanding of the effectiveness of different actions and to reduce unintended negative consequences. This understanding is important to improve the efficiency of environmental water use and maximise positive outcomes.

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282 Friends of Lake Wallace, *Submission 12*, p.2

283 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.59

284 Victorian Environmental Water Holder, *Corporate Plan 2017-18 to 2020-21* (n.d.), p.26

285 Department of Environment, Land, Water and Planning, *Our Catchments, Our Communities: Integrated Catchment Management in Victoria 2016–19* (n.d.), pp.46-9

FINDING 16: Some concerns have been raised about environmental watering programs having negative social and economic impacts of local communities, such as the loss of income and jobs associated with irrigation. It is important for the Government to monitor for these potential outcomes to reduce or mitigate any negative side effects of environmental watering. Monitoring broader social and economic effects may also help water managers to identify approaches where there may be both environmental and social benefits.

RECOMMENDATION 2: That the Government expand plans to increase the amount of monitoring of the outcomes achieved with environmental watering actions so that a continuous learning and improvement approach can be adopted. This should include both environmental outcomes and the social and economic impacts on local communities and irrigators.

5.2.3 Areas for further research

> ***'A strong and ongoing commitment to aquatic science is required to provide environmental water managers with the information needed to maximise environmental water benefits.'*** [286]

Research is important to provide water managers with information about how to use environmental water in the most efficient and effective ways. As noted earlier in this chapter, there is still much to be learnt about how the environment responds to environmental watering actions.

Professor Ewen Silvester from the Murray-Darling Freshwater Research Centre indicated that research is currently being undertaken but that there is scope for more:

> The MDFRC [Murray-Darling Freshwater Research Centre] is currently engaged in two large adaptive management projects to assist in understanding how flows affect and can be manipulated to produce our desired ecological outcomes and potentially with less water. Those projects include the long-term intervention monitoring program, specifically directed towards understanding the role of environmental water in the implementation of the Murray-Darling Basin plan. The second one is the environmental water knowledge and research project, which aims to understand the ecological response to different water regimes.
>
> It is true to say there is still a great deal of science to be done around this, particularly in developing predictive models of how ecosystems respond to flow, and this is going to become even more challenging. It is particularly challenging in the Australian context because our flows are, in any case, irregular and are now superimposed upon changing climate.[287]

Climate change may also lead to changes in the amount of water available in the future. The Wentworth Group of Concerned Scientists called for:

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286 Melbourne Water in Victorian Government, *Submission 39*, Appendix 16, p.2

287 Ewen Silvester, Deputy Director, Murray-Darling Freshwater Research Centre, *Public Hearing,* 5 December 2017, p.60

> Improving scientific understanding of the potential future stresses due to extreme weather events (e.g. more frequent and more severe drought, bushfires affecting stream flow and higher evaporation from rising temperature) and long term changes in climate including water availability, supported by a climate change adaptation program for environment assets, industries and public infrastructure.[288]

The importance of planning for and adapting to climate change has been recognised in *Water for Victoria* and the Victorian Environmental Water Holder's corporate plan.[289]

Other areas where submitters and witnesses called for further research included:

- better forecasting of river inflows[290]
- the potential benefits of using groundwater to supplement environmental water flows[291]
- a more complete understanding of the benefits of healthy ecosystems[292]
- the effectiveness of existing environmental water infrastructure[293]
- the flows required to stimulate native fish migration and to connect floodplains with wetlands[294]
- the causes of blackwater events, including the impact of material from agricultural land[295]
- the hydrology of the Murray-Darling Basin and sodic soils within the basin[296]
- the current and potential environmental benefits of existing irrigation infrastructure.[297]

As discussed earlier in this chapter, the Government has indicated that it has adopted a continuous learning and improvement approach. Supporting, encouraging and learning from research should be an important part of this approach. This has been recognised in *Water for Victoria*, which includes a commitment to:

> ... establish a waterway research hub to support more coordinated, strategic research and monitoring both within the Department of Environment, Land, Water and Planning and across relevant government stakeholders and research providers, and include mechanisms for independent science oversight and knowledge brokering.[298]

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288 Wentworth Group of Concerned Scientists, *Five Actions Necessary to Deliver the Murray-Darling Basin Plan 'in Full and on Time'* (2017) (included in Wentworth Group of Concerned Scientists, *Submission 32*), p.5

289 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.54; Victorian Environmental Water Holder, *Corporate Plan 2017-18 to 2020-21* (n.d.), pp.25-6

290 Greater Shepparton City Council, *Submission 21*, p.2; Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.4

291 Friends of Lake Wallace, *Submission 12*, p.1

292 Terry Court, Vice President, Goulburn Valley Environment Group, *Public Hearing,* 24 October 2017, p.35; Friends of Lake Wallace, *Submission 12*, p.3

293 Terry Hillman AM, Member, Wentworth Group of Concerned Scientists, *Public Hearing,* 5 December 2017, p.66—see Section 4.6.1 of this report

294 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.4

295 Commonwealth Environmental Water Holder, *Submission 7,* p.3; Yarra Riverkeeper Association, *Submission 22*, p.3

296 John Bentley, *Submission 3*, p.4

297 See Section 4.6.2 of this report

298 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.59

FINDING 17: Research into areas associated with environmental water has the potential to enable more efficient and effective use of environmental water. There are some research projects currently underway and the Government has committed to additional support for research. Submitters and witnesses identified a variety of areas where additional research may be beneficial.

5.2.4 Real-time monitoring

'... some of the greatest barriers that now exist to efficient use of environmental water are through imperfect knowledge. So actions that we could undertake to address that would be increasing our metering and monitoring of our networks and providing research to enable improved predictive capacity that could allow environmental water and events to tie in with natural flow events, irrigation water releases or urban water transfers and the like.' [299]

The Committee heard a significant number of calls for improved real-time monitoring of water levels and water quality. For example, the River Basin Management Society told the Committee:

> A greater understanding of water use during delivery events is needed to enable the most efficient use of environmental water. The current level of available metering and monitoring data is often insufficient to prevent over- or under-watering, The RBMS [River Basin Management Society] believe that an enhancement to the gauging and telemetry networks is a relatively simple and economical way to improve monitoring that can directly lead to greater efficiencies in environmental water deliveries.[300]

Submitters and witnesses identified a number of benefits that would come from real-time data about water flows:

- the ability to create higher flows in waterways, with associated environmental benefits (as water managers wish to avoid overbank flooding but currently have only limited information about water levels, they are currently conservative in how much water they release, which can lead to lower flows than would be ideal)[301]
- more accurate accounting of return flows[302]
- a better understanding of local situations, allowing water managers to avoid releasing environmental water when there are high natural flows and thus avoid undesired flooding[303]
- more capacity to time environmental water releases to piggy-back on natural flows or water released for other uses, so that high flows can be achieved with less environmental water.[304]

There were also calls for real-time monitoring of dissolved oxygen and carbon levels in the water to identify and mitigate blackwater events:

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299 Mark Stacey, Immediate Past President, River Basin Management Society, *Public Hearing*, 5 December 2017, p.35

300 River Basin Management Society, *Submission 17*, p.5

301 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.8

302 Jan Beer and Ken Pattison, *Submission 9*, pp.1-2

303 Juliet Le Feuvre, Healthy Rivers Campaign Manager, Environment Victoria, *Public Hearing,* 5 December 2017, p.31

304 Mark Stacey, Immediate Past President, River Basin Management Society, *Public Hearing*, 5 December 2017, p.35

> ... having access to data quickly often gives you some opportunities to work out what your management options are, some of which would be to just alert people that there is going to be a blackwater event. In other cases there is the opportunity to divert flows to try to dilute the water or to create flows to create refuges where fish can congregate ... In this day and age with the technology and the price of this material I am surprised that we do not have more of it ...[305]

> We can definitely real-time monitor things like organic carbon levels in water. That is possible. People do it now; it can be done. Through telemetry you could have those numbers instantly. You could also respond through environmental flows if you have the water available to create refugia. If you find the organic carbon levels are going high and the oxygen levels are going low and you think you need to respond, you could do it. You could do it from a river management point of view. Certainly it is theoretically possible. I am sure there is a whole range of engineering constraints around that, but there is no scientific reason why you could not achieve that. How long it would take to implement, well, that technology already exists for doing those sorts of measurements, so you could do that rather rapidly.[306]

Monitoring of water flows and water quality has been conducted in a number of places. Real-time monitoring of flows has been undertaken on the Murrumbidgee.[307] Dr Darren Baldwin has worked with Goulburn Broken Catchment Management Authority to monitor dissolved oxygen levels in the Goulburn Broken catchment.[308] Monitoring equipment has also been used in the Wimmera during floods.[309]

Based on the evidence presented to it, the Committee considers that there may be significant benefits to investing in gauges and meters to provide real-time data about water flows and dissolved oxygen and carbon levels.

FINDING 18: Real-time monitoring of water flows may contribute to more efficient and effective use of environmental water. Real-time monitoring of dissolved oxygen and carbon levels may assist with mitigating blackwater events.

RECOMMENDATION 3: That the Government allocate additional funds to install monitoring equipment to provide real-time data about water flows and dissolved oxygen and carbon levels in Victorian rivers and wetlands.

5.3 Increased transparency and better communication

A key message that came from submitters and witnesses to this inquiry was that there was a lack of clear information about several areas of environmental water management. Given that environmental water often reduces the amount of water available for irrigators, local communities have a key stake in understanding what is being done with environmental water and what is being achieved.

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305 Darren Baldwin, *Public Hearing,* 5 December 2017, p.49

306 Ewen Silvester, Deputy Director, Murray-Darling Freshwater Research Centre, *Public Hearing,* 5 December 2017, p.61

307 Jan Beer and Ken Pattison, *Submission 9*, p.1; Rob Rendell, Environmental and Agricultural Consultant, RMCG, *Public Hearing,* 5 December 2017, p.20

308 Darren Baldwin, *Public Hearing,* 5 December 2017, p.48

309 Wimmera Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 12, p.5

Chapter 3 of this report noted that there is a considerable degree of confusion about how much environmental water holders pay in relation to the storage and delivery of environmental water. Suggested areas of improvement have been included in Section 3.3.2, which also notes the Government's intention to improve the transparency and reporting on environmental water fees and charges.

5.3.1 The need for more disclosure

> *'Increased communications as well as strategic and targeted engagement with other water users and communities will help dispel the concerns that currently exist. Greater dialogue about the purposes of environmental water, the successes, and the lessons from uses that did not achieve planned objectives would generate greater public confidence. GMW [Goulburn-Murray Water] knows of several successful environmental watering actions that would have benefitted from increased public attention.'* [310]

Multiple submitters and witnesses called for clearer disclosure of plans, goals and achievements in relation to environmental water actions. For example, Environment Victoria told the Committee:

> [The Victorian Environmental Water Holder (VEWH)'s] decision making and prioritisation frameworks must be clear, robust and transparent and readily communicable to and understood by affected individuals and communities. The VEWH needs to be able to buy, sell and carryover entitlements and allocations to maximise benefits and some decisions may not accord with community expectation. For example, the VEWH may decide to carry over water rather than deliver it to a wetland that is in a drying phase, contrary to community expectations about water delivery. Or the VEWH may choose to deliver environmental water at a time when temporary water prices are high. These types of decisions must be explained so that the community becomes more informed about and supportive of the aims and objectives of environmental watering.[311]

However, the Goulburn Broken Catchment Management Authority noted that:

> A recent investigation by the Victorian Environmental Water Holder showed the community had limited awareness and understanding of how waterways are managed across Victoria and the aims and benefits of environmental water use. This lack of awareness and understanding reduces community confidence in environmental water use and support to advance opportunities to improve its effectiveness and efficiency.[312]

According to the study referred to, only 30 per cent of non-metropolitan respondents were 'fully aware that Victoria's waterways have been modified for human use'. The study found that 'the lack of general "water literacy" ... as well as a number of myths and misconceptions meant that many research participants did not have adequate context to understand the need for environmental water'.[313] The Committee heard similar conclusions from a number of people that it met with over the course of this inquiry.

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310 Goulburn-Murray Water in Victorian Government, *Submission 39*, Appendix 14, p.4

311 Environment Victoria, *Submission 23*, p.4

312 Goulburn Broken Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 7, p.4

313 Documentation provided to the Committee by the Department of Environment, Land, Water and Planning in response to questions on notice

The results of the study indicated that people were more supportive of environmental water when exposed to information on waterway management and that many respondents wanted to know more information. It also found that there was a need for a change in the language used when discussing environmental water.[314] Mr Trent Wallis from the Victorian Environmental Water Holder concluded that:

> ... there are some areas where we can look at targeting our communication and engagement to get people more involved, particularly in terms of local communities working with catchment management authorities in terms of the planning of environmental water use, but also at a statewide level as well in terms of how we engage with peak bodies and particularly user groups that will really benefit from environmental water. So it was really important and useful research.[315]

In addition to a general understanding of environmental water programs, several specific areas were identified by submitters and witnesses to this inquiry where more disclosure would be beneficial:

- the impact of environmental water carryover (see Section 4.3.2 of this report) on the availability of water for irrigators[316]
- water trading activities, including presenting data in a way that allows the differentiation of market-based trades from other types of trade (see Section 4.5)[317]
- details of all environmental water entitlements (and who holds them) in individual catchments and trading zones[318]
- administrative mechanisms available to environmental water holders that are not available to other users (such as the ability to 'overdraw' water, to have return flows re-credited to the holder's account and to protect water from down-stream extraction)[319]
- the basis for the Victorian Environmental Water Holder's determination of current climate scenarios[320]
- the methodology and accuracy of calculations about environmental water use and return flows[321]
- the importance of experimentation by environmental water holders to learn how best to manage environmental water.[322]

The need for better disclosure has been recognised by multiple bodies involved with environmental water. The Government's *Water for Victoria* policy states:

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314 Documentation provided to the Committee by the Department of Environment, Land, Water and Planning in response to questions on notice

315 Trent Wallis, Co-Executive Officer, Victorian Environmental Water Holder, *Public Hearing,* 5 December 2017, p.9

316 Murray Darling Association, *Submission 38*, p.2

317 Australian Competition and Consumer Commission, *Submission 34*, pp.9-11

318 Australian Competition and Consumer Commission, *Submission 34*, pp.11, 13

319 Australian Competition and Consumer Commission, *Submission 34*, p.9

320 Mallee Catchment Management Authority in Victorian Government, *Submission 39*, Appendix 8, p.9

321 Keith Greenham AM, *Submission 5*, p.5; Jan Beer and Ken Pattison, *Submission 9*, p.2; Keith Greenham AM, *Public Hearing,* 13 October 2017, p.28

322 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.5

The government will increase monitoring and reporting back to communities on progress towards expected environmental outcomes from environmental watering, with a focus on digital reporting from 2017.

- The Victorian Environmental Water Holder will report annually on where environmental watering has achieved shared benefits.
- The Commissioner for Environmental Sustainability will:
  - report on the outcomes of environmental watering in Victoria, as part of the five-yearly State of the Environment Report; a requirement under Section 8 of the *Commissioner for Environmental Sustainability Act 2003*
  - recommend ways to improve future public reporting, consistent with the objectives of the Commissioner set out in Section 7 of the *Commissioner for Environmental Sustainability Act 2003*.[323]

The Victorian Government's strategy *Our Catchments, Our Communities* indicates that the Government will seek to improve reporting and improve access to information about catchments.[324] The Victorian Environmental Water Holder's corporate plan notes that the organisation plans on 'improving the transparency around its decision-making and providing clearer, more accessible information about the rationale and benefits of environmental watering.'[325]

The Committee received a number of suggestions about how best to communicate and educate the community about environmental water management, as set out in Section 5.3.2 below.

5.3.2 Ways to improve community understanding

> ***'We feel that it has been working relatively well, but there are definitely opportunities for improvement, particularly with things such as increased communication, coming predominately from the water managers themselves indicating what the purpose and intended outcome of the deployment of water is; some more strategic and targeted engagement with particular groups who have an interest in how the water is being used, particularly those who may have some reservations about how the water is currently being used for the environment; and also some greater transparency in governance arrangements ...'*** [326]

The Committee was told about several approaches being adopted or planned by catchment management authorities and others to improve community understanding of environmental watering programs.

A number of submitters and witnesses emphasised the importance of providing the community with information about the benefits of environmental water. For example, Ms Louissa Rogers (from the North Central Catchment Management Authority) told the Committee that 'the way to our community's heart is actually to show how environmental water will benefit them'. She indicated that this has been a focus for her catchment management authority:

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323 Department of Environment, Land, Water and Planning, *Water for Victoria* (2016), p.55

324 Department of Environment, Land, Water and Planning, *Our Catchments, Our Communities: Integrated Catchment Management in Victoria 2016–19* (n.d.), p.49

325 Victorian Environmental Water Holder, *Corporate Plan 2017-18 to 2020-21* (n.d.), p.23

326 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, p.9

> ... we are actually able to start quantifying the KPIs [key performance indicators] for the ecological outcomes. I think as we start seeing the response to the improved systems by the region's communities and tourism, then we will be able to quantify that too.
>
> We have got a project ... that we will be implementing over the next couple of years where we will be actually seeing what sort of usage the forest has been getting and be able to put some economic benefit dollars around the use of the forest, and I would like to do a similar thing with our wetlands in the Kerang Lakes system.[327]

Government policies and plans, as noted in Section 5.3.1 of this chapter, recognise the need for additional information about the outcomes of environmental watering and have indicated an intention to improve reporting. However, Goulburn-Murray Water noted that a challenge faced by this approach is that the benefits from environmental water can often only be seen over the longer term.[328]

Dr Mark Bailey from Goulburn-Murray Water suggested that more personal engagement by water managers may be helpful:

> ... we would encourage some more discussion and open discussion between the environmental water managers about how they operate. There is a feeling that they put out media releases and put out some brochures—but perhaps going out and talking with the community and making themselves more available than perhaps they are at the moment to talk about those things and to appear at irrigator meetings, if that is necessary or if that is the way forward, to explain why they believe this is the right way and conversely provide the same opportunities for irrigators or other groups to speak to them as well.[329]

Mr John Laing told the Committee that the Goulburn Broken Catchment Management Authority had done some successful work to improve community understanding of environmental water issues through a:

> ... Wetland Working Group [which] brings community members from a range of organisations together with agency and department staff. This structure enables groups to interact with the decision makers in a robust forum to discuss options and best outcomes when using environmental water.[330]

The Murray-Darling Basin Authority noted that it and the Commonwealth Environmental Water Holder had taken a similar approach:

> One barrier that is not well addressed by Basin Plan processes is the need to build a stronger social licence for the use of environmental water. Effective community engagement processes at local and regional scales are required to build understanding, recognition and support for environmental watering. The establishment of local engagement officers by the Commonwealth Environmental Water Office and moves towards a stronger regional presence and outreach activities by MDBA [Murray-Darling Basin Authority] may soon help with this.[331]

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327 Louissa Rogers, Program Manager, Environmental Water, North Central Catchment Management Authority, *Public Hearing*, 25 October 2017, p.8

328 Chris Norman, Chief Executive Officer, Goulburn Broken Catchment Management Authority, *Public Hearing,* 24 October 2017, p.22

329 Mark Bailey, Head of Water Resources, Goulburn-Murray Water, *Public Hearing,* 24 October 2017, p.15

330 John Laing, *Submission 10,* p.4

331 Murray-Darling Basin Authority, *Submission 13*, p.5

The Committee notes these programs to provide more personal engagement between community members and water managers and encourages them. This sort of personal engagement may also complement efforts to seek community input into environmental water planning and decisions (see Section 5.4 of this report). As Mr John Laing told the Committee, providing information to the community can be important in developing informed community opinions.[332]

FINDING 19: Submitters and witnesses to this inquiry indicated that there is a need for clearer disclosure and more information about environmental watering programs, including details of the way they operate, the rationale for decisions and the outcomes achieved by these programs. The need to improve communication and reporting about environmental water has been recognised by the Government in various policies and plans.

FINDING 20: In addition to communicating information about environmental water through reports and brochures, there may be benefits to water managers and representatives undertaking more personal engagement with local communities.

RECOMMENDATION 4: That the Government continue efforts to improve community understanding of environmental watering programs and their impacts, including through both improved reporting and personal engagement between water managers and local communities.

5.4 Incorporating community input

'... waterway managers [the catchment management authorities and Melbourne Water] engage local communities and a broad range of key stakeholders throughout all stages of the environmental water management cycle; when planning watering activities (and prioritising them at a regional level), delivering environmental water and then reporting on its benefits.' [333]

As discussed in Chapter 1 of this report, water is a limited resource that is not only essential for the health of the natural environment, but is also required by human settlements for drinking and by irrigators for farming. Changes in the use of water for one purpose may come at the cost of other potential uses. The community therefore has a large stake in decisions about how water is used.

Even water used for environmental purposes has a range of stakeholders in addition to the environment. Environmental water can be important to recreational water users (such as people who enjoy boating, fishing or hunting), tourism operators and residents who enjoy environmental water within their towns.

A number of submitters and witnesses emphasised the value of community input to decisions about environmental water. Community input is important to identify local needs and priorities. Local experience with water management and local understanding of how wetlands and waterways function can also be a valuable source of information for planning.

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332 John Laing, *Submission 10,* p.4

333 Victorian Environmental Water Holder, *Corporate Plan 2017-18 to 2020-21* (n.d.), p.10

Community engagement is already a part of environmental watering processes. The Victorian Government told the Committee:

> Each year, CMAs [catchment management authorities] and MW [Melbourne Water] identify environmental watering priorities with their communities and prepare annual Seasonal Watering Proposals which are provided to the VEWH [Victorian Environmental Water Holder]. To contribute to this planning process, the CMAs and MW establish Environmental Water Advisory Groups (EWAGs) of community and interest groups. These include representatives of groups such as the Victorian Recreational Fishing Peak Body, Birdlife Australia, Field and Game and other interested parties.[334]

The Victorian Environmental Water Holder explained that:

> At a program-wide level, the VEWH directly engages with key state-level stakeholders, such as the Victorian Fisheries Authority, VR Fish, Field and Game Australia, Environment Victoria and representatives of the Murray Lower Darling Rivers Indigenous Nations (MLDRIN). These stakeholder meetings are to inform, consult and collaborate in matters relating to environmental watering.
>
> Forums, such as the Environmental Water Matters Forum (EWMF), provide an avenue for drawing together key stakeholder groups and community representatives with an interest in watering outcomes. The VEWH also holds other state and regional forums to initiate discourse on environmental watering and bring together policy, management and research experts to identify and address necessary improvements for the program. In 2016-17 the VEWH Commission approved the establishment of a state-wide Environmental Water Reference Group to establish deeper state-level stakeholder engagement.[335]

The Victorian Environmental Water Holder told the Committee that its strategies currently include 'collaborating with communities and special interest groups to make sure local knowledge informs the use of environmental water and that additional shared social and cultural benefits can be considered'.[336] The water holder also stated that 'The willingness of the program partners and local communities to share their local knowledge and experience has led to many improvements.'[337]

The Committee heard some positive feedback about these efforts but also heard calls for improvements. For example, Mr Gary Constantine believed there was 'a lack of consultation with those whose livelihoods depend on river flows.'[338] Mr Neville Goulding noted that 'Generally, the average person ... does not have that opportunity to talk to the CMA [catchment management authority]. It is quite difficult at times to have a forum where people can have that say, but by the same token, it would be good to have that input.'[339]

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334 Victorian Government, *Submission 39*, p.5

335 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.5

336 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.16

337 Victorian Environmental Water Holder in Victorian Government, *Submission 39*, Appendix 2, p.17

338 Gary Constantine, *Submission 14*, p.1

339 Neville Goulding, *Public Hearing,* 13 October 2017, p.25

The Kerang Lakes Land and Water Action Group noted a successful collaborative partnership between the community and water managers in the development of local salinity management plans.[340] However, the group believed that poor decisions had been made about the Kerang Lakes as a result of not listening to community input:

> The Kerang Lakes is a complex environment of interconnected rivers, lakes and wetlands. Past environmental management practices have adversely impacted on the region, often as a result of the failure of responsible agencies to give credence to local knowledge, and the slow response to emerging environmental issues and adaptive management.[341]
>
> It should be noted that community expectations are that consultation is not talking at people; it is a two way exchange of information and investigation is seeking understanding; not just working to a pre-determined outcome.[342]

The group called for better use of local knowledge and criticised the 'no boots on the ground' employment model, in which policy decisions are made in capital cities, with a lack on local on-ground staff and the use of short-term project-based employment contracts. The group believed that this approach presented barriers to community-based collaboration, arguing that:

> With no employment permanency environmental and water staff do not establish themselves within communities preventing them from building rapport and good working relationships with communities. With no assured employment, especially in country areas where there are no other employment options, they are not in a financial or professional position to go against the establishment, restricting robust examination of issues as they arrive or the full investigation and consideration of community input received during projects.[343]

The Committee also heard from residents of the Lake Meran area who reiterated the need for more local knowledge to be incorporated into management plans for the lake.[344]

The Victorian Recreational Fishing Peak Body noted that anglers are becoming more involved with environmental water decisions and that catchment management authorities and water managers are recognising them as key stakeholders. However, both that body and the Victorian Fisheries Authority told the Committee that there was potential for further collaboration with anglers and representative groups to maximise the benefits of environmental water for fish populations.[345]

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340 Kerang Lakes Land and Water Action Group, *Submission 20*, p.12

341 Kerang Lakes Land and Water Action Group, *Submission 20*, p.2

342 Kerang Lakes Land and Water Action Group, *Submission 20*, p.12

343 Kerang Lakes Land and Water Action Group, *Submission 20*, p.12

344 Stephen English, *Public Hearing,* 13 October 2017, pp.14, 18

345 Victorian Fisheries Authority in Victorian Government, *Submission 39*, Appendix 3, p.4; Victorian Recreational Fishing Peak Body, *Submission 31*, p.2; Michael Burgess, Executive Officer, Victorian Recreational Fishing Peak Body, *Public Hearing*, 10 November 2017, pp.2-3

The Murray Lower Darling Rivers Indigenous Nations acknowledged some successful partnerships between Aboriginal groups and catchment management authorities.[346] The Federation of Victorian Traditional Owner Corporations called for improved engagement, participation, research and practices to achieve a greater alignment between environmental and cultural objectives.[347] The group noted that:

> There can be significant differences between cultural and environmental watering objectives in terms of species or other environmental outcomes that may be prioritised in determining where to allocate an environmental flow.[348]

The Murray Darling Association, a peak body representing local councils in the Murray-Darling Basin, called for greater consultation with local councils in relation to environmental water:

> The MDA [Murray Darling Association] is of the position that environmental watering could be further informed by local government through the MDA. Such local knowledge—informed by decades of observations and experience—is essential in ameliorating the incidence and impacts of blackwater events.
>
> Additionally, inclusion of local government through the MDA—along with local land services, catchment management authorities and CEWO [Commonwealth Environmental Water Office] local engagement officers—in the planning for environmental watering invites greater public confidence in environmental watering.
>
> Environmental watering absolutely must consider local knowledge as the best way of avoiding unintended consequences inherent in blackwater events, including the proliferation of carp spawning, and any potential corollary gaps in mitigating blue-green algae outbreaks.[349]

The association also recommended 'active consultation' with local governments in relation to water infrastructure projects to ensure that the projects 'deliver maximum benefit to the local communities'.[350] Explaining the value of using local government, Mr Angus Verley from the association noted that:

> All local governments already have environmental officers, technical officers and operations directors. They are the most connected to their local communities, and a lot of those people already have a lot of that knowledge, which is probably being under-utilised at the moment.[351]

The Committee notes that the Government policy *Our Catchments, Our Communities* includes actions to strengthen community engagement and collaboration.[352]

The evidence received by the Committee suggests that there is potential for further work to be done to enhance and expand opportunities for community input to environmental water planning and management.

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346 Murray Lower Darling Rivers Indigenous Nations, *Submission 24*, p.2

347 Federation of Victorian Traditional Owner Corporations, *Submission 26*, p.2

348 Federation of Victorian Traditional Owner Corporations, *Submission 26*, p.2

349 Murray Darling Association, *Submission 38*, p.2

350 Murray Darling Association, *Submission 38*, p.3

351 Angus Verley, Senior Officer, Murray Darling Association, *Public Hearing,* 24 October 2017, p.30

352 Department of Environment, Land, Water and Planning, *Our Catchments, Our Communities: Integrated Catchment Management in Victoria 2016–19* (n.d.), p.25

FINDING 21: Environmental water planning and decision-making processes currently provide a number of opportunities for community input. However, the Committee heard calls from a range of stakeholders for additional opportunities and for better use of local knowledge and for it to be formalised in policies.

RECOMMENDATION 5: That the Government and water managers continue to explore further opportunities to incorporate community input into decisions about environmental water.

5.5 Conclusion

Environmental water management in its current form is a relatively new field in Victoria and one that is constantly evolving. The Committee heard that there is still much to be learnt, both in terms of the most efficient way to use environmental water and in terms of the most effective way to engage with the community.

Many submitters and witnesses told the Committee about good work that is being done with environmental water. At the same time, the Committee heard a variety of concerns about environmental watering programs and was told that there is scope for improvement in a number of areas.

There were calls for additional research and monitoring of the environmental, social and economic impacts of environmental watering programs. Submitters and witnesses advocated for greater transparency in relation to the details of environmental watering programs, the rationale for the programs and the charges paid by environmental water holders. The Committee was told that there is a need for improved approaches to communication about environmental water with the community. Submitters and witnesses also indicated that there could be improvements in the way that community input is sought and incorporated into environmental water planning and decision-making.

The Committee notes that these issues have been identified by the Government and that the Government, environmental water holders and catchment management authorities have committed to making improvements in most of these areas. The Committee supports further work in these areas and encourages all relevant bodies to maintain a continuous learning and improvement approach.

Appendix 1
Inquiry process

A1.1 Inquiry process

The Committee formally determined to self-reference an inquiry into management, governance and use of environmental water on 5 June 2017. The terms of reference are provided in full at the beginning of this report.

A1.1.1 Submissions

A call for written submissions through the Committee's website, the Parliament's Twitter account, on Facebook and in several Victorian newspapers occurred in June 2017. The Committee also wrote to a range of key stakeholders inviting submissions, including government departments, catchment management authorities and environmental groups.

In total, the Committee received 39 submissions from individuals and organisations. One of those submissions (from the Victorian Government) included a further 15 submissions from different government bodies in its appendices.

A full list of submitters can be found in Section A1.2 of this appendix.

A1.1.2 Public hearings

The Committee conducted five days of public hearings between 13 August and 5 December 2017. It received evidence from 25 separate organisations and individuals.

The public hearings were held in:

- Kerang
- Shepparton
- Bendigo
- Colac
- Melbourne.

The Committee spoke to witnesses from a number of government organisations, community groups and individuals who are concerned about environmental water.

A list of the witnesses who attended public hearings is included in Section A1.3 of this appendix.

A1

A1.1.3 Site visits

The Committee undertook site visits to see environmental water infrastructure and sites benefitting from environmental water near Cohuna and Koondrook on 12 October 2017. The Committee was accompanied by the North Central Catchment Management Authority.

The Committee also visited two wetlands near Shepparton on 24 October. Representatives of several environmental groups accompanied the Committee.

A1.2 Submissions

1	Office of the Commissioner for Environmental Sustainability
2	Neville Goulding
3	John Bentley
4	Goulburn Valley Environment Group
5	Keith Greenham AM
6	Environmental Farmers Network
7	Commonwealth Environmental Water Holder
8	Barry Bishop
9	Jan Beer and Ken Pattison
10	John Laing
11	*number not used*
12	Friends of Lake Wallace
13	Murray Darling Basin Authority
14	Gary Constantine
15	Rodger Schifferle
16	Ross McPherson
17	River Basin Management Society
18	*name withheld*
19	Australian Environment Foundation
20	Kerang Lakes Land and Water Action Group
21	Greater Shepparton City Council
22	Yarra Riverkeeper Association
23	Environment Victoria
24	Murray Lower Darling Rivers Indigenous Nations
25	Ken and Jill Hooper
26	Federation of Victorian Traditional Owner Corporations
27	Concerned Lake Meran Community Members
28	Murray-Darling Freshwater Research Centre
29	Chris Bromley
30	Victorian Farmers Federation
31	Victorian Recreational Fishing Peak Body
32	Wentworth Group of Concerned Scientists
33	Institute for Land, Water and Society

34	Australian Competition and Consumer Commission
35	Dr Darren Baldwin
36	People for a Living Moorabool
37	Infrastructure Victoria
38	Murray Darling Association
39	Victorian Government, including appendices from: • Department of Environment, Land, Water and Planning • Victorian Environmental Water Holder • Victorian Fisheries Authority • Parks Victoria • Corangamite Catchment Management Authority • Glenelg Hopkins Catchment Management Authority • Goulburn Broken Catchment Management Authority • Mallee Catchment Management Authority • North Central Catchment Management Authority • North East Catchment Management Authority • West Gippsland Catchment Management Authority • Wimmera Catchment Management Authority • Gippsland Water • Goulburn-Murray Water • Goulburn Valley Water • Melbourne Water
40	Andrew Ash

A1.3 Public hearings

Friday 13 October 2017, Kerang

Name	Position	Organisation
Stuart Simms	President	Kerang Lakes Land and Water Action Group
Raelene Peel	Secretary	
Norman Condely		Concerned Lake Meran Community Members
Peter Condely		
Stephen English		
John Pike		
Shelley Ritchie		
Neville Goulding		–
Melanie Tranter		–
Keith Greenham AM		–
Roger Schifferle		–
Barry Bishop		–

A1

Tuesday 24 October 2017, Shepparton

Name	Position	Organisation
Greg McKenzie	Manager, Environment	Greater Shepparton City Council
Geraldine Christou	Acting Director, Sustainability Development	
Dr Mark Bailey	Head of Water Resources	Goulburn-Murray Water
Chris Norman	Chief Executive Officer	Goulburn Broken Catchment Management Authority
Mark Turner	River and Wetland Health Program Manager	
Simon Casanelia	Environmental Water and Wetlands Manager	
Peter Mansfield	Chair, Region 2	Murray Darling Association
Angus Verley	Senior Officer	
John Pettigrew	Chair (Goulburn Valley Environment Group) and Water Spokesperson (Environmental Farmers Network)	Goulburn Valley Environment Group and Environmental Farmers Network
Terry Court	Vice-President	Goulburn Valley Environment Group
Melissa Stagg	Committee Member	

Wednesday 25 October 2017, Bendigo

Name	Position	Organisation
Brad Drust	Chief Executive Officer	North Central Catchment Management Authority
Louissa Rogers	Program Manager, Environmental Water	

Friday 10 November 2017, Colac

Name	Position	Organisation
Michael Burgess	Executive Officer	Victorian Recreational Fishing Peak Body
Cameron Steele	Coordinator	People for a Living Moorabool

Tuesday 5 December 2017, Melbourne

Name	Position	Organisation
Dr Amber Clark	Director, Waterway Programs	Department of Environment, Land, Water and Planning
Julia Reed	Senior Manager, Environmental Water	
Joe Banks	Senior Manager, Retail Entitlements and Markets	
John Lind	Senior Manager, Economic Management	
Denis Flett	Chairperson	Victorian Environmental Water Holder
Trent Wallis	Co-Executive Officer	
Suzanna Sheed MP	Member for Shepparton District	Parliament of Victoria
Rob Rendell	Environmental and Agricultural Consultant	RMCG
Dr Nicholas Aberle	Campaigns Manager	Environment Victoria
Juliet Le Feuvre	Healthy Rivers Campaign Manager	
Mark Stacey	Immediate Past President	River Basin Management Society
Richard Anderson	Victorian Farmers Federation Water Council Chair	Victorian Farmers Federation
Caitlin Hirst	Senior Policy Advisor	
Dr Darren Baldwin		–
Phillip Glyde	Chief Executive	Murray-Darling Basin Authority
Carl Binning	Executive Director, Environmental Management Division	
Jo Kneebone	General Manager, Water Quality and Environmental Water	
Professor Ewen Silvester	Deputy Director	Murray-Darling Freshwater Research Centre
Dr Terry Hillman AM	Member	Wentworth Group of Concerned Scientists
Dr Celine Steinfeld	Policy Analyst	