



Australian Government
National Water Commission

Australian environmental water management report **2010**





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Foreword by the Acting Chief Executive Officer

The National Water Commission is pleased to release the *Australian environmental water management report 2010*. This report is an important first step in a three-year Raising National Water Standards Program project that is contributing to improved environmental water reporting in Australia.

The aim of this project is to assist governments in the delivery of the National Water Initiative's water resource accounting outcome:

to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions, to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for *environmental and other public benefit outcomes* (NWI, paragraph 80).

This report provides an authoritative statement of the environmental water management arrangements around Australia at the end of the 2010 water year (30 June 2010). Having established this consolidated and agreed baseline, the Commission will continue to work with the state, territory and Australian governments to improve environmental water reporting and management.

This report is not intended to assess the arrangements in place or to make recommendations. However it reveals a number of key findings:

- + Environmental water management is a complex task that has developed in response to vastly different water resources around the country and a range of historical demands on those resources.
- + While the 'delivery' of water through water access entitlements for environmental purposes in the Murray–Darling Basin has received widespread public attention, environmental water management around Australia is primarily based on 'restrictions on extraction' from water resources, through water plans and conditions on water access entitlements.
- + While the determination of environmental water requirements and the commitment of such water is improving, the detail, frequency and geographic coverage of monitoring, reporting and review of environmental water use and outcomes varies around Australia.

Although the Australian Government has become increasingly active in water management since the *Water Act 2007* (Cwth), the states and territories remain primarily responsible for environmental water management across Australia. Therefore, the Commission is grateful to the states and territories for their involvement in producing this report. The Commission would also like to acknowledge the assistance of a number of Australian Government agencies engaged in environmental water management or reporting: the Commonwealth Environmental Water Holder; the Murray–Darling Basin Authority; the Department of Sustainability, Environment, Water, Population and Communities; the Bureau of Meteorology and the Australian Bureau of Statistics. Finally, the Commission would like to thank Alluvium Consulting for its assistance in producing this report.

The Commission welcomes feedback on *Australian environmental water management report 2010* and invites contributions to its continuing work over the next two years in further developing environmental water reporting.

James Cameron

Acting Chief Executive Officer

30 November 2010

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Explanatory notes

Information sources

The sources of information on environmental water differ in each jurisdiction. The *Australian environmental water management report 2010* is compiled on the basis of:

- + jurisdictional legislation and legislative instruments, including water plans
- + publicly available reports and background information
- + content from jurisdictional websites
- + consultation with state, territory and Australian government departments and agencies
- + other National Water Commission publications.

The report summarises this information; however, direct quotes and references are used where appropriate.

Table i. Organisations that contributed information to the *Australian environmental water management report 2010* (30 June 2010)

Jurisdiction	Agency
Commonwealth	Australian Bureau of Statistics
	Bureau of Meteorology
	Commonwealth Environmental Water Holder
	Department of the Environment, Heritage, Water and the Arts (since September 2010, Department of Sustainability, Environment, Water, Population and Communities)
	Murray–Darling Basin Authority
Australian Capital Territory	Department of Environment, Climate Change, Energy and Water
New South Wales	Department of Environment, Climate Change and Water
Northern Territory	Department of Natural Resources, Environment, The Arts and Sport
Queensland	Department of Environment and Resource Management
South Australia	Department of Water, Land and Biodiversity Conservation (since 1 July 2010, the Department for Water)
Tasmania	Department of Primary Industries, Parks, Water and Environment
Victoria	Department of Sustainability and Environment
Western Australia	Department of Water

Disclaimer

The Commission and its consultants, Alluvium Consulting Pty Ltd, have made reasonable endeavours to ensure the accuracy of this report. However, the information contained within this document should not be relied upon for commercial dealings, and the accuracy and currency of the material should be verified by users with the relevant state, territory and Commonwealth authorities. The Commission and Alluvium Consulting will not be liable under any circumstances for any loss of profits or damages of any kind arising from use of, or reliance upon, the information in this report.

Abbreviations and acronyms

2007 biennial assessment	<i>National Water Initiative: First biennial assessment of progress in implementation 2007</i>
2009 biennial assessment	<i>Australian water reform 2009: second biennial assessment of progress in implementation of the National Water Initiative</i>
AWAS	Australian Water Accounting Standard
AWRIS	Australian Water Resources Information System
CMA	Catchment management authority
Commission	National Water Commission
GDE	groundwater-dependent ecosystem
GL	gigalitre (one billion litres)
GPWAR	General purpose water accounting reports
ML	megalitre (one million litres)
NRM	natural resources management
NWADp	National Water Accounting Development project
NWI	National Water Initiative
WACF	Water Accounting Conceptual Framework

Executive summary

The Commission's *Australian environmental water management report 2010* provides a consolidated and authoritative statement of the environmental water management arrangements in Australia at 30 June 2010—the end of the 2009–2010 water year. Notably since this date, the Murray–Darling Basin Authority released its Guide to the proposed Murray–Darling Basin Plan on 8 October 2010. That guide is not reviewed in this report, as it was released after 30 June 2010 and this report is concerned with current management arrangements—as opposed to potential future developments (which are not just limited to the Murray–Darling Basin).

The report is not intended to assess the arrangements in place or to make recommendations. Instead, it is intended to promote better understanding of environmental water management and to provide a clear, agreed baseline for future reference.

The basis for this report is paragraph 80 of the National Water Initiative (NWI):

The Parties agree that the outcome of water resource accounting is to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions, to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for *environmental and other public benefit outcomes* (NWI, paragraph 80).

Currently not all NWI parties report annually on 'the environmental and other public benefit outcomes sought and achieved', and therefore the purpose of the *Australian environmental water management report 2010* is to address a number of ongoing gaps in reporting by:

- + detailing arrangements in place at a jurisdiction scale, of the status of reporting against NWI requirements
- + being produced for the 2009–10 water year to assist future national water reporting undertaken by the Bureau of Meteorology, the Australian Bureau of Statistics and other Australian Government agencies
- + providing nationally consistent coverage through consistent definitions and an environmental water management framework.

Definition of environmental water

This report shows that the management of 'environmental water' is extremely complex. From the outset, the National Water Initiative (NWI) does not define environmental water, nor is it commonly defined in water management legislation (with the exception of Victorian, New South Wales and the Commonwealth Acts). The *Australian environmental water management report 2010* provides the following definition of environmental water:

Environmental water is the water regime provided to achieve environmental objectives.

In defining and reporting on environmental water, the *Australian environmental water management report 2010* is focused only on environmental objectives and values, not 'other public benefit outcomes' (e.g. recreational and aesthetic outcomes) although they are often linked. Section 2 of the report discusses the various definitions of environmental water and the conceptual issues involved in defining it. Notably, the Commission's definition aligns closely to definitions used by the Australian Bureau of Statistics. The Commission's definition is also important in the context of a consistent water management model used throughout this report (also presented in Section 2).

An environmental water management framework

This report uses a consistent environmental water management framework, which is applied to each jurisdiction (including the Commonwealth) to allow a comparison of the various approaches around Australia. The framework used in the report consists of four elements: determination, commitment, compliance and review. The elements are discussed in detail in Section 3 of the report and are applied to jurisdictional management arrangements in sections 4–12 as the basis for consistent analysis.

Figure i. The environmental water management framework used in the *Australian environmental water management report 2010*

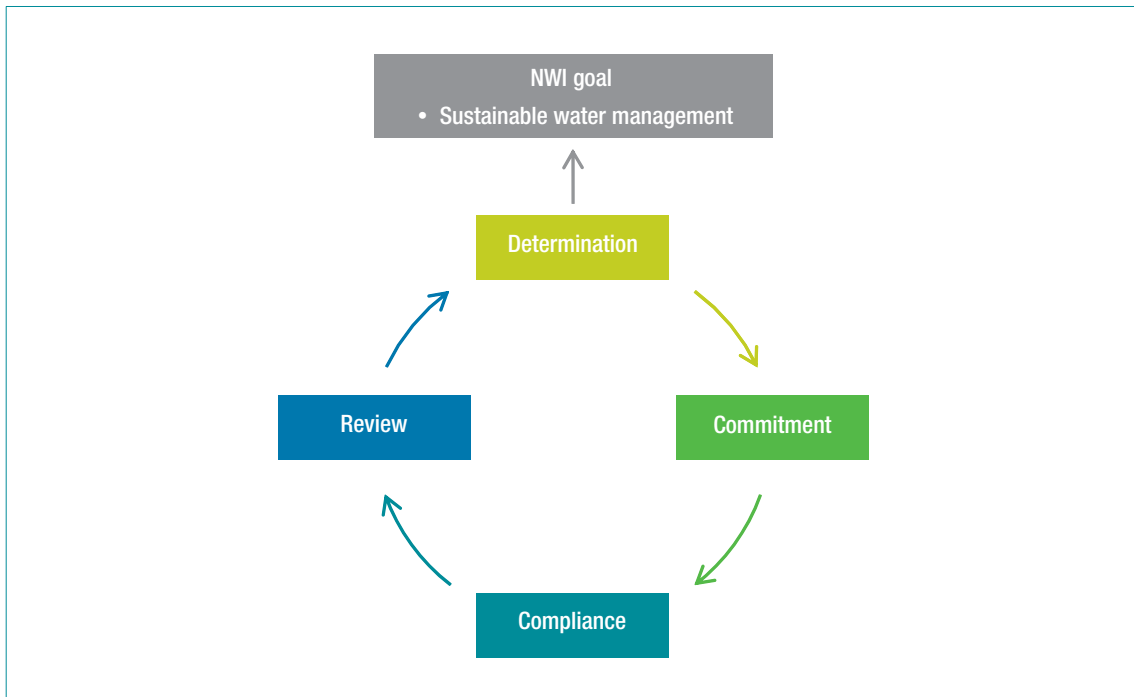


Table ii. Description of the elements of the environmental water management framework

Element	Description
Determination	Determine environmental objectives and water requirements for a range of risk levels.
Commitment	Decide the environmental water provisions and commit to them through the management of the water regime (planned and held environmental water).
Compliance	Monitor and report to assess if the water regime that was provided complies with the commitment.
Review	Monitor and report on environmental response and condition so as to evaluate and review both the determination and the commitment.

While in recent years environmental water has gained increased attention as a result of governments purchasing and delivering entitlements, this report demonstrates that environmental water management is primarily embodied in the various water allocation planning frameworks around Australia. Therefore this report focuses on the environmental water aspects within water plans, which state and territory governments are responsible for issuing under their relevant water legislation. The Commission's 2009 biennial assessment noted that:

Water plans are fundamental to water management, transparently establishing the intended balance between environmental and consumptive use outcomes and often setting out the terms and conditions of access to water for consumptive and non-consumptive users and the environment. (p. 14).

Figure ii. Australia: surface water plans (30 June 2010)

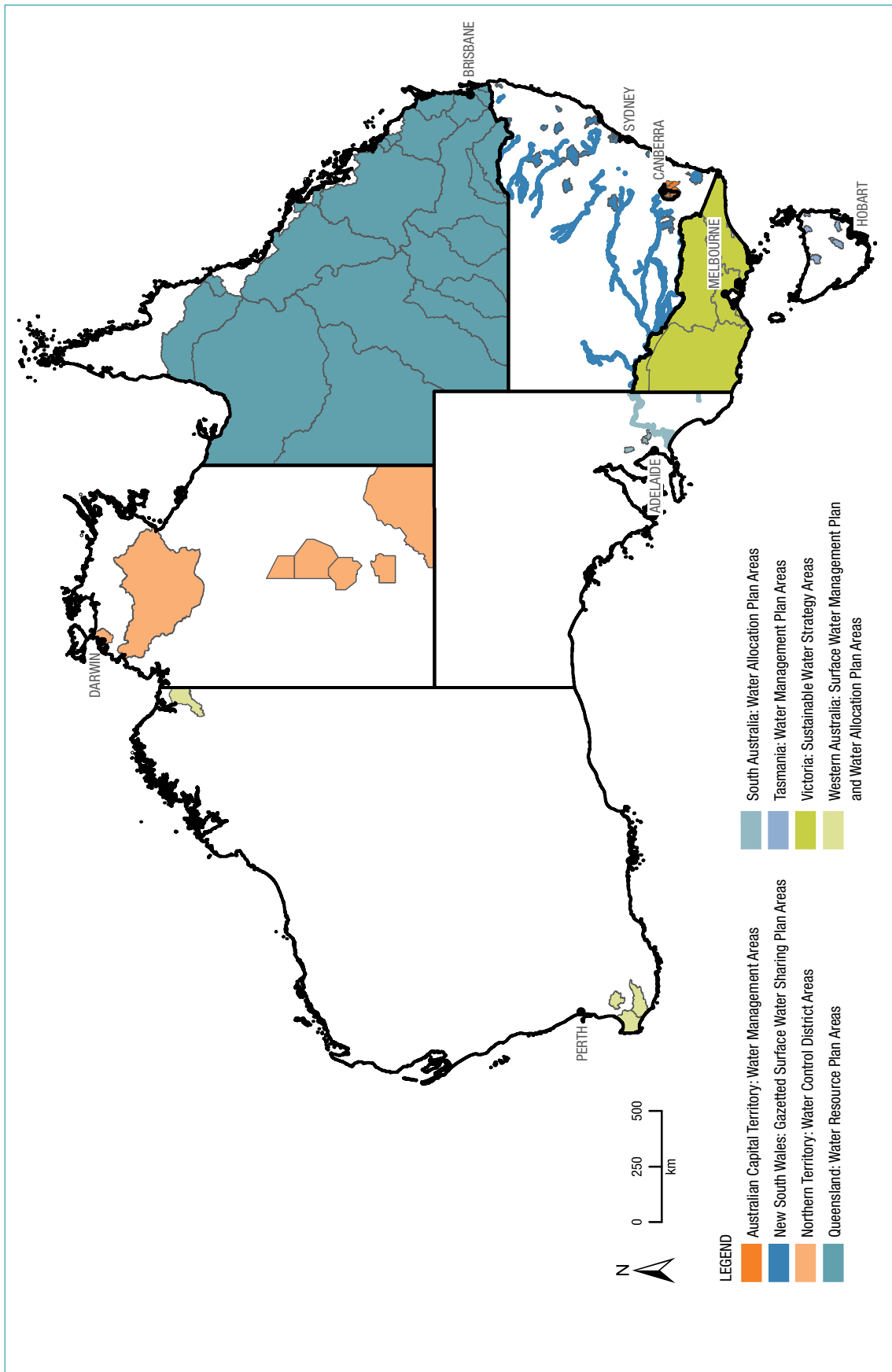
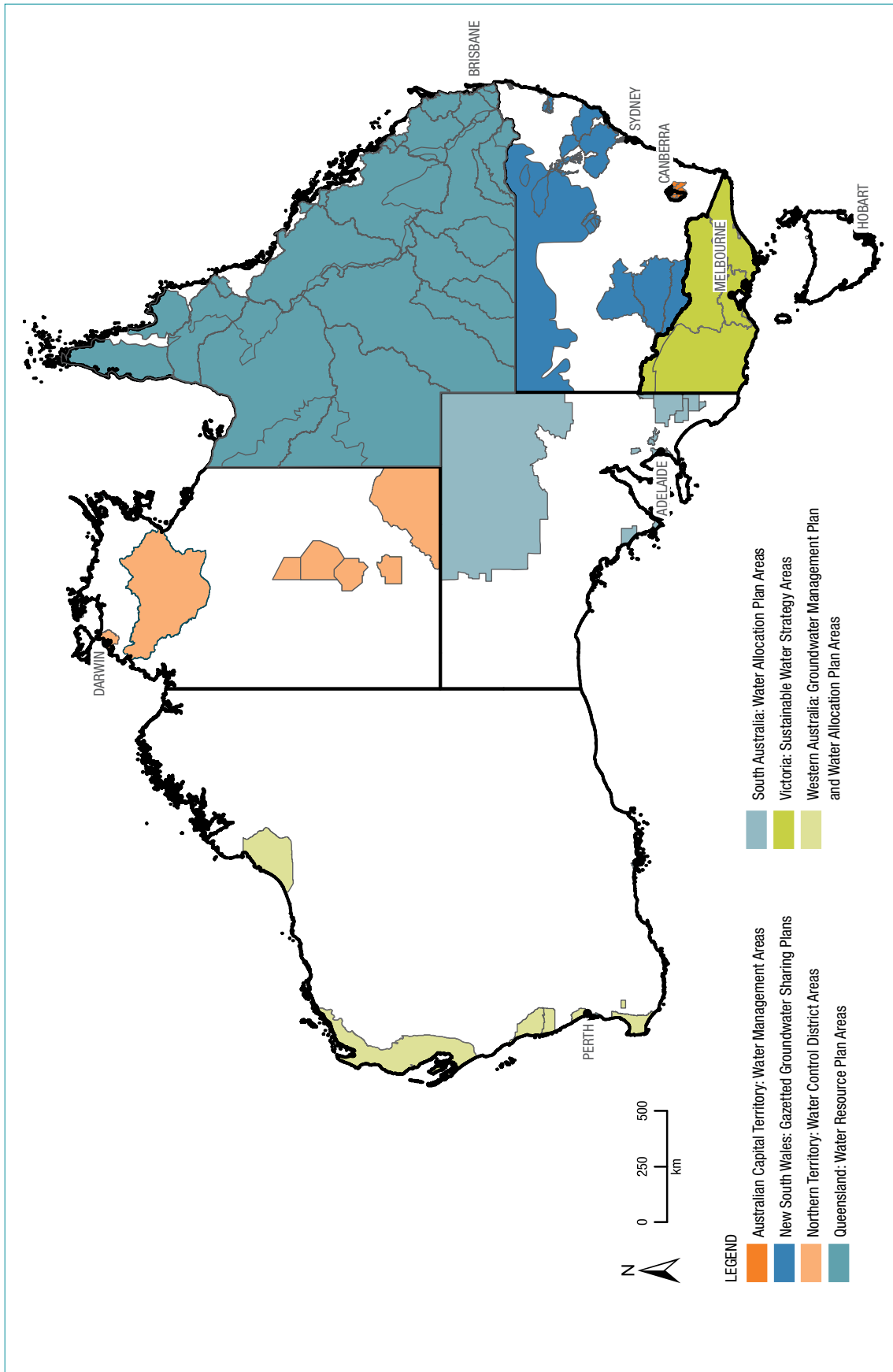


Figure iii. Australia: groundwater plans (30 June 2010)



Reporting on environmental water management

The development of this first baseline report has taken over 12 months since the Commission produced *Australian water reform 2009: second biennial assessment of progress in implementation of the National Water Initiative* (the 2009 biennial assessment) in October 2009. That report recommended 'annual public reporting of the existence, delivery and outcomes of environmental water' consistent with paragraph 85(ii) of the NWI, and therefore the annual reporting obligation explicitly rests with the NWI parties. It is not the Commission's role to produce the annual reports required under the NWI, but the *Australian environmental water management report 2010* has been prepared to provide an overview of the NWI parties' management of environmental water and to demonstrate where reporting is currently available.

The Commission recognises that the establishment of the water requirements of the environment and the subsequent provision of water through water plans—following the trade-off process with other public benefit outcomes and consumptive uses—does not lend itself easily to volumes and 'water balances'. Environmental water requirements necessarily involve issues of timing, water quality and dynamic flows—an overall regime that is difficult to represent numerically and that poses a significant challenge in water resource accounting. However, it is this complexity and sophistication of environmental water management in Australia that makes public reporting so important for the public and the investor confidence that the NWI seeks to deliver. Clearly, where volumes of 'held' environmental water are part of the environmental water regime, environmental water managers should be able to provide registers or reports of their holdings (which are identified throughout this report).

Therefore, section 1 of this report provides an overview of water management and the increasing nation-wide reporting arrangements in Australia. Sections 4–12 provide detailed summaries of the arrangements for each NWI party and identifies where further detailed jurisdictional specific information is publicly available. There is varied, but extensive information publicly available on each of the four elements of the environmental water management framework, which is far beyond the scope of this report to capture in detail. Therefore an important role of the *Australian environmental water management report 2010* is to provide a consolidated directory to this jurisdictional information.

Conclusion: overview of the elements of the environment water management framework in Australia

This report is not intended to assess environmental water management that is currently in place or to make recommendations. Instead, it provides a current statement of arrangements to promote better understanding of environmental water management and to provide a clear, agreed baseline for future reference. Having established a baseline at 30 June 2010, the Commission now intends to assist jurisdictions in improving environmental water accounting and reporting during 2011 and 2012.

Section 3 does however provide an overview of the jurisdictional arrangements and a number of common findings can be stated:

- + While the 'delivery' of water through entitlements is used for environmental purposes in the Murray–Darling Basin, environmental water management is based primarily on 'restrictions on extraction' from water resources through water plans and conditions on water access entitlements.
- + Environmental water determination
 - The determination of environmental water requirements has improved from focussing on base flows, to more sophisticated methods that consider components of the entire water regime.
 - The jurisdictional approaches to determining environmental water requirements vary with the level of demand on the water resource.
- + Environmental water commitment
 - Jurisdictions commonly make their environmental water commitments through the establishment of annual allocation limits and access rules, in both surface water and groundwater systems. These are significant forms of environmental water commitment, constraining the consumptive use of the resource, so as to 'leave behind' enough water to meet the environmental water objectives adopted in water plans.
 - Aside from rules-based management, in some jurisdictions where a high level of competition for water resources exists within systems, entitlements have been purchased (or created through water savings) to be held and used for environmental purposes.

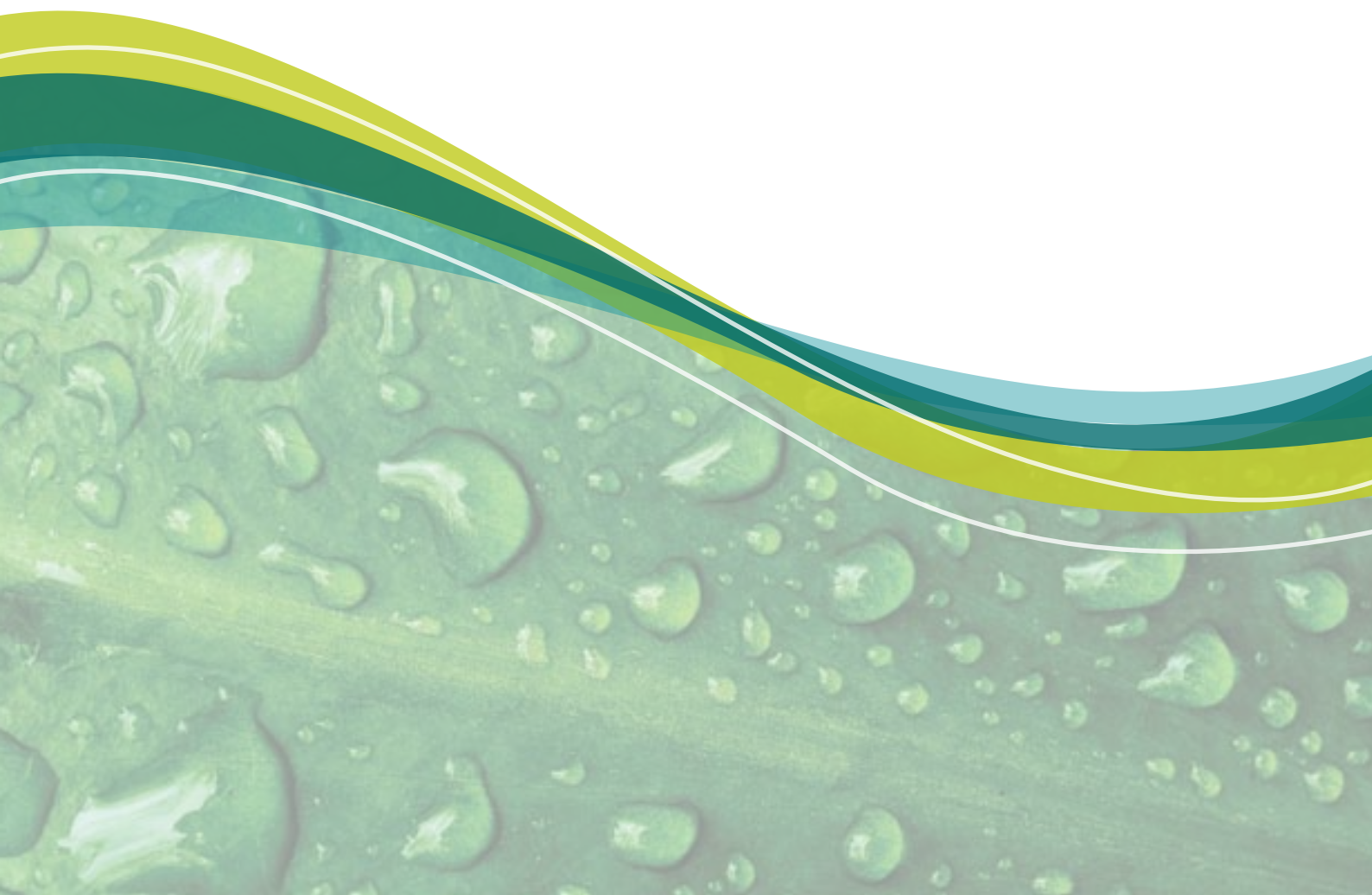
- + Environmental water compliance
 - Reporting on the compliance of management actions with environmental water commitments involves activities such as measuring stream flow, monitoring groundwater levels and mapping inundation extents for environmental watering events.
 - A majority of jurisdictions annually report publicly on compliance (within the overall performance of water management), to varying levels of detail, at a drainage basin or plan area scale. The reports are typically issued 6–18 months following the end of the water year.
 - Although water plans typically require the compliance with planned environmental water commitments to be reported each water year, publicly available reports rarely explicitly state this compliance.
 - Jurisdictions with held environmental water report on their entitlements through environmental water registers. The registers typically document the allocation of water to and from water access entitlements. Environmental water managers that hold entitlements for environmental purposes report on the management of their entitlements annually.
 - General purpose water accounting reports (GPWAR) prepared in accordance with Australian Water Accounting Standards (AWAS) offer a common approach for reporting on environmental water management and disclosing compliance with environmental water commitments. AWAS have been voluntarily adopted and demonstration GPWARs prepared in several jurisdictions.
- + Environmental water review
 - The review of environmental water commitments can only be undertaken if:
 - ecological values, environmental objectives and environmental water provisions have been clearly determined and articulate what is intended to be achieved through the commitment of environmental water in water plans, and
 - monitoring is in place that assesses the ecological responses and condition in relation to the environmental water provided.
 - While water plans are increasingly providing clarity in their environmental objectives, it remains difficult to review the effectiveness of environmental water commitments for a number of reasons:
 - outcome monitoring (assessing if the system is responding as expected ecologically) is not widespread or consistent due to its cost, and
 - the timeframes involved in detecting ecological responses and changes in condition are often longer than annual water year reporting.
 - The environmental objectives for the delivery of held environmental water are often more specific than for planned (rules-based) environmental water and as a result, the intended outcomes of entitlement delivery and the subsequent watering actions are more easily made publicly available. The review of the outcomes arising from held environmental water management faces the same ecological monitoring difficulties noted for planned water.
- + Overall, although the determination and commitment of environmental water is improving, the detail, frequency and geographic coverage of monitoring, reporting and review of environmental water varies around Australia. Often this is a reflection of the different water resources and the different levels of pressure on those resources.
- + Importantly, jurisdictional legislation and the water plans that arise from that legislation generally identify the roles and responsibilities of environmental water managers, which is important for management accountability.

While this report does not include recommendations, the Commission encourages the recent (and ongoing) developments in water accounting standards, that will assist in delivering consistency and rigour to environmental water reporting, which will in turn promote the 'public and investor confidence' that the NWI seeks to achieve.

Finally, and most importantly, the Commission wishes to thank the jurisdictions for their involvement in this report and looks forward to working with them in the coming years to promote environmental water management and reporting around Australia.

1 Introduction

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1 Introduction

Environmental water is defined and managed through different legislative and institutional arrangements at a range of scales across Australia. This section describes the legal setting within which environmental water is managed and highlights the need for the National Water Commission (Commission) to accurately report on the various arrangements in place at the end of the 2009–10 water year (i.e. 30 June 2010).

The 2004 Intergovernmental Agreement on a National Water Initiative (the NWI) has clear requirements for annual reporting on environmental water; however, the Commission's biennial assessments in 2007¹ and 2009² both found that reporting was not occurring consistently or comprehensively around Australia. In response, the Commission has produced this report, the *Australian environmental water management report 2010*, to explain the different environmental water management arrangements in Australia and to identify sources of environmental water information. A range of other national reporting mechanisms (summarised at the end of this section) are currently in place or under development.

The role of this report is not to repeat any current reporting processes, but to clarify arrangements so that environmental water management and reporting in Australia can be better understood.

1.1 Water management in Australia

The NWI was signed at the 25 June 2004 Council of Australian Governments meeting. The Tasmanian Government agreed to the NWI in June 2005 and the Western Australian Government in April 2006. The preamble to the NWI states:

In Australia, water is vested in governments that allow other parties to access and to use water for a variety of purposes—whether irrigation, industrial use, mining, servicing rural and urban communities, or for amenity values. Decisions about water management involve balancing sets of economic, environmental and other interests. (NWI, paragraph 2)

Because the Australian Government received no express legislative power over water in the Australian Constitution, the management of water in Australia has been vested in the states and territories.

Each state and territory government has therefore enacted water resource legislation that declares that the management of water within its jurisdiction is vested in the Crown (with a few exceptions, such as private rights). It is the state and territory governments that independently determine access to water resources through a number of mechanisms, including the creation of water plans and the issuing of water access entitlements. (A water access entitlement is 'a perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan'.³)

Water plans

State and territory governments are responsible for issuing water plans. The NWI provides the following definition of water plans:

statutory plans for surface and/or ground *water systems*, consistent with the *Regional Natural Resources Management Plans*, developed in consultation with all relevant stakeholders on the basis of best scientific and socio-economic assessment, to provide secure ecological outcomes and resource security for users. (NWI, Schedule B(i), Glossary of terms)

As the Commission's 2009 biennial assessment noted:

Water plans are fundamental to water management, transparently establishing the intended balance between environmental and consumptive use outcomes and often setting out the terms and conditions of access to water for consumptive and non-consumptive users and the environment. (p. 14).

1 National Water Commission, *National Water Initiative: First biennial assessment of progress in implementation 2007*, National Water Commission, Canberra, 2007.

2 National Water Commission, *Australian water reform 2009: Second biennial assessment of progress in implementation of the National Water Initiative*, National Water Commission, Canberra, 2009.

3 NWI, Schedule B(i), Glossary of terms.

'Consumptive use' is defined in the NWI to mean 'use of water for private benefit consumptive purposes including irrigation, industry, urban and stock and domestic use'. Furthermore, the NWI introduces the concept of a 'consumptive pool', which is defined as 'the amount of water resource that can be made available for *consumptive use* in a given water system under the rules of the relevant water plan' (NWI, Schedule B(i), Glossary of terms).

The NWI provides an agreed framework for water plans in Australia:

Recognising that settling the trade-offs between competing outcomes for water systems will involve judgements informed by best available science, socio-economic analysis and community input, statutory *water plans* will be prepared for surface water and groundwater management units in which entitlements are issued. (NWI, paragraph 36)

State and territory water plans are therefore intended to deliver the following outcomes:

- i) secure ecological outcomes, by describing the *environmental and other public benefit outcomes* for water systems and defining the appropriate water management arrangements to achieve those outcomes; and
- ii) resource security outcomes, by determining the shares in the *consumptive pool* and the rules to allocate water during the life of the plan. (NWI, paragraph 37).

Finally, paragraph 38 of the NWI recognises that it is a matter for state or territory governments to determine:

whether a plan is prepared, what area it should cover, the level of detail required, its duration or frequency of review, and the amount of resources devoted to its preparation based on an assessment of the level of development of water systems, projected future consumptive demand and the risks of not having a detailed plan.

1.2 Why the *Australian environmental water management report 2010*?

Management of environmental water is embedded within whole-of-system water management. Paragraphs 78 and 79 of the NWI describe the management framework for environmental water, including 'establishing and equipping environmental water managers with the necessary authority and resources to provide sufficient water at the right times and places to achieve the environmental and other public benefit outcomes'. The NWI therefore recognises the ability of environmental managers to provide water to locations, drawn from (and limited by) the water rights provided by the jurisdictions. Furthermore, the NWI recognises that environmental water, where not required to achieve environmental outcomes, can be traded on water allocation⁴ markets, in terms similar to those for consumptive water.

Paragraph 85 required NWI parties (the state, territory and Australian governments) to develop by mid-2005 (and apply by mid-2006):

- i) a compatible register of new and existing environmental water ... showing all relevant details of source, location, volume, security, use, environmental outcomes sought and type; and
- ii) annual reporting arrangements to include reporting on the environmental water rules, whether or not they were activated in a particular year, the extent to which rules were implemented and the overall effectiveness of the use of resources in the context of the environmental and other public benefit outcomes sought and achieved.

The Commission's 2007 biennial assessment stated:

... the Commission is concerned that the desired NWI outcomes are not being achieved in the way envisaged. This view is arrived at for two reasons.

The first is related to the specificity of the environmental outcomes being sought. In some cases 'as much specificity as possible' is not very specific at all. This is generally due to the shortcomings in the water planning processes and in particular the adequacy of the science underpinning the water plans. The inability, in the first instance, to provide a high degree of specificity in environmental outcomes sought will lead to broad brush management regimes, difficulty in monitoring outcomes and consequent low levels of accountability.

The second is related to whether established environmental managers are equipped with the necessary authority and resources envisaged by the NWI. (p. 61)

⁴ A water allocation is 'the specific volume of water allocated to water access entitlements in a given season, defined according to rules established in the relevant water plan' (NWI, Schedule B(i), Glossary of terms).

Two years later, the Commission's 2009 biennial assessment found that:

There is no transparent, accessible and accountable mechanism for registration of entitlements based and non-entitlements-based water being delivered for environmental outcomes. It is therefore not possible to assess the level of compliance with environmental entitlements and rules and the risks associated with non-compliance. (Finding 4.8)

The Commission therefore recommended:

Consistent with the NWI, the Commission recommends the development of nationally consistent registration of environmental water across Australia, showing all relevant details of entitlements based and non-entitlements-based environmental water and outcomes, as well as annual public reporting of the existence, delivery and outcomes of environmental water. (Recommendation 4.6)

The second limb of that recommendation, 'annual public reporting of the existence, delivery and outcomes of environmental water,' is relevant to the *Australian environmental water management report 2010*.

The NWI obligation clearly rests with the NWI parties, and (as is shown in this report) various reporting has been delivered. Therefore, it is not the Commission's role to produce the annual reports required under paragraph 85(ii); however, this report has been prepared to provide an overview of the NWI parties' management of environmental water and to demonstrate where the NWI-required reporting is available.

Importantly the National Water Accounting Development project (NWADp) commenced in 2007 to deliver paragraph 80 of the NWI:⁵

The Parties agree that the outcome of water resource accounting is to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions, to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for *environmental and other public benefit outcomes*.

The NWADp envisaged that reporting for environmental water would be through the General Purpose Water Accounting Reports (GPWAR) in accordance with Australian Water Accounting Standards (AWAS). That is, separate reports would not be required for environmental water as GPWARs were envisaged to include compliance against water plans. As part of the NWADp, the Water Accounting Standards Board is developing AWAS.⁶ The development and future adoption of the AWAS should provide the opportunity for NWI parties (and other water report preparers) to consistently and comparably report against environmental rules and entitlements. The extent to which NWI parties have adopted the non-compulsory AWAS is noted in this report.

The *Australian environmental water management report 2010* is not intended to assess the arrangements in place or to make recommendations. Instead, it provides a statement of arrangements at 30 June 2010 to promote better understanding of environmental water management and to provide a clear, agreed baseline for future reference.

1.3 Current Australian Government environmental water reporting

The management of environmental water is reported by jurisdictions with varying detail and coverage, as described in sections 4–12 of this report. As the Commonwealth is an NWI party, it is bound by the same obligations as the states and territories to report on its environmental water holdings and management (NWI, paragraph 85(ii)). Separate from this NWI requirement, various Australian Government agencies produce a range of national and cross-jurisdictional reports that include environmental water. Those reports (which are described in Table 1) are not intended to satisfy the NWI requirements for the Commonwealth or other NWI parties, but contribute to environmental water reporting as part of their broader reporting purposes.

Therefore, until all NWI parties report annually on 'the environmental and other public benefit outcomes sought and achieved', the *Australian environmental water management report 2010* addresses a number of ongoing gaps in reporting by:

- + detailing arrangements in place to provide a baseline, at a jurisdiction scale, of the status of reporting against NWI requirements
- + being produced for the 2009–10 water year (as at 30 June 2010) to assist future national water account reporting undertaken by the Bureau of Meteorology, the Australian Bureau of Statistics and other Australian Government agencies
- + providing nationally consistent coverage.

5 Further background to the National Water Accounting Development project is provided in Appendix A and is available at the Bureau of Meteorology website: <http://www.bom.gov.au/water/standards/standardsDev.shtml>

6 Extracts of the exposure draft of AWAS 1 are provided in Appendix B.

Table 1. Australian Government environmental water reporting (30 June 2010)

Report	Water Account Australia ⁷	Pilot National Water Account ⁸	Water Audit Monitoring Report ⁹	The Living Murray Reports ¹⁰	Commonwealth Environmental Water Holder annual report ¹¹
Organisation	Australian Bureau of Statistics	Bureau of Meteorology	Murray–Darling Basin Authority (on behalf of The Living Murray partnergovernments)	Murray–Darling Basin Authority	Commonwealth Environmental Water Holder
Basis	At discretion of the Australian Statistician <i>Census and Statistics Act 1905</i> (Cwth) <i>Arrangements with states Act 1956</i> (Cwth) <i>Australian Bureau of Statistics Act 1975</i> (Cwth)	<i>Water Act 2007</i> (Cwth), ss. 120(d), 121 and 122	Schedule E to the Murray–Darling Basin Agreement	Clause 199 of The Living Murray business plan	<i>Water Act 2007</i> (Cwth), s. 114
Geographic coverage	Australia-wide	Eventually Australia-wide	Murray–Darling Basin	Murray–Darling Basin	Murray–Darling Basin (potentially Australia-wide, but not currently)
Temporal coverage	Currently a 12-month account produced for every fourth year. However, annual accounts will be produced from 2011.	Annual account	Annual report	Annual report	Each financial year
Due date	4th edition (2008–09) due in November 2010. Previous editions delivered in May 2000 (1993–94–1996–97), May 2004 (2000–01) and Nov 2006 (2004–05).	National Water Account 2010 due in April 2011.	2009–10 report due in May 2011.	2009–10 report due after December 2010.	As soon as practicable after 30 June.

Report	Water Account Australia ⁷	Pilot National Water Account ⁸	Water Audit Monitoring Report ⁹	The Living Murray Reports ¹⁰	Commonwealth Environmental Water Holder annual report ¹¹
Content	Water supply and use in the Australian economy, including environmental water. The recording and separate identification of environmental water in the account is currently under review.	The Pilot NWA covered the Murray–Darling Basin and the Onkaparinga, Murrumbidgee and Namoi–Peel catchments. The NWA will cover the Murray–Darling Basin, Ord River and capital cities.	Provides a broader picture of the Cap compliance, water use for consumptive and environmental purposes, climatic overview, water availability through allocations, off-allocations and water trading, storages losses and groundwater use.	Describes the annual activities and achievements of The Living Murray in 2008–09 (The activities include water recovery, environmental works and measures, environmental watering and monitoring and community communication and consultation. The activities are intended to achieve specific environmental outcomes for six Icon Sites along the River Murray).	Commonwealth Environmental Water Holder operations as provided in s. 114(2)

Note: At its October 2008 meeting, the Council of Australian Governments agreed to a regular report on environmental water recovery in the Murray–Darling Basin.

The report lists the volume and cost of environmental entitlements registered by governments since 2004, and is updated every six months. Reports are available on the Council of Australian Governments website: <http://www.environment.gov.au/water/australia/coag.html>

Note: The Australian Government Department of Sustainability, Environment, Water, Population and Communities produces National State of the Environment reports, on the basis of s 516B of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth). The Australia-wide reports have had a five-year reporting cycle since 1996 and the Australian State of the Environment 2011 report is to be tabled in Parliament by 31 December 2011. The reports include broader environmental information than just water, as they contain information about, and assessment of environmental and heritage conditions, trends and pressures for the Australian continent, surrounding seas and Australia's external territories. Within this broader context, they include a thematic chapter on inland waters. Further information on State of the Environment reporting is available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/soe/index.html>

7 Further information on the Water Account, Australia is available at the Australian Bureau of Statistics website: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4610.0Main+Features12004-05?OpenDocument>

8 Further information on the National Water Account is available at the Bureau of Meteorology website: <http://www.bom.gov.au/water/nwa/index.shtml>

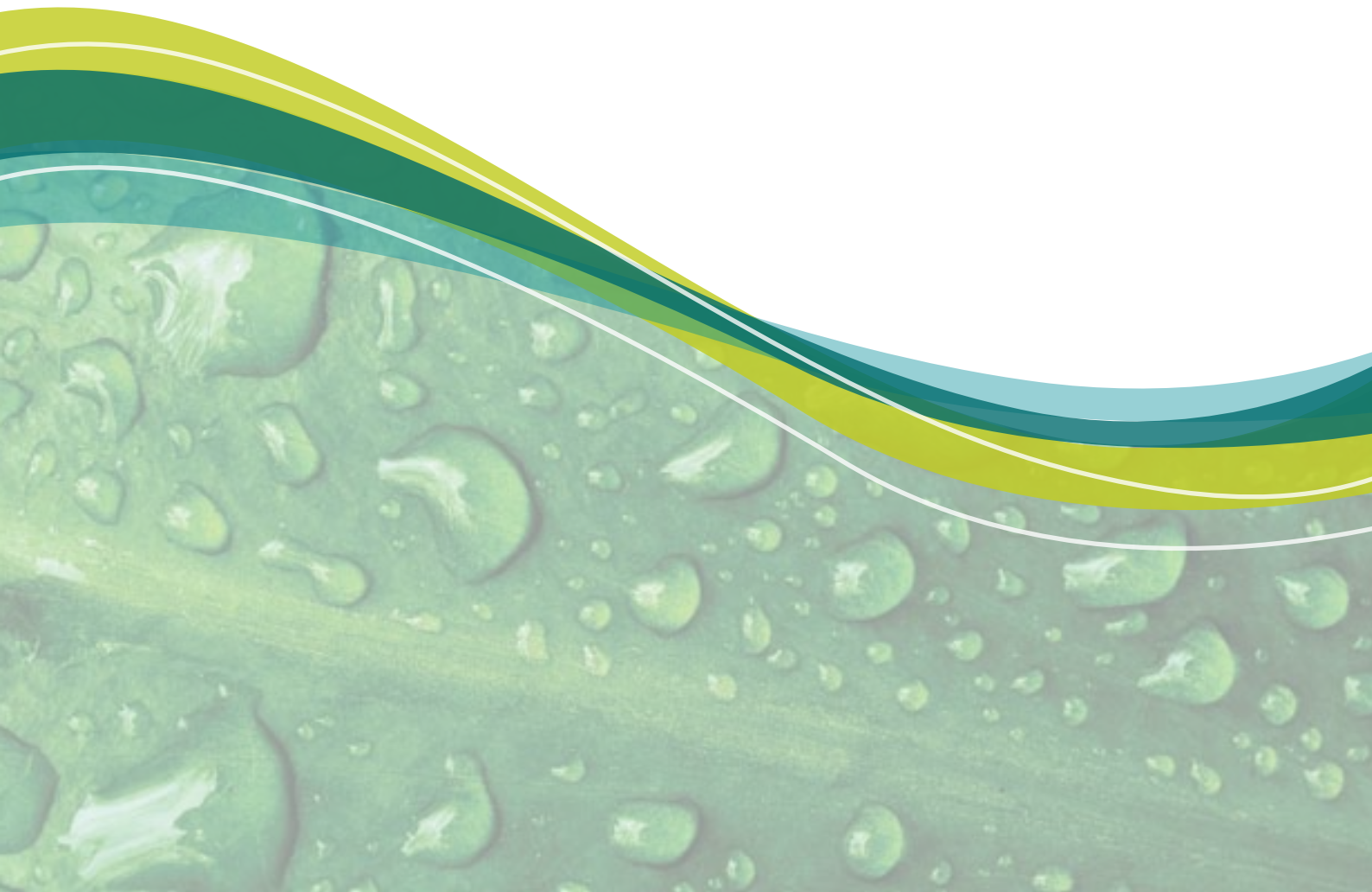
9 The Water Audit Monitoring Reports are available at the Murray–Darling Basin Authority website: <http://www.mdba.gov.au/services/publications>

10 Further information on The Living Murray water recovery is available at the Murray–Darling Basin Authority website: http://www.mdba.gov.au/programs/tlm/programs_to_deliver/water_recovery

11 The Commonwealth Environmental Water Holder also produces an outcomes report. Further information on the Commonwealth Environmental Water Holder and its reports is available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/policy-programs/cewh/index.html>

2 Environmental water

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2 Environmental water

Given the range of definitions and the complexity involving environmental water, this section outlines a common basis for consistent reporting on all jurisdictional arrangements. For the purposes of the entire *Australian environmental water management report 2010*, this section:

- + reviews environmental water terminology and demonstrates the difficulties in its definition
- + notes the important relationship between ecological values, environmental objectives, environmental water requirements and environmental water provisions
- + adopts a consistent management model and definition for environmental water
- + describes the four elements of the environmental water management framework, which is the basis for the jurisdictional sections in this report.

2.1 What is environmental water?

Before the *Australian environmental water management report 2010* there was no clear, concise and commonly agreed definition for 'environmental water' used in Australian water management. The closest reference in the NWI to a definition of environmental water is found in paragraph 35, which states:

Water that is provided by the States and Territories to meet agreed environmental and other public benefit outcomes as defined within relevant water plans (paragraphs 36 to 40 refer) is to:

- i) be given statutory recognition and have at least the same degree of security as water access entitlements for consumptive use and be fully accounted for
- ii) be defined as the water management arrangements required to meet the outcomes sought, including water provided on a rules basis or held as a water access entitlement; and
- iii) if held as a water access entitlement, may be made available to be traded (where physically possible) on the temporary market, when not required to meet the environmental and other public benefit outcomes sought and provided such trading is not in conflict with those outcomes.

The NWI definition recognises that both 'rules-based' (planned) and 'held' (entitlement) water can deliver agreed environmental and other public benefit outcomes. Importantly, those outcomes are both:

- + 'environmental'—defined as maintaining ecosystem function, biodiversity, water quality and river health targets
- + 'other public benefits'—defined as mitigating pollution, public health, Indigenous and cultural values, recreation, fisheries, tourism, navigation and amenity values. (NWI, Schedule B(i), Glossary of terms)

The *Australian environmental water management report 2010* is focused only on environmental outcomes and not 'other public benefit outcomes.'

Legislative definitions

Three jurisdictions explicitly define environmental water in legislation. In New South Wales, section 8 of the *Water Management Act 2000* (NSW) states that 'environmental water' comprises:

- (a) water that is committed by management plans for fundamental ecosystem health or other specified environmental purposes, either generally or at specified times or in specified circumstances, and that cannot to the extent committed be taken or used for any other purpose ('planned environmental water')
- (b) water that is committed by the conditions of access licences for specified environmental purposes, either generally or at specified times or in specified circumstances ('adaptive environmental water').

In Victoria, environmental water has been statutorily recognised in section 4A(1) of the *Water Act 1989* (Vic.):

The environmental water reserve comprises water that is set aside for the environment—

- (a) as an environmental entitlement; and
- (b) through the operation of—
 - (i) conditions on any bulk entitlement, or any licence, permit or authority issued under this or any other Act, or regulations made under this or any other Act; and
 - (ii) any management plan under this Act; and
 - (iii) any other provision of this Act, the *Murray–Darling Basin Act 1993* or the *Groundwater (Border Agreement) Act 1985* or any regulations made under this Act or those Acts.

Section 4B(1) states:

The environmental water reserve objective is the objective that the environmental water reserve be maintained so as to preserve the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and quality of water and the other uses that depend on environmental condition.

Recent Commonwealth legislation defines ‘environmental water’ in sections 4 and 6 of the *Water Act 2007* (Cwth). Section 4 defines environmental water as either ‘held environmental water’ or ‘planned environmental water’. In summary, held environmental water is further defined as a ‘right’ (water access, water delivery, irrigation) for the purposes of achieving environmental outcomes. The definition of ‘planned environmental water’ includes water that is committed or preserved by plans or other legislative instruments for achieving environmental outcomes.

The Australian Bureau of Statistics has used the following definitions in its *Water Account, Australia*:¹²

Ecological water requirement (Environmental water requirement): A description of the water regimes needed to maintain ecological values of water dependent ecosystems at a low level of risk.

Environmental water provisions: The water regimes that are provided as a result of the water allocation decision-making process, taking into account ecological, social and economic impacts. They aim to meet in part or in full, the ecological water requirements.

The multiple benefits of water

Water can be used for multiple benefits temporally and spatially, and is normally ‘used’ more than once. Therefore, the complexity in defining and accounting for environmental water is that environmental, economic and social benefits are derived from the same volume of water. For example, a particular flow in a river may:

- + sustain key environmental assets (environmental)
- + ensure that consumptive (extraction) volumes can be conveyed downriver by surcharging the system (economic)
- + provide sufficient water levels for navigation by houseboats and other commercial and recreational craft (social).

Multiple benefits can be derived from a single volume of water in a system, and can be derived from surface and groundwater systems. Despite the concept of the ‘consumptive pool’ articulated in water plans, attempts to demarcate volumes into ‘consumptive’ or ‘environmental’ often fail because of this complexity. Therefore, the multiple benefits of a single volume of water create challenges for jurisdictions when they attempt to comply with the reporting requirements of the NWI.¹³

In pristine systems from which no water is extracted for consumptive use, there is no requirement to define ‘environmental water’. All the water remains in the system and meets the environmental requirements of that system. As soon as water is managed (e.g. removed, regulated, stored) in the system for consumptive use, a resulting pressure is placed on the environment in that system. Where demand exists, there is a need to balance environmental and consumptive requirements. In general, consumptive use requires a healthy and sustainable environment. For example, a town cannot meet its water supply needs if water quality is below standards able to be treated for consumptive uses (similarly, an irrigator cannot use a groundwater resource that has become hypersaline).

¹² Australian Bureau of Statistics (ABS), *4610.0 –Water Account, Australia, 2004–05*, issued 28 November 2006, ABS, Canberra.

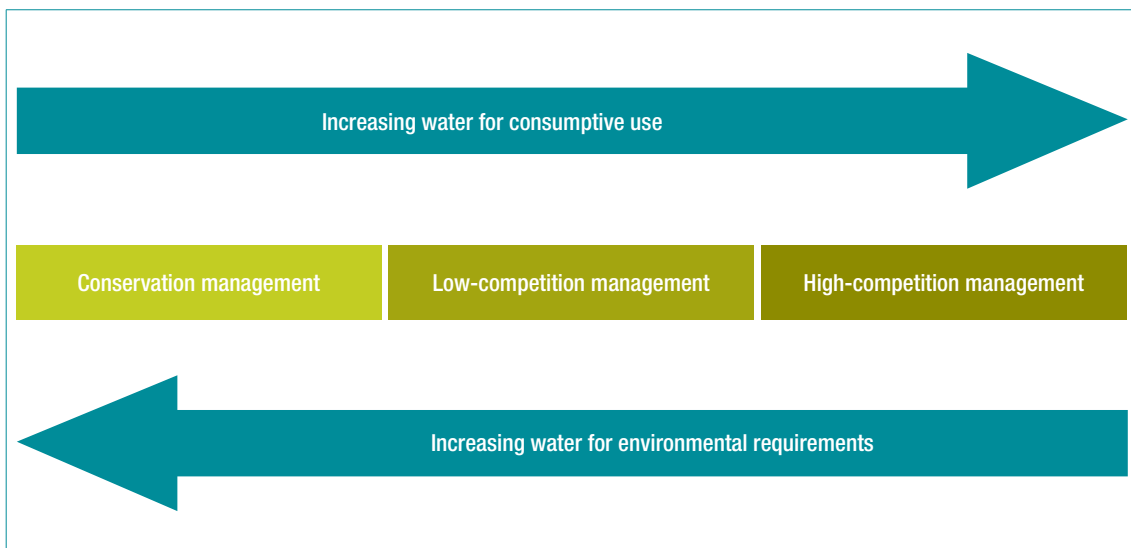
¹³ Reporting on a single volume of water has additional complexity when there are not just multiple benefits, but a mix of beneficial and detrimental effects (for example, counter-cyclical delivery of irrigation water).

As water resource pressures increase, the trade-off between environmental and consumptive requirements becomes increasingly difficult. In recognition of this, the Commission's 2009 Waterlines report, *Improving environmental sustainability in water planning*¹⁴, introduced the concept of three different classes (or settings) of water management:

1. **Conservation management** applies to water systems that have little or no water extraction (consumptive use), retain a high degree of 'naturalness', and are designated to be protected. Water planning and management in such systems aim to maintain ecosystem health and unique ecological characteristics, with minimal exposure to risk associated with the extraction of water. The level of investment in planning would be expected to be low.
2. **Low-competition management** applies to water systems where there are low levels of demand for water supply (consumptive use), and risks to ecosystem assets and services can be managed by general or regional management arrangements that have low socioeconomic impact. The level of investment in plan development and implementation would be expected to be low to moderate.
3. **High-competition management** applies to water systems where current or projected demand for water supply (consumptive use) is likely to result in loss or degradation of ecosystem attributes unless management arrangements that may have substantial socioeconomic impact are imposed. Such systems require a statutory water plan. The levels of investment in both plan development and implementation would be expected to be high.

The trade-offs between environmental requirements and consumptive use and the different management settings that they generate are shown in Figure 1.

Figure 1. A simplified representation of the environmental–consumptive spectrum within a water resource

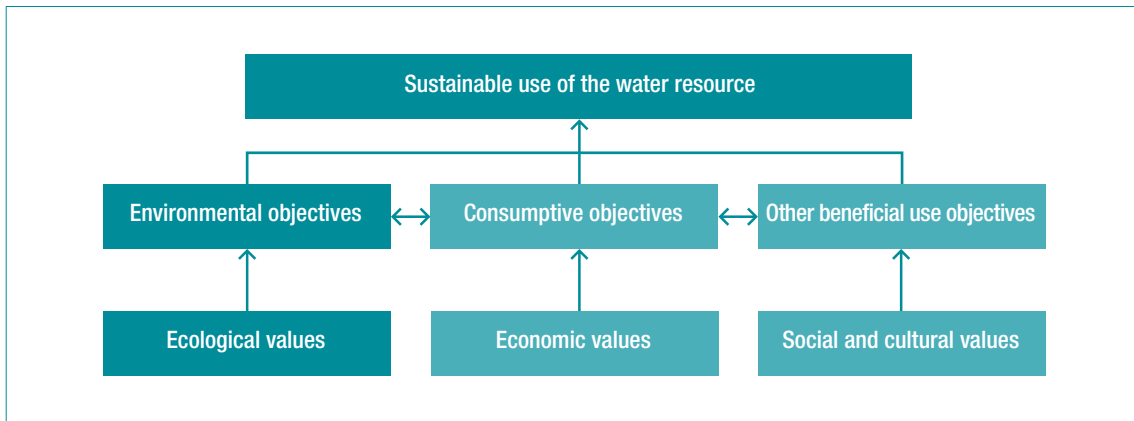


2.2 Environmental water in this report: the importance of environmental objectives and ecological values

In most systems where a balance must be struck between competing environmental and consumptive requirements, jurisdictions attempt to determine an environmentally sustainable level of extraction through a range of different approaches (essentially, how much water can be extracted from the system without pushing the system into environmental decline). On this basis, environmental water is generally linked to the achievement of environmental objectives, which are often informed by 'ecological values'. The objectives underpin the ongoing sustainable use of the water resource. Objectives may relate to how much of an environmental asset is to be maintained (for example 80% of a flood plain forest is to be inundated at an average frequency of one in three years). Values may relate to specific endangered species, or ecological functions which can be linked to particular components of the natural hydrological regime. Although it is often difficult to link outcomes (over time) to a specific watering event, to make sense of environmental water, it is essential to recognise this linkage between 'environmental water' and 'environmental objectives and ecological values' (see Figure 2).

14 M Hamstead, *Improving environmental sustainability in water planning*, Waterlines report, National Water Commission, Canberra, 2009.

Figure 2. Hierarchy of environmental water terminology



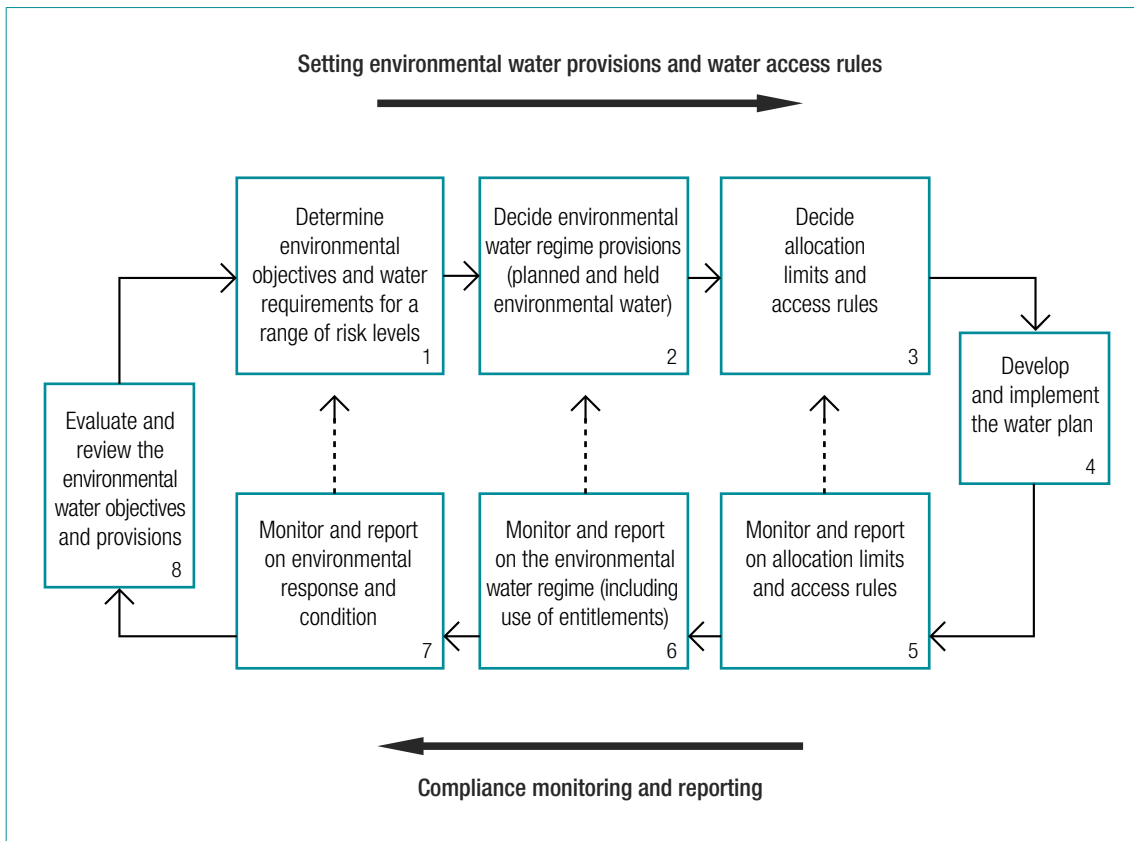
Recording and reporting on environmental water cannot be done sensibly without:

- + providing information on the administrative and management regime that defines it and
- + being explicit about the environmental objectives and how the water regime is intended to enable achievement of these objectives.

A consistent environmental water management model and definition

Similarities between jurisdictional approaches to the determination and compliance monitoring of environmental water have enabled the Commission to adopt a consistent model in this report (see Figure 3). The model is adapted from the Western Australian water accounting approach for setting and compliance monitoring of environmental water.

Figure 3. Environmental water management model, adapted from the Western Australian model for setting and compliance monitoring of environmental water



Consistent with the Australian Bureau of Statistics' definition, the 'environmental water requirements' in this model are the water regimes needed to maintain ecological values of water dependent ecosystems at a low level of risk.¹⁵ A range of risk levels is included in step one of this model to indicate that the environmental objectives and water requirements to be adopted (as the environmental water regime provisions in step two) are within an acceptable range of risk. The environmental water regime provisions are the water regimes that are intended to be provided; they will be decided after any trade-offs between environmental, consumptive and other beneficial use outcomes, and may fully or partly meet the ecological water requirements.

Importantly, Australian streams are some of the most hydrologically variable in the world and, as a result, environmental water requirements vary from month to month and year to year. As noted in the jurisdictional summaries of this report (sections 4–12), a water regime that achieves the objectives within a system on intra- and inter-annual timeframes may be achieved through a combination of:

- + planned and held water
- + consumptive and environmental water.

Therefore, for the purposes of this report, a common definition has been adopted:

Environmental water is the water regime provided to achieve environmental objectives.

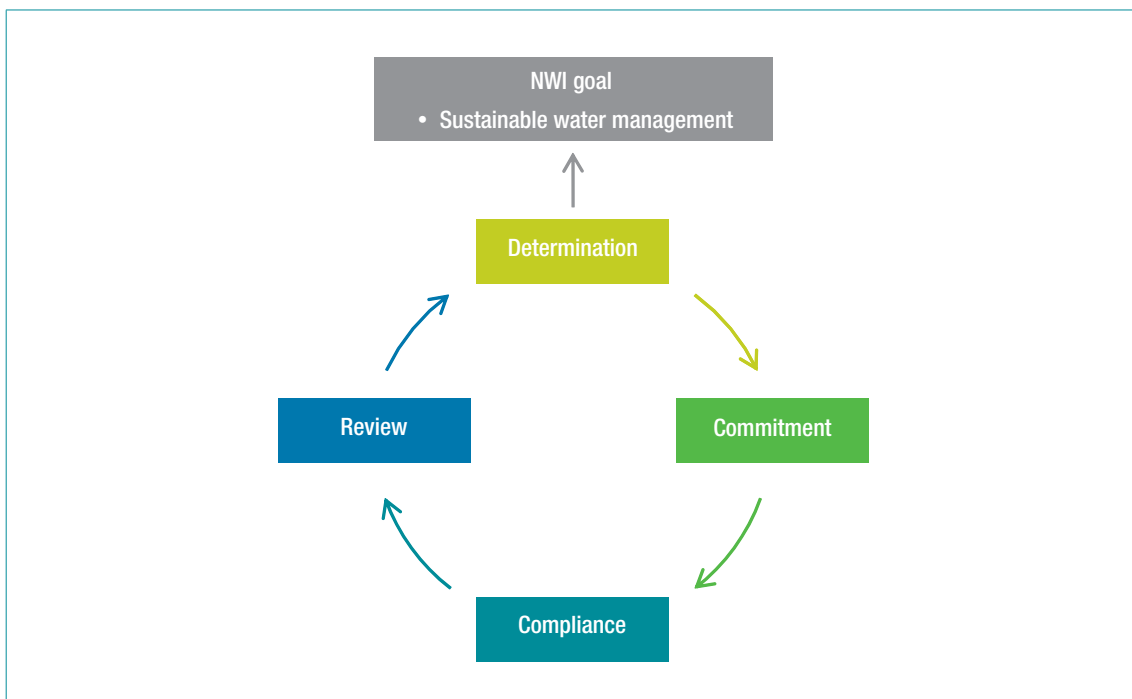
As Figure 3 illustrates, water managers need to establish the environmental water requirements within their management area, before deciding on the balance between consumptive and environmental or other beneficial use objectives (see box 1 of Figure 3). Therefore environmental water is the water regime that is deliberately managed to achieve environmental objectives—the definition of environmental water is not 'all of the water in Australia' or 'all of the water that the environment needs.'

The Commission recognises that environmental provisions also often deliver other public benefit outcomes— for example, relating to social and cultural values, however the *Australian environmental water management report 2010* is focused only on environmental objectives and values. Likewise environmental objectives often provide other benefits, beyond ecological values, such as aquifer integrity and water quality.

The environmental water management framework used in this report

The *Australian environmental water management report 2010* has adopted a simplified version of the environmental water management model described in Figure 3. The report is structured using a framework of four elements, as shown in Figure 4 and described in Table 2.

Figure 4. The four elements of the environmental water management framework



¹⁵ Note the ABS definition of 'environmental water requirement' in Section 2.1.

These elements form an adaptive management cycle in which the ability to define a 'sustainable level of use' is continually pursued.

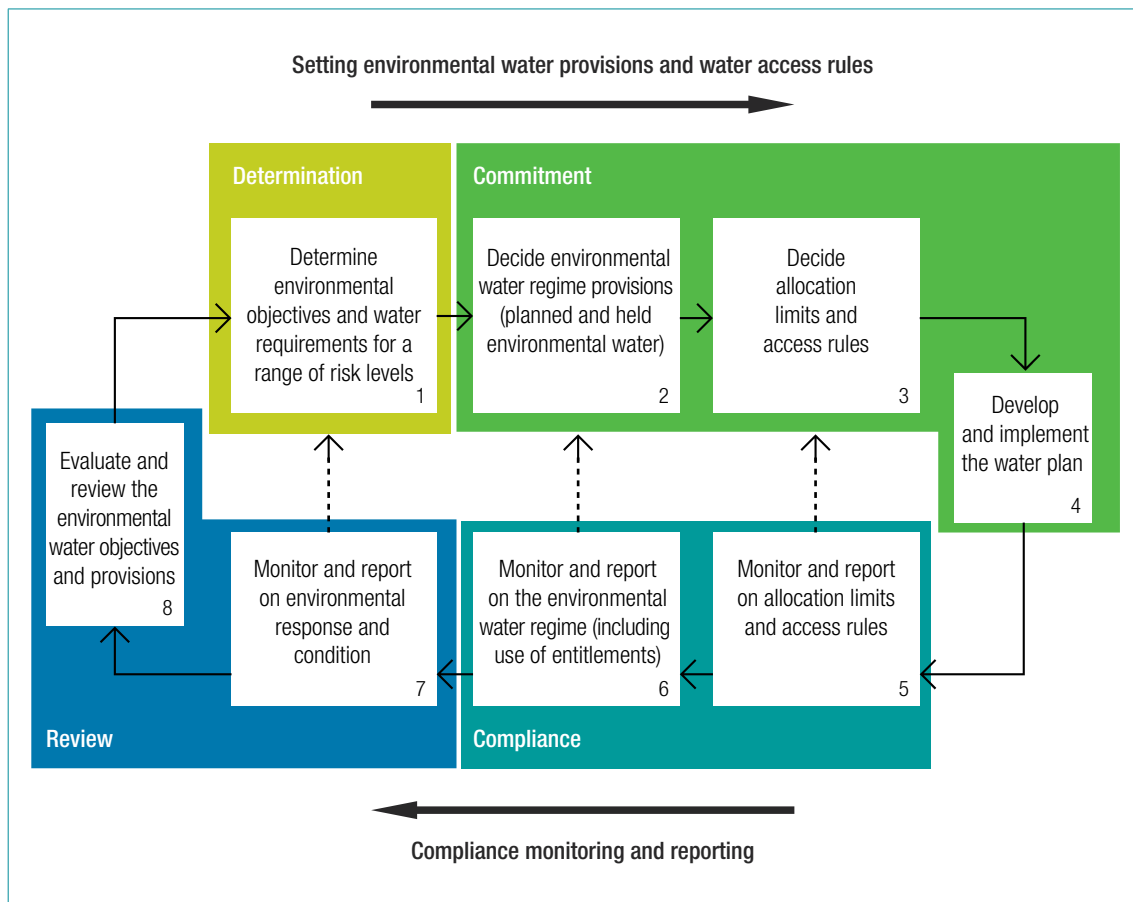
Table 2. Description of the elements of the environmental water management framework

Element	Description
Determination	Determine environmental objectives and water requirements for a range of risk levels.
Commitment	Decide the environmental water provisions and commit to them through the management of the water regime (planned and held environmental water).
Compliance	Monitor and report to assess if the water regime that was provided complies with the commitment.
Review	Monitor and report on environmental response and condition so as to evaluate and review both the determination and the commitment.

Each of the four elements is discussed in more detail in the jurisdictional summaries (sections 4–12), and a consolidation of the findings for each element is provided in Section 3.

Figure 5 shows how the eight steps in the environmental water management model (Figure 3) are simplified for the purposes of this report.

Figure 5. The environmental water management model simplified into the *Australian environmental water management report 2010* framework



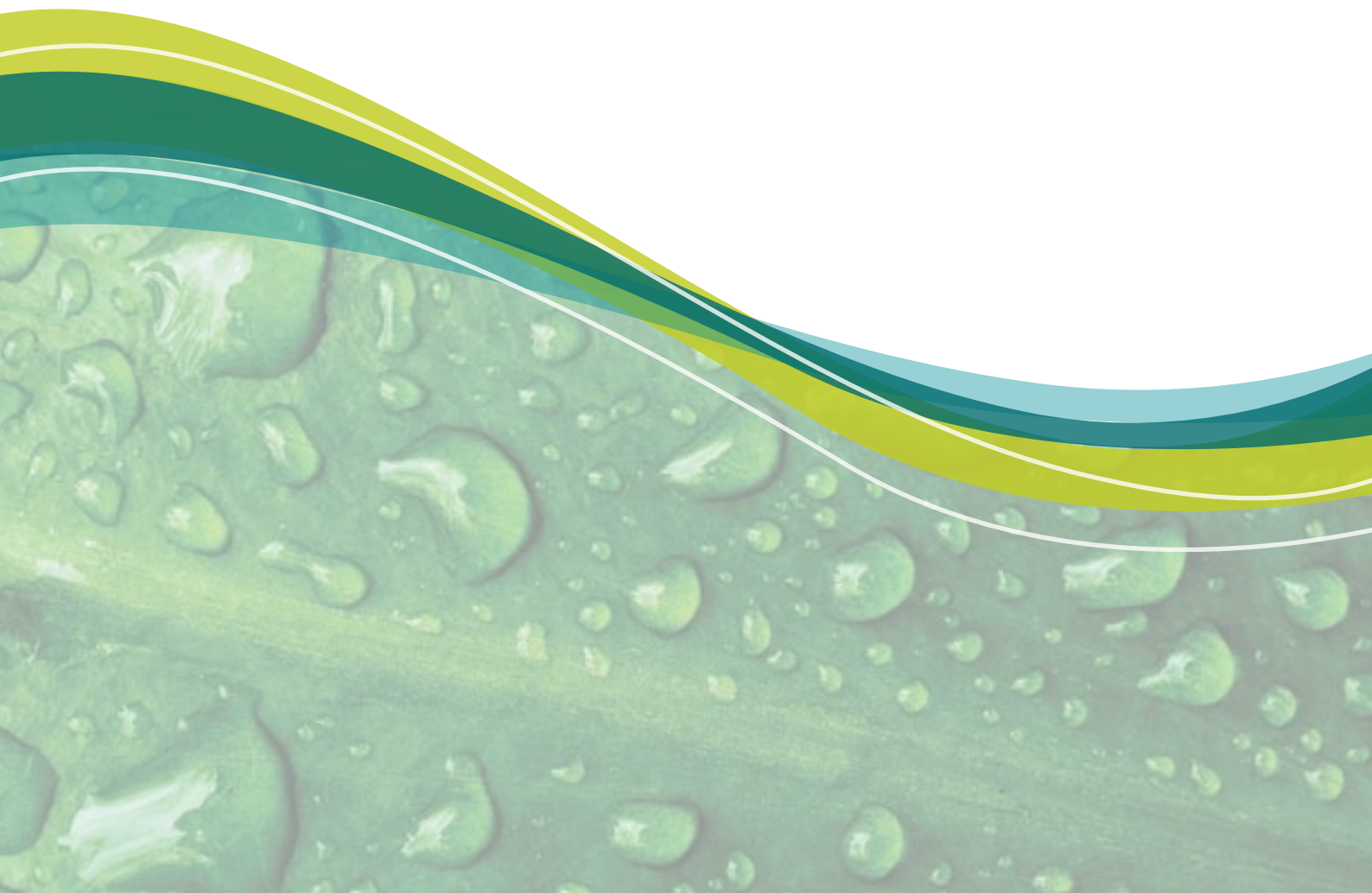
Source: Adapted from the Western Australian model.

By using this framework as the basis for the *Australian environmental water management report 2010*:

- + a common platform can be established for comparing disparate approaches (for example, planned water and held water)
- + all elements of the water regime can be analysed in an approach that seeks to build the knowledge base over time to achieve sustainable management of the water resource.

3 Elements of environmental water management

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3 Elements of environmental water management

This section provides a national summary of each of the four elements of environmental water management in each jurisdiction.

3.1 Environmental water determination

The description of the elements of the environmental water management framework (see Table 2) describes this element as:

Determine environmental objectives and water for a range of risk levels.

As discussed in Section 2.2, determining environmental water requirements for surface and groundwater systems requires the jurisdictions to identify water-dependent (ecological) values within their state or territory. Examples of water-dependent values include fish and macro-invertebrates for surface water systems, or groundwater-dependent ecosystems (GDEs) for groundwater systems. Once jurisdictions have identified the water-dependent (ecological) values, environmental objectives and environmental water requirements can be established through a range of different scientific methods and hydrologic techniques (Table 3). Historically, the jurisdictions' methods have focused on specifying base flow requirements. More recently however, the methods have improved to consider other components of the flow regime (such as freshes and overbank flows) and spatial and temporal dimensions, including inter- and intra-annual variability.

The detailed environmental water requirements determined for surface water can include the magnitude, duration, frequency and seasonality of flows. In some methods, the water requirements are a combination of ecological objectives and hydraulic performance. Other jurisdictional approaches define environmental water requirements based on flow components and ecosystem types. Some jurisdictions vary the objectives and associated environmental water requirements depending on the prevailing climatic conditions through a 'seasonally adaptive' approach in which the priorities for environmental watering and complementary measures in any given year are identified in accordance with the amount of water available (a flexible approach to manage short-term climatic variability).

The jurisdictional approaches to determining environmental water requirements in Table 3 vary with the level of demand on the water resource (as noted in Figure 1). In high-demand settings where there is large consumptive use (that is, situations requiring high-competition management), eco-hydraulic methods¹⁶ are often employed to justify the retention of water in systems or the return of water to them. These methods are aimed at protecting or restoring key flow components to cater for the water requirements of ecological values within the system.

In lower demand settings (requiring low-competition management), eco-hydrologic methods¹⁷ are typically the basis upon which environmental water requirements are determined. These methods take a holistic approach to water within the system, often defining a percentage of the total flow that should remain to sustain ecological values.

Jurisdictions generally identify GDEs and meet their environmental water requirements through the provision of base flow to surface water systems to support vegetation and wetlands, and the maintenance of groundwater levels. In coastal groundwater systems, environmental objectives such as maintaining the saltwater–freshwater interface often exist.

Knowledge of aquifer ecosystems is extremely limited and very location specific, so environmental water requirements for those ecosystems are rarely included specifically in water plans (aside from being part of the overall aquifer maintenance).

There is a level of risk inherent in the determination of environmental objectives and associated water requirements. Therefore the consideration of a range of risk levels is likely to be implicit in the development of environmental objectives and water requirements. However, making the level of risk explicit in the determination of environmental objectives and water requirements is not a feature commonly reported by jurisdictions as at 30 June 2010.

16 Eco-hydraulic methods lead to recommendations that are based on the hydraulic performance of water within the system. For example, the achievement of a particular flow height in a river.

17 Eco-hydrologic methods generate recommendations based on the hydrology or water availability within the system. For example, providing 60% of the naturally occurring winter base flow.

Table 3. Determination of environmental water requirements across jurisdictions (30 June 2010)

Jurisdiction	Groundwater	Surface water
Commonwealth and cross jurisdictional	<i>Commonwealth Environmental Water Holder objectives</i> Environmental water requirements are determined based on a prioritisation framework and seasonally adaptive environmental objectives.	
	<i>The Living Murray</i> Not applicable.	<i>The Living Murray</i> The Living Murray focuses on improving the environment at six 'icon sites' along the River Murray. The icon sites were chosen for their high ecological value and cultural significance to Indigenous people and the broader community. Ecological objectives were developed with the aim of retaining, restoring or improving the sites' ecosystems, habitats, and species of flora and fauna. Water requirements were determined for each icon site, based on flow-ecology relationships and hydrological modelling.
	<i>Water for Rivers</i> Not applicable.	<i>Water for Rivers</i> A water savings target of 282 GL of water access entitlements from the Murrumbidgee, Goulburn and River Murray systems (upstream of the South Australian border) has been set for June 2012. This volume is aimed at restoring 212 GL or 21 per cent of the average natural flow in the Snowy River and provide 70 GL of water for environmental flows in the River Murray system by June 2012.
Australian Capital Territory	Groundwater environmental requirements are not determined.	<i>Environmental flow guidelines</i> Influences of flow regime components (base flows, riffle maintenance, pool maintenance, channel maintenance and maintenance of reservoir levels) on environmental objectives are defined through an expert panel approach and are documented in the <i>Environmental flow guidelines</i> .
New South Wales	GDEs are identified, then the long term storage component of the aquifer, plus a proportion of the groundwater recharge is set aside in the water sharing plan to meet the requirements of the GDE.	<i>River flow objectives</i> River flow objectives provided the basis for establishing environmental flow rules in the initial water sharing plans. The environmental flow rules were tailored for each river system and based on broad river flow objectives that set out 12 aspects of flow that were considered to be critical for the protection or restoration of river health, ecology and biodiversity. <i>Risk classification</i> For more recent plans, rules are based on instream values that are designed to limit extractions, so that a share of water is protected to for the environment and to better reflect natural flow patterns or events.
Northern Territory	<i>80:20 rule</i> 80% of natural annual recharge must be left for environmental purposes.	<i>80:20 rule</i> 80% of natural stream flow must be left for environmental purposes.

Jurisdiction	Groundwater	Surface water
Queensland	Groundwater environmental requirements are not determined.	<p><i>Environmental flow objectives</i></p> <p>Environmental flow objectives are defined by an independent scientific advisory panel using a hydrologic benchmarking methodology.</p>
South Australia	Scientific assessments are used to determine water quality and quantity requirements for priority GDEs.	There is no standard, state-wide approach for determining environmental water requirements. Environmental water provisions are determined based on studies such as environmental water requirement assessments and surface water budgets.
Tasmania	Groundwater environmental requirements are not determined.	<p><i>Conservation of Freshwater Ecosystem Values</i></p> <p>A state-wide audit and conservation evaluation of freshwater-dependent values.</p> <p><i>Tasmanian Environmental Flows project</i></p> <p>TEFlows defines flow components of the flow regime to maintain or approximate the regime required for priority ecosystems.</p>
Victoria	Environmental objectives may be specified in various groundwater management plans.	<p><i>FLOWS method</i></p> <p>FLOWS is a technical panel approach and a combination of ecological objectives and hydraulic performance.</p> <p><i>Hydraulic habitat method</i></p> <p>The availability of native fish habitat is identified at a range of flows by considering flow depth and velocity requirements of a few key species.</p>
Western Australia	Scientific assessment based on groundwater area, connectivity, complexity and ecosystem value.	<p><i>Flow events method</i></p> <p>The flow events method considers environmental values and objectives, hydraulic surveys and modelling, and hydrologic analysis.</p> <p><i>Building block approach</i></p> <p>The health of all components of the system is addressed to construct a flow regime for maintaining a river in a predetermined condition.</p> <p><i>Wetted perimeter method</i></p> <p>Environmental water requirements are determined using the relationship between wetted perimeter and discharge.</p>

3.2 Environmental water commitment

The description of the elements of the environmental water management framework (see Table 2) describes this element as:

Decide the environmental water provisions and commit to them through the management of the water regime (planned and held environmental water).

In practice, environmental water commitments are the provisions within statutory instruments and management tools to meet, either fully or in part, the environmental water requirements. Jurisdictions have adopted a range of approaches to secure environmental water provisions (see Table 4). The major division in the management of water in surface water systems is between entitlement-based (held environmental water) and rules-based (planned environmental water) management.

Jurisdictions commonly make their environmental water provisions through the establishment of annual allocation limits (or caps) on extraction and access rules, in both surface water and groundwater systems. Allocation limits and access rules constrain the volume that can be extracted, usually under water access entitlements, in a set period (usually over the course of a water year). These limits and rules are a significant form of environmental water commitment, constraining the consumptive use of the resource to 'leave behind' enough water to meet environmental water requirements. In addition to allocation limits, jurisdictional water plans can include a suite of water allocation criteria and transfer rules to help achieve sustainable management of the resource.

Environmental water provisions are commonly documented in jurisdictional water plans as rules-based commitments (such as cease-to-pump rules, flow sharing arrangements, passing flow releases, environmental water allowances and storage operation rules). All jurisdictions have documented environmental water commitments (in varying degrees of detail) in their water plans.

Aside from rules-based management, in some jurisdictions entitlements have been set aside in water plans, purchased or created through water savings, to be used for environmental purposes where a high level of competition for water resources exists within a system. The NWI defines a water access entitlement as 'a perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water plan.' Entitlements may be held on behalf of the environment (and separately, in some cases designated as environmental entitlements), to be used to contribute to specific environmental objectives for a system or a site. The water allocations that accrue to these entitlements are delivered to achieve environmental outcomes specified on an annual basis, typically by an environmental watering working group (such as The Living Murray Environmental Watering Group, CMAs and NRM boards).

Therefore, in some jurisdictions environmental water requirements are met through a combination of held and planned water in the one system. To further complicate matters, non-environmental or consumptive, entitlements can be delivered in a way that contributes significantly towards the environmental water requirements of a system.

Table 4. Commitment of environmental water across jurisdictions (30 June 2010)

Jurisdiction	Groundwater	Surface water
Commonwealth and cross jurisdictional	Not applicable—groundwater environmental requirements are not determined, therefore there are currently no specific groundwater commitments.	<p><i>Commonwealth environmental water holdings</i></p> <p>All environmental water held by the Commonwealth is currently in the form of water access entitlements.</p> <hr/> <p><i>The Living Murray Environmental Watering Plan</i></p> <p>The watering plan is developed by The Living Murray Environmental Watering Group on an annual basis to guide management of water access entitlements acquired through The Living Murray initiative. The plan describes objectives for watering under different climatic scenarios, and criteria for assessing and implementing proposed watering actions. This enables an adaptive approach to environmental watering throughout the year.</p> <hr/> <p><i>Water for Rivers</i></p> <p>All water recovered is held by Water for Rivers as water access entitlements. The water savings target of 282 GL will be achieved through a range of water recovery methods however, which may include investment in water efficiency infrastructure projects, commissioning riverine works and purchasing water access entitlements. The Water Advisory Panel provides policy and technical advice to the Water for Rivers Board.</p> <hr/> <p>Environmental water requirements are implemented through conditions placed on water access entitlements.</p>
New South Wales	<p>Groundwater environmental commitments are specified in water sharing plans to limit extraction and set aside a proportion of the average annual recharge (plus the groundwater storage volume) for environmental requirements.</p> <p>Restrictions may also be imposed such as:</p> <ul style="list-style-type: none"> + distance conditions from high value GDEs and + local restrictions to manage water level drawn downs below a certain level or declining water quality. 	<p>Environmental water requirements are implemented through extraction limits and specific environmental flow rules.</p> <p><i>Adaptive environmental water licences</i></p> <p>Water licences are purchased or recovered and committed for environmental purposes through The Living Murray, Snowy Initiative and Riverbank programs.</p>
Northern Territory	<p><i>Water allocation plans</i></p> <p>Environmental water commitments are delivered through rules specified in water allocation plans.</p>	
Queensland	<p><i>Water resource plans</i></p> <p>Groundwater areas are progressively being incorporated into water resource plans, which provide a framework for sharing water between consumptive use and environmental requirements.</p>	<p><i>Water resource plans</i></p> <p>Water resource plans establish a framework for sharing water between consumptive use and environment requirements.</p> <hr/> <p><i>Resource operations plans</i></p> <p>Resource operations plans detail rules for the management of the entire water resource to achieve environmental water objectives.</p>

Jurisdiction	Groundwater	Surface water
South Australia	<p><i>Water allocation plans</i></p> <p>Commitment to environmental water is through water allocation plans, and is through an annual allocation limit or a range of management principles or rules. Held environmental water is also delivered within the South Australian River Murray.</p>	
Tasmania	<p><i>Water management plans</i></p> <p>Water management plans establish a framework for sharing water between consumptive use and environmental requirements. They are delivered through a range of mechanisms, including allocations and licences, minimum flow requirements, environmental flow release requirements, operating guidelines and cease-to-take protocols.</p> <hr/> <p><i>Entitlements</i></p> <p>No licensing system has been established for the taking of groundwater in Tasmania.</p> <hr/> <p><i>Hydro Tasmania</i></p> <p>Not applicable</p>	<p><i>Entitlements</i></p> <p>Environmental commitments are met through conditions on licences that restrict extraction.</p> <hr/> <p><i>Hydro Tasmania</i></p> <p>Hydro Tasmania has been undertaking voluntary releases of environmental flows, which are considered in the preparation of water management plans.</p>
Victoria	<p><i>Permissible consumptive volume</i></p> <p>Groundwater extraction is limited by the permissible consumptive volume, and the remaining groundwater is left for the environment.</p> <hr/> <p><i>Groundwater management plans</i></p> <p>Groundwater management plans are also used to establish rules and minimum water levels relating to water quality and the protection of base flows.</p>	<p><i>Sustainable water strategies</i></p> <p>The strategies set out a long-term regional plan to secure water for local growth and are intended to maintain the balance of the area's water system and safeguard the future of its rivers and other natural resources.</p> <hr/> <p><i>Environmental Water Reserve</i></p> <p>The reserve contains all of the water set aside for environmental purposes.</p> <hr/> <p><i>Bulk entitlements</i></p> <p>Bulk entitlements are generally held by water authorities and provide environmental water through rights to water in storage, a cap on total use and passing flow requirements.</p> <hr/> <p><i>Environmental entitlements</i></p> <p>Environmental entitlements are held by the Minister for Environment and are delivered according to the annual watering plans.</p> <hr/> <p><i>Stream flow management plans</i></p> <p>Plans prescribe a permissible consumptive volume for extraction from unregulated streams and the remaining water is allocated to the environment.</p>
Western Australia	<p><i>Groundwater allocation plans and water licences</i></p> <p>Groundwater allocation limits and water licence conditions are set to achieve environmental water provisions.</p>	<p><i>Surface water allocation plans and water licences</i></p> <p>Surface water allocation limits and water licence conditions are set to achieve environmental water provisions.</p>

3.3 Environmental water compliance

The description of the elements of the environmental water management framework (see Table 2) describes this element as:

Monitor and report to assess if the water regime that was provided complies with the commitment.

Reporting on the compliance of management actions with environmental water commitments involves activities such as measuring stream flow at a particular place and time, monitoring groundwater levels and mapping inundation extents for environmental watering events. Reporting also needs to address compliance with aspects such as the water access regime, allocations, caps and groundwater use within allowable limits. Without specific environmental water commitments within environmental water plans, or specific environmental objectives for held environmental water, it is not possible to establish effective compliance monitoring.

Most jurisdictions report annually on the performance of water management, to varying levels of detail, at a drainage basin or plan area scale (Table 5). The reports are typically issued 6–18 months following the end of the water year.

The annual water reports prepared by jurisdictions rarely explicitly state the compliance with planned environmental water commitments. Compliance with planned environmental water provisions is typically required (in the relevant water plan) to be reported each water year. However, those reports are not typically publicly available.

Jurisdictions with held environmental water report on their entitlements through recently developed environmental water registers. The registers typically document the assignment of water allocations to and from held water access entitlements. Environmental entitlement holders are required by legislation to report on the management of their entitlements annually.

An Australian Water Accounting Standard (AWAS) (Appendix B) has been developed by the Water Accounting Standards Board for the preparation and presentation of general purpose water accounting reports (GPWARs). Several jurisdictions have experience in preparing demonstration GPWARs in accordance with the developed standard, including the disclosure of information about water related to environmental benefit. This accounting approach relies on the disclosure of information in the notes to GPWARs that relates to planned water primarily for environmental benefit. This approach includes high level information on:

- + environmental objectives
- + the nature of the environmental water regime committed and the water access rules
- + a summary statement on the extent of compliance with the environmental water regime that was committed to
- + disclosure of any environmentally relevant noncompliance with the water access rules
- + references to more detailed information sources on the water access rules, the environmental water provision regime or environmental/ecological outcomes.

The Water Accounting Standards Board has also developed a Water Accounting Conceptual Framework (WACF) to guide the development of AWASs. The WACF provides guidance on standard setting and includes concepts of independent verification (Statement of Water Accounting Concept 8: Assurance of GPWARs). Further information on the National Water Accounting Development project (NWADp) and its application to reporting on environmental water compliance is provided in Appendix A.

The National Water Account being prepared by the Bureau of Meteorology under the *Water Act 2007* (Cwth) will also include information on planned and held environmental water.

Table 5. Compliance reporting of environmental water commitments across jurisdictions (30 June 2010)

Jurisdiction	Groundwater	Surface water
Commonwealth and cross jurisdictional	Not applicable—no groundwater commitments to date.	<p><i>Commonwealth environmental water holdings</i></p> <p>The Commonwealth Environmental Water Holder:</p> <ul style="list-style-type: none"> + maintains a register of entitlements¹⁸ + reports on the Commonwealth's holdings in its annual report, which is tabled in parliament and published on the department's website.¹⁹ <hr/> <p><i>The Living Murray Annual Implementation Report</i></p> <p>The Murray–Darling Basin Authority produces an annual report that outlines water delivered and outcomes achieved against annual and long-term environmental objectives at each Icon site.²⁰</p> <hr/> <p><i>Murray–Darling Basin cap reports</i></p> <p>These reports are published on the Authority's website.²¹</p> <hr/> <p><i>Water audit monitoring reports</i></p> <p>Produced as a requirement under Schedule E to the Murray–Darling Basin Agreement, these reports provide a broad picture of the Cap compliance, water use for consumptive and environmental purposes, climatic overview, water availability through allocations, off-allocations and water trading, storages losses, and groundwater use.²²</p> <hr/> <p><i>Water for Rivers</i></p> <p>Water for Rivers:</p> <ul style="list-style-type: none"> + provides information on water saving projects²³ + maintains a project register of water recovered²⁴ <p>New South Wales and Victoria are responsible for the compliance reporting of the commitment of water secured by Water for Rivers.</p>
Australian Capital Territory	14 groundwater monitoring bores are monitored in high-demand areas.	<p>Compliance and stream-flow reports are generated at the end of each calendar year, but are not publicly available.</p> <p>The ACT Government produces annual water reports outlining the state of water resources in the ACT.²⁵</p>
New South Wales	<p>The NSW Government produces cap compliance reports annually for the Murray–Darling Basin Authority which specify extractions compared to cap limits.</p> <p>The NSW Office of Water produces periodic reports which include details on the delivery of environmental water under water sharing plans.²⁶</p> <p>Details of held environmental water (adaptive environmental water licences) are included in the Environmental Water Register.²⁷</p> <p>Details of adaptive environmental water holdings and how they are applied also reported on the NSW Department of Environment, Climate Change and Water website.</p> <hr/> <p><i>Groundwater monitoring</i></p> <p>Aquifers are monitored for changes in groundwater levels and in some cases, water quality. Major extractions are metered to ensure consistency with allocation announcements and sustainable yields. This information is reported in the status and compliance reports published periodically for each major groundwater system.</p>	<p>Reports on the application of held and adaptive environmental water in major regulated river valleys are also published by the NSW Office of Water.²⁸</p>

Jurisdiction	Groundwater	Surface water
Northern Territory	There is limited compliance monitoring in the Northern Territory. No reporting publicly available at 30 June 2010.	
Queensland	<p><i>Self-monitoring</i></p> <p>Resource operations licence holders are required to monitor and report their water resource use (surface or groundwater) to the Queensland department (these reports are not publicly available).</p> <hr/> <p><i>Annual reports on water resource plans</i></p> <p>The Minister for Natural Resources prepares an annual report on the implementation of all water resource plans. The report includes information for each plan on flows, water allocation and use, compliance with rules and ecological monitoring activity.²⁹</p>	
South Australia	Water allocation plans require monitoring of the water resource and its overall management. Specific monitoring requirements are provided in the plans. No reporting publicly available at 30 June 2010.	
Tasmania	Not applicable—there are no specific groundwater commitments to monitor and report on.	<p><i>Stream-flow monitoring</i></p> <p>Water management plans include a range of monitoring requirements mainly focused on river levels and stream flow. No reporting publicly available at 30 June 2010.</p>
Victoria	<p><i>State Observation Bore Network</i></p> <p>The movement, availability and quality of groundwater are monitored by the network. Groundwater information is reported in the Groundwater Management System.³⁰</p> <hr/> <p><i>Management plans</i></p> <p>Groundwater management plans provide for the equitable and sustainable management of groundwater resources in areas that have been declared water supply protection areas. The relevant water corporation administering a plan is required to report annually to the Minister for Water and the relevant CMA in respect of its activities in carrying out its duties in relation to the plan.</p>	<p><i>Management plans</i></p> <p>Stream-flow management plans determine how river water will be shared between consumptive use and the environment in declared water supply protection areas in unregulated systems. The relevant water corporation administering the plan is required to report annually to the Minister for Water and the relevant CMA in respect of its activities in carrying out its duties in relation to the plan.³¹</p> <hr/> <p><i>Bulk and environmental entitlements</i></p> <p>Holders of bulk and environmental entitlements may be required to undertake metering programs that typically monitor the amount of water taken by the holder, the amount of water returned to waterways, storage inflows and volumes in storage, or passing flows. Entitlement holders and resource managers may be required to report on the metering program annually.³²</p> <hr/> <p><i>Victorian Water Accounts</i></p> <p>The accounts provide an overview of how water was managed at both statewide and river basin levels. This includes reporting on compliance with passing flow requirements in relevant basins for selected compliance points.³³</p>

Jurisdiction	Groundwater	Surface water
Western Australia	<p><i>Groundwater level monitoring</i></p> <p>Levels are monitored and compliance audits are undertaken for larger licence holdings.</p> <p>No reporting publicly available at 30 June 2010.</p>	<p>Monitoring for the Ord and other selected surface water systems.</p> <p>No reporting publicly available at 30 June 2010.</p>

3.4 Environmental water review

The description of the elements of the environmental water management framework (see Table 2) describes this element as:

Monitor and report on environmental response and condition so as to evaluate and review both the determination and the commitment.

The final step in the framework should enable jurisdictions to understand the responses to environmental watering and to determine whether the environmental condition is declining, stable or improving. Therefore to review the effectiveness of environmental water provisions and management (in achieving sustainable water use), monitoring is required that is targeted to assess the ecological responses and condition in relation to the environmental water provided. This ecological monitoring relies on flow–ecology relationships used when determining environmental water requirements (the ‘determination’ element of the report framework).

Critically, the ecological monitoring can only inform a review of environmental water management if ecological values, environmental objectives and water requirements have been clearly determined and the environmental water provisions clearly articulate what is intended to be achieved through the commitment of environmental water. For example, if the intent is to restore a native fish population, ecological monitoring must be designed to assess whether that is being achieved. Beyond direct flow–ecology relationship monitoring, broader river health monitoring programs can assist in building a more comprehensive understanding of changes in ecosystem condition.

As was stated in the Commission’s 2009 biennial assessment, the common lack of detail on ecological values and environmental objectives often prevents an accurate review of the effectiveness of environmental water commitments. The rules-based (planned environmental water) objectives embodied within water plans are however reviewed within the context of statutory plan reviews, which typically occur over a 5–10 year timeframe. Therefore, more recently reviewed and developed water plans better define ecological values, their associated environmental objectives and how those objectives will be achieved within a system.

Commonly the jurisdictional objectives for held environmental water are more specific than rules within plans (which often target multiple benefits, not just environmental), making the establishment of ecological monitoring easier for held water than for planned water. As a result, the intended outcomes of entitlement delivery and the subsequent watering actions are more clearly documented by jurisdictions and are publicly available.

Although the specification of environmental objectives is improving, outcome monitoring (assessing if the system is responding as expected ecologically) is not widespread or consistent due to its cost. Furthermore, the timeframes involved in detecting ecological responses and changes in condition are often longer than annual water year reporting, which makes assessments of effectiveness difficult.

18 The register of Commonwealth environmental water holdings is available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/policy-programs/cewh/holdings.html>

19 Further information is available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/policy-programs/cewh/index.html>

20 Available at the Murray–Darling Basin Authority website: <http://www.mdba.gov.au/programs/tlm>

21 Further information is available at the archived Murray–Darling Basin Commission website: http://www2.mdbc.gov.au/nrm/the_cap.html

22 The 2008–09 report and further information is available at the Murray–Darling Basin Authority website: http://www.mdba.gov.au/files/publications/MDBA_WaterAuditReport_Web_B.pdf

23 Available at the Water for Rivers website: <http://www.waterforrivers.org.au/projects/completed/>

24 Available at the Water for Rivers website: <http://www.waterforrivers.org.au/about/update/>

25 Available from the ACT Department of Environment, Climate Change, Energy and Water website: http://www.environment.Australian Capital Territory.gov.au/water/act_water_reports

26 Available at the NSW Office of Water website: http://www.water.nsw.gov.au/Water-management/Water-sharing/plans_commenced/default.aspx

27 Further information is available at the NSW Office of Water website: <http://ewr.water.nsw.gov.au/ewr/main/ewrHome>

28 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Water-recovery/default.aspx>

29 Available at the Queensland Department of Environment and Resource Management website: http://www.derm.qld.gov.au/wrp/annual_reports.html

30 Available on the Victorian Department of Sustainability and Environment website: <http://groundwater.geomatic.com.au/Main.aspx>

31 Available on the Melbourne Water website: http://www.melbournewater.com.au/content/rivers_and_creeks/waterway_diverters/stream_flow_reports.asp?bhcp=1

32 Section 43 of the *Water Act 1989* (Vic.).

33 Available at the Victorian Department of Sustainability and Environment website: <http://www.ourwater.vic.gov.au/monitoring/accounts>

Table 6. Review of environmental water commitment across jurisdictions (30 June 2010)

Jurisdiction	Groundwater	Surface water
Commonwealth	Not applicable—there are no groundwater commitments to review.	<p><i>Commonwealth Environmental Water Holder</i></p> <p>The Commonwealth Environmental Water Holder reports annually on watering actions and environmental outcomes in its outcomes report³⁴ and its annual report, which is tabled in parliament.</p> <hr/> <p><i>The Living Murray</i></p> <p>The outcomes evaluation framework outlines program requirements for comprehensive ecological monitoring for The Living Murray ecological objectives.³⁵</p> <hr/> <p><i>Sustainable Rivers Audit</i></p> <p>The Sustainable Rivers Audit assesses river health across all of the Basin's rivers and is overseen by a panel of ecologists, the Independent Sustainable Rivers Audit Group.³⁶</p> <hr/> <p><i>Water for Rivers</i></p> <p>New South Wales and Victoria are responsible for the review of the commitment of water secured by Water for Rivers.</p>
Australian Capital Territory	Not applicable—there are no groundwater commitments to review.	<p><i>Ecological monitoring</i></p> <p>Indicators for environmental objectives are outlined in the <i>Environmental flow guidelines</i>.³⁷ The ACT Government undertakes monitoring for the indicators.</p>
New South Wales	<p>A broad scale state-wide GDE layer is currently being developed. Long-term groundwater level monitoring and modelling is being undertaken in high use aquifers. In some systems (e.g. coastal aquifers at risk of saline intrusion), water quality is also monitored and modelled.</p> <p>Groundwater resource condition assessment reports and groundwater status reports are produced periodically and published on the NSW Office of Water website.³⁸ These reports contain information on a range of environmental and resource condition factors, including GDEs, water quality and groundwater levels.</p>	<p><i>Integrated Monitoring of Environmental Flows</i></p> <p>The NSW Government has developed an environmental flow response monitoring and evaluation program covering the major regulated rivers and priority unregulated areas, where a water sharing plan is in place.</p> <p>The NSW Office of Water publishes papers on the monitoring program.³⁹</p> <p>State of the Catchments reports are used to track progress against the state-wide natural resource management targets for NSW.⁴⁰</p>
Northern Territory	The Northern Territory Government reviews water allocation plans at least every five years.	
Queensland	<p><i>Environmental Flows Assessment Program</i></p> <p>The Queensland Government undertakes a state-wide monitoring and evaluation program to assess whether water resource plans are achieving environmental outcomes based on selected ecological assets. The results inform the review of water resource plans every 8–10 years.</p> <p>No reporting publicly available at 30 June 2010.</p>	

Jurisdiction	Groundwater	Surface water
South Australia	<p><i>Monitoring, evaluation and reporting framework for the South Australian Murray–Darling Basin</i></p> <p>Monitoring within the Murray–Darling Basin portion of the state is undertaken by the South Australian Murray–Darling Basin NRM Board.</p> <p>No reporting publicly available at 30 June 2010.</p> <p><i>Ecological monitoring</i></p> <p>Baseline monitoring for ecological values is required under a water allocation plan. A review period is specified in each plan.</p> <p>No reporting publicly available at 30 June 2010.</p>	
Tasmania	<p>Not applicable—there are no groundwater commitments to review.</p>	<p><i>Ecological monitoring</i></p> <p>Monitoring is to be undertaken as a condition of water management plans. Indicators include fish, macro-invertebrates and water quality.</p> <p>Additional scientific investigations are conducted during the life of water management plans to build the knowledge base in preparation for review of the plans. All Tasmanian plans are required to be reviewed and updated five years after initial implementation.</p> <p>No reporting publicly available at 30 June 2010.</p>
Victoria	<p>No review</p>	<p><i>Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP)</i></p> <p>Applies a consistent method for the monitoring of environmental flow outcomes for eight major regulated rivers.</p> <p>Some CMAs publish the results of their VEFMAP assessments.⁴¹</p>
Western Australia	<p><i>Condition monitoring</i></p> <p>Vegetation monitoring is undertaken only for the South West and Gngalara groundwater allocation plans.</p> <p>Large water licences (such as for mines and public water abstraction) have condition monitoring requirements associated with them.</p> <p>No reporting publicly available at 30 June 2010.</p>	<p>Large water licences (such as for mines and public water abstraction) have condition monitoring requirements associated with them.</p> <p>No reporting publicly available at 30 June 2010.</p>

34 Available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/publications/action/cewh-outcomes-report-2008-09.html>

35 Murray–Darling Basin Commission, *The Living Murray Outcomes Evaluation Framework: A framework for monitoring and evaluating*, the achievement of outcomes and objectives of The Living Murray 2008

36 Further information available at the Murray–Darling Basin Authority website: <http://www.mdba.gov.au/programs/sustainable-rivers-audit>

37 Available at the ACT Department of the Environment, Climate Change, Energy and Water website: http://www.environment.act.gov.au/water/act_water_resources/environmental_flows

38 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Water-availability/Groundwater/Groundwater/default.aspx>

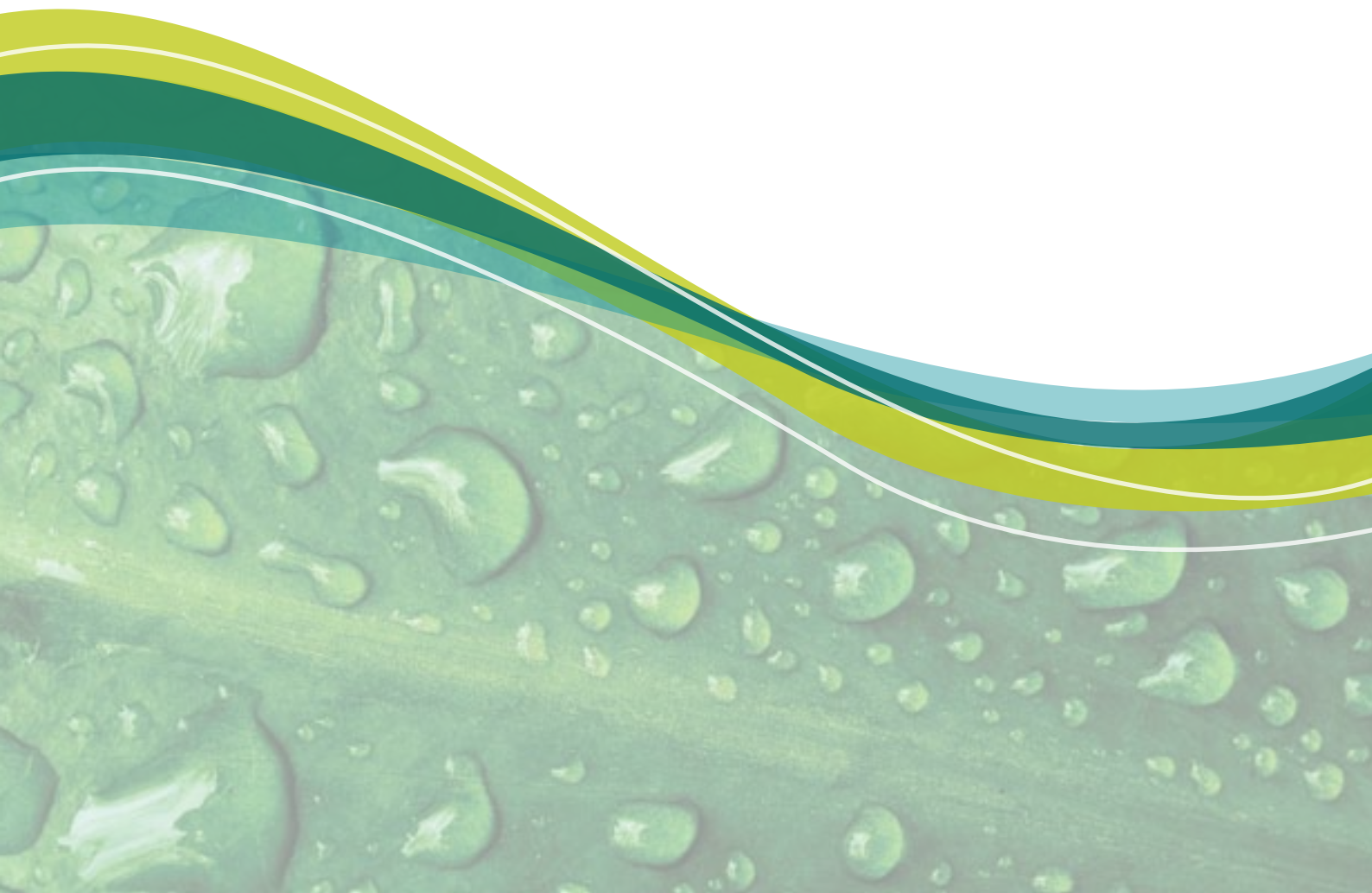
39 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Monitoring/Regulated-rivers/default.aspx>

40 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-management/Monitoring/Catchments/Catchments/default.aspx>

41 For example, the West Gippsland CMA website: <http://www.wgcma.vic.gov.au/programs/multi-region/134-monitoring-flows-in-the-thomson-and-macalister-rivers-background.html>

4 Commonwealth and cross-jurisdictional

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4 Commonwealth and cross-jurisdictional

4.1 Summary

Overview of the jurisdiction

While current responsibility for water management (including environmental water management) rests primarily with the states and territories, the Australian Government has had an increasing role in recent years, particularly in the Murray–Darling Basin. The *Water Act 2007* (Cwth) enabled the Commonwealth, in conjunction with the Murray–Darling Basin states (Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia), to manage basin water resources in the national interest.

The Water Act established the Murray–Darling Basin Authority with the functions and powers to manage basin water resources. The Authority is responsible for overseeing water resource planning in the Murray–Darling Basin, including the preparation of a strategic plan for the sustainable management of water resources (the Basin Plan).

The Act also established the Commonwealth Environmental Water Holder to manage the Commonwealth's environmental water with the aim of protecting and restoring the environmental assets of the Murray–Darling Basin, and outside the basin where the Commonwealth owns water. The Commonwealth held 738 GL of water entitlements for the Murray–Darling Basin at 30 June 2010, consisting of a mix of high, medium and low security entitlements, including supplementary and unregulated (or un-supplemented in Queensland) entitlements.

Overview of environmental water management arrangements

The Murray–Darling Basin cap

In July 1997 the Murray–Darling Basin Ministerial Council introduced a permanent limit on the water that could be extracted each year from the surface water resources of the Murray–Darling Basin for consumptive uses—the 'cap'. The basin cap remains in place (30 June 2010) and is a complex formula based on water use arrangements in the 1993–94 water year. At an operational level, the cap is managed in designated 'cap valleys' under the Murray–Darling Basin Agreement (now part of the Water Act) by the governments of the Australian Capital Territory, New South Wales, Queensland, South Australia and Victoria.

The Living Murray first-step decision

The Living Murray program was established in 2002 in response to evidence showing the declining health of the River Murray system. It is a partnership of the Australian, New South Wales, Victorian, South Australian and Australian Capital Territory governments. In 2004, under the 'first step' decision, ministers from The Living Murray partner governments committed to recovering 500 GL (long-term cap equivalent⁴²) of water to improve environmental outcomes at six Living Murray Icon sites. That decision was a first step towards The Living Murray's long-term goal of 'achieving a healthy working River Murray system for the benefit of all Australians'. However, the partner governments recognised at the time that the first-step decision alone would be insufficient to achieve that goal, and that further steps were likely to be required in future.

42 The long-term Cap equivalent is a type of average. It takes into account the different characteristics of water entitlements in New South Wales, Victoria and South Australia, and their reliability. For instance, to recover a long-term Cap equivalent volume of 1,000 ML in the NSW Murray region, you could purchase either a 1,053 ML High Security Water Access Licence or a 1,237 ML General Security Water Access Licence. This measure of water recovery creates a common unit of measure, thus allowing equitable comparison of a broad range of water recovery measures. The long-term Cap equivalent volume equates approximately to the theoretical long-term average increase in the flows in the River Murray resulting from the implementation of the water recovery measure. (Source: http://www.mdba.gov.au/programs/tlm/faqs#How_is_water_recovery_measured)

Joint Government Enterprise (Water for Rivers)

The Joint Government Enterprise, trading as Water for Rivers, is a ten-year (2002–2012), \$375 million initiative of the Australian, Victorian and New South Wales Governments. The Joint Government Enterprise was a commitment under the corporatisation of the Snowy Mountains Hydro-electric Authority in June 2002. It reflects the agreement of all three governments to deliver water for environmental flows in the Snowy River and the River Murray.

The Snowy Water Inquiry Outcomes Implementation Deed provides for the broad structure and operations of the enterprise.

The broad mission of the Joint Government Enterprise is to recover water through water efficiency projects and water entitlement purchases, and through the commissioning of environmental and riverine works. The location of water efficiency works is restricted to the Murrumbidgee River system, the Goulburn River system and diversions from the River Murray system. The water recovered is in addition to the 500 GL to be recovered under The Living Murray Initiative.

The Water Advisory Panel provides water policy and technical advice to the Water for Rivers Board for the preparation of business plans prior to the submission to the members and, where requested, provides additional ongoing technical and general water advice to Water for Rivers.

The panel membership comprises one person appointed by each member government (Australian, New South Wales and Victoria; South Australia is afforded observer status to meetings of the Water Advisory Panel).⁴³

Commonwealth Environmental Water Holder

The Commonwealth Environmental Water Holder was established under the Water Act to manage water entitlements, which are primarily acquired under the *Restoring the Balance in the Murray–Darling Basin Program* and the *Sustainable Rural Water Use and Infrastructure Program*. Both programs are part of the \$12.9 billion *Water for the Future* initiative, which is addressing river health and water availability in Australia. The Commonwealth Environmental Water Holder is required to manage the Commonwealth's environmental water holdings in order to protect and restore environmental assets and in accordance with the environmental watering plan, which the Murray–Darling Basin Authority is obliged to develop under the Water Act.

Lake Eyre Basin Intergovernmental Agreement

The Lake Eyre Basin covers about 1.2 million square kilometres and is among the world's largest internally draining river systems. The basin is an unregulated river system that includes parts of South Australia, the Northern Territory, Queensland and New South Wales (Figure 6).

The Lake Eyre Basin Intergovernmental Agreement is a joint undertaking of the Australian, Queensland, South Australian and Northern Territory governments. The purpose of the agreement is to ensure the sustainability of the Lake Eyre Basin river systems, in particular to avoid or eliminate cross-border impacts. The agreement established the Lake Eyre Basin Ministerial Forum, the decision-making body responsible for overseeing the implementation of the agreement.

The agreement provides for the ministerial forum to develop policies and strategies for the sustainable cross-border management of water and related natural resources within the agreement area. Policies include the management of river system flow regimes to protect and maintain the ecological integrity and natural function of in-stream and floodplain ecosystems.

While each state maintains responsibility for policy formulation and the administration of its legislation relevant to water within the Lake Eyre Basin area, it must comply with the agreement.

Environmental water management arrangements in the Lake Eyre Basin are discussed further in the South Australian, Queensland and Northern Territory sections (sections 7, 8 and 9, respectively).

43 Further information is available at the Water for Rivers website: <http://www.waterforrivers.org.au/>

Figure 6. Lake Eyre Basin area

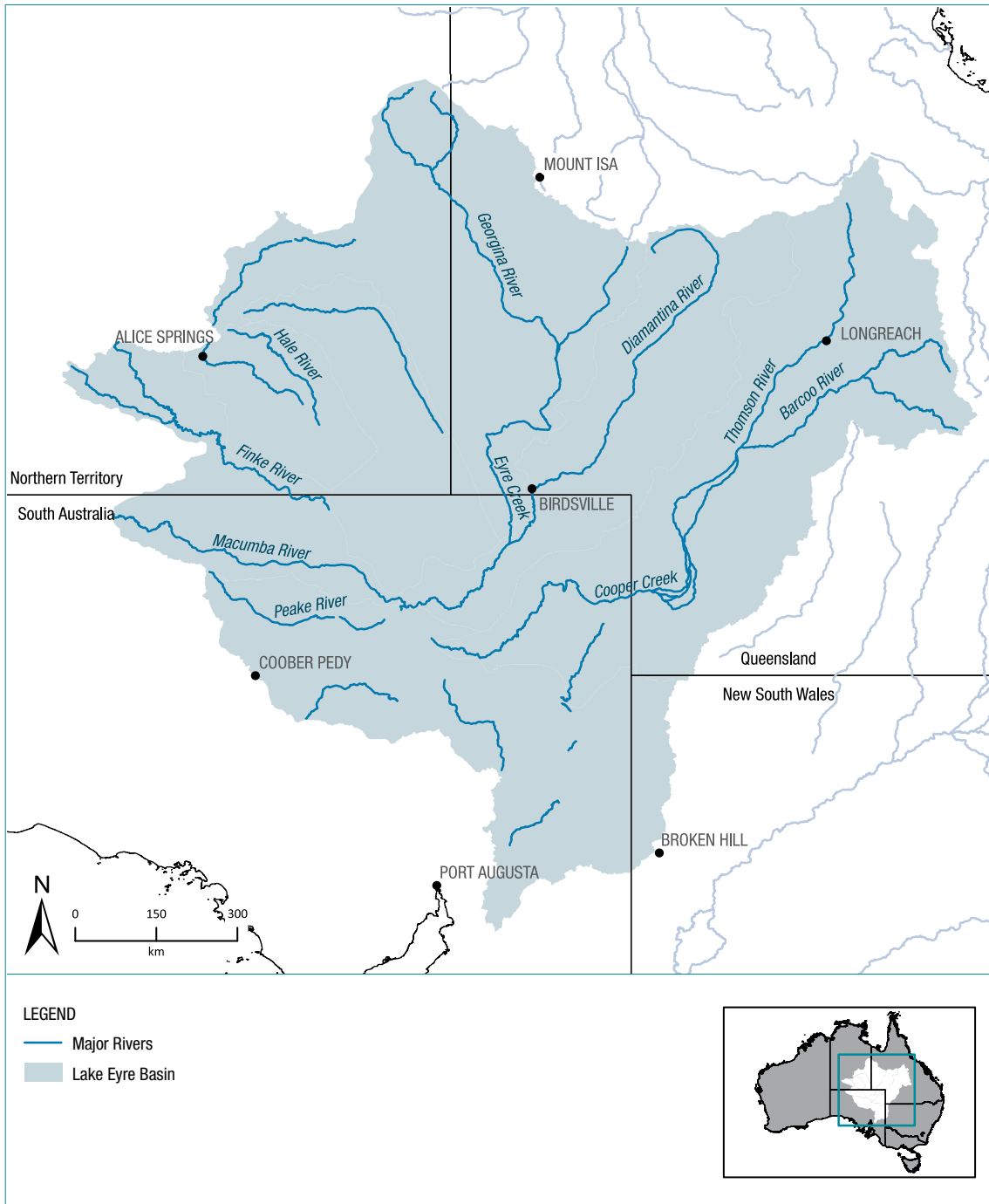


Table 7. Commonwealth environmental water statutory framework (30 June 2010)

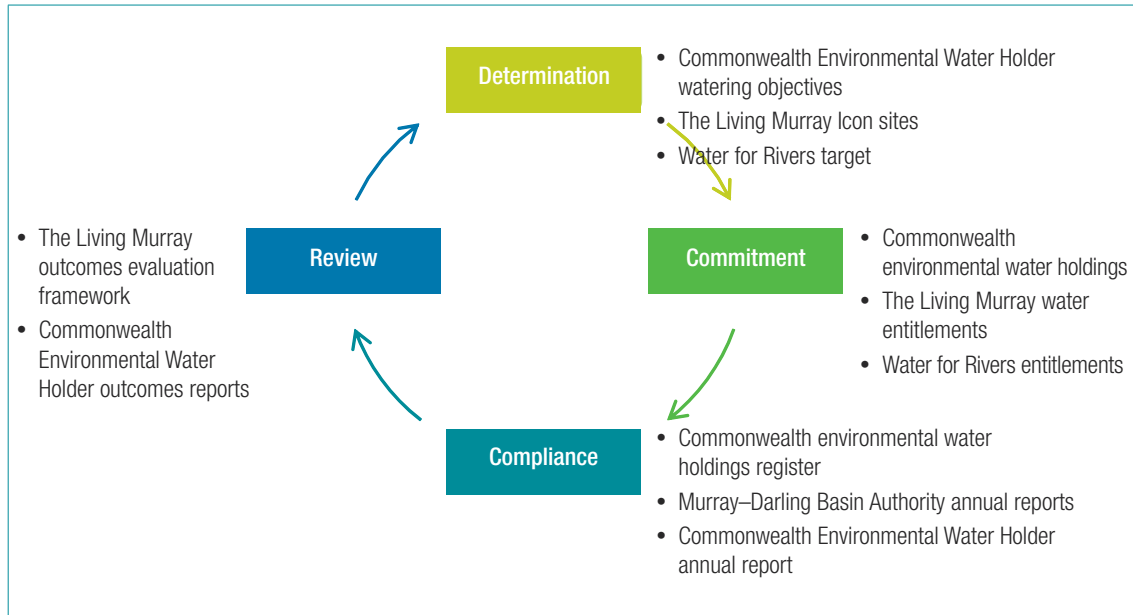
Legislation	<i>Water Act 2007</i> (Cwth)
Responsible minister	Minister for Climate Change, Energy Efficiency and Water at 30 June 2010, now the Minister for Sustainability, Environment, Water, Population and Communities
Environmental water manager	Commonwealth Environmental Water Holder Murray–Darling Basin Authority
Other relevant institutions	Department of the Environment, Water, Heritage and the Arts at 30 June 2010, now the Department of Sustainability, Environment, Water, Population and Communities Lake Eyre Basin Ministerial Forum
Method of securing environmental water	Planned: Sustainable diversion limits Held: Water access entitlements

Table 8. Commonwealth environmental water terminology (30 June 2010)

Term	Type	Definition
Environmental watering plan	Statutory instrument	A plan: (a) to safeguard existing environmental water (b) to plan for the recovery of additional environmental water (c) to coordinate the management of: (i) existing environmental water (ii) the additional environmental water that is recovered in order to: (d) protect and restore the wetlands and other environmental assets of the Murray–Darling Basin (e) protect biodiversity dependent on the Basin water resources and achieve other environmental outcomes for the Murray–Darling Basin. (Water Act, s. 28(1))
Water acquisitions	Management process	Water acquired under a transfer of rights, donation, efficiency measures or water buyback.
Sustainable diversion limit	Management tool	A long-term average sustainable diversion limit for the basin water resources, for the water resources of a particular water resource plan area or for a particular part of those water resources may be specified: (a) as a particular quantity of water per year; or (b) as a formula or other method that may be used to calculate a quantity of water per year; or (c) in any other way that the Authority determines to be appropriate. (Water Act, s. 23(2))
Water-dependent ecosystem	Natural system	A surface water ecosystem or a groundwater ecosystem, and its natural components and processes, that depends on periodic or sustained inundation, waterlogging or significant inputs of water for its ecological integrity and includes an ecosystem associated with: (a) a wetland; or (b) a stream and its floodplain; or (c) a lake or a body of water (whether fresh or saline); or (d) a salt marsh; or (e) an estuary; or (f) a karst system; or (g) a groundwater system and a reference to a water-dependent ecosystem includes a reference to the biodiversity of the ecosystem. (Water Act, s. 4)

The four elements of the environmental water management framework are applied to the Commonwealth in sections 4.2–4.5 and summarised in Figure 7.

Figure 7. Commonwealth and cross-jurisdictional: summary environmental water management framework (30 June 2010)



4.2 Determination of environmental water

Under the Water Act, environmental assets are defined as:

- + water-dependent ecosystems
- + ecosystem services
- + sites with ecological significance.

The definition of water-dependent ecosystems in section 4 of the Act includes both surface water and groundwater, including their natural components and processes that depend on periodic or sustained inundation, waterlogging or significant inputs of water for their ecological integrity. The definition includes an ecosystem associated with any of the following:

a wetland; a stream and its floodplain; a lake or a body of water (whether fresh or saline); a salt marsh; an estuary; a karst system; or a groundwater system.

Commonwealth Environmental Water Holder objectives

The Commonwealth Environmental Water Holder is to manage environmental water holdings to protect and restore environmental assets:

- + so as to 'give effect to relevant international agreements'
- + in accordance with the Murray–Darling Basin Environmental Watering Plan (once implemented)
- + in other areas, in accordance with any plans relating to environmental watering in those areas (s. 105 of the Water Act); it is expected that specific outcomes and objectives will be part of those plans.

In the absence of the Basin Plan, the Commonwealth Environmental Water Holder's approach to using Commonwealth environmental water is aimed at achieving the best environmental outcomes across the basin and is based on the *Framework for determining Commonwealth environmental watering actions*, which was finalised and published in December 2009.⁴⁴

⁴⁴ Department of the Environment, Water, Heritage and the Arts, *A Framework for Determining Commonwealth Environmental Watering Actions*, Canberra, 2009, available from the Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/publications/action/cewh-framework.html>

The Commonwealth's environmental watering program objectives are dependent upon the prevailing climatic and ecological conditions during the period for which they are established. Specifically, under the Commonwealth Environmental Water Holder's Business Plan,⁴⁵ a number of stipulated environmental objectives must be taken into account under a range of scenarios (Table 9).

Table 9. Ecological watering objectives under different scenarios

	Extreme dry	Dry	Median	Wet
Ecological watering objectives	Avoid damage to key environmental assets.	Ensure ecological capacity for recovery.	Maintain ecological health and resilience.	Improve and extend healthy and resilient aquatic ecosystems.
Management objectives	Avoid critical loss of threatened species and communities. Maintain key refuges. Avoid irretrievable damage or catastrophic events.	Support the survival and growth of threatened species and communities, including limited small-scale recruitment. Maintain diverse habitats. Maintain low-flow river and floodplain functional processes in sites and reaches of priority assets.	Enable growth, reproduction and small-scale recruitment for a diverse range of flora and fauna. Promote low-lying floodplain–river connectivity. Support medium-flow river and floodplain functional processes.	Enable growth, reproduction and large-scale recruitment for a diverse range of flora and fauna. Promote higher floodplain–river connectivity. Support high-flow river and floodplain functional processes.
Management actions	Water refugia and sites supporting threatened species and communities. Undertake emergency watering at specific sites of priority assets. Use carryover volumes to maintain critical needs.	Water refugia and sites supporting threatened species and communities. Provide low flow and freshes in sites and reaches of priority assets. Use carryover volumes to maintain follow-up watering.	Prolong flood/high-flow duration at key sites and reaches of priority assets. Contribute to the full range of in-channel flows. Use carryover to provide optimal seasonal flow patterns in subsequent years.	Increase flood/high-flow duration and extent across priority assets. Contribute to the full range of flows, including overbank flows. Use carryover to provide optimal seasonal flow patterns in subsequent years.

Source: Commonwealth Environmental Water Holder Business Plan 2010–11.

Sites to receive environmental water are selected by the Commonwealth Environmental Water Holder based on proposals put forward including by basin jurisdictions, with a view to achieving the best possible outcomes. Potential watering options are assessed against a set of publicly available criteria, developed in consultation with jurisdictions and the Environmental Water Scientific Advisory Committee. The criteria are:

- + the ecological significance of the asset(s)
- + the expected ecological outcomes from the proposed watering action
- + the potential risks of the proposed watering action at the site and at connected locations
- + the long-term sustainability of the asset(s), including appropriate management arrangements
- + the cost-effectiveness and operational feasibility of undertaking the watering.

Decisions on environmental water use are also informed by advice provided by the panel of scientific experts who make up the Environmental Water Scientific Advisory Committee.

45 Department of the Environment, Water, Heritage and the Arts, *Water for the future: Commonwealth Environmental Water Holder 2010–2011 Business Plan*, Canberra, 2010, available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/publications/action/cewh-business-plan-2010-11.html>

The Living Murray

The Living Murray Intergovernmental Agreement is implemented as set out in The Living Murray Business Plan 2007⁴⁶, which sets out in detail how water recovered will be assessed, used and accounted for. It mandates the development of environmental management plans for each of the six Icon sites (shown in Figure 8) and The Living Murray Environmental Watering Plan, which aims to apply available water across all of the assets in a way that achieves the greatest overall environmental benefit.

The Living Murray environmental management plan for each icon site is to include hydrologic requirements needed to achieve the ecological objectives listed in Table 10.

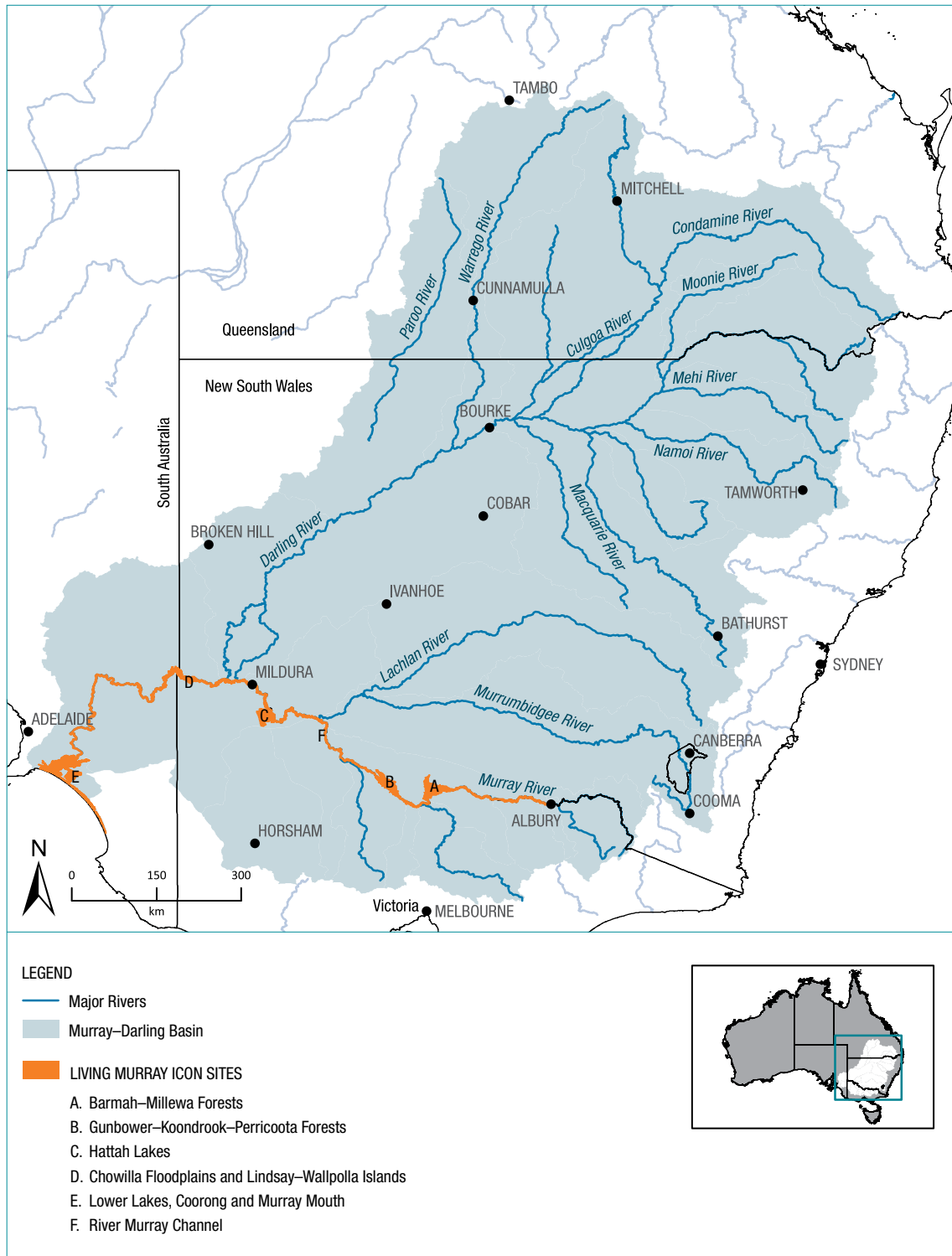
Table 10. Ecological objectives for The Living Murray Icon sites

Icon site	Ecological objectives
Barmah–Millewa Forest	Enhance forest, fish and wildlife values, as indicated by: <ul style="list-style-type: none"> + successful breeding of thousands of colonial waterbirds in at least 3 years in 10 + healthy vegetation in at least 55% of the area of the forest (including virtually all of the giant rush, Moira grass, river red gum forest and some river red gum woodland).
Gunbower–Koondrook–Perricoota Forests	Maintain and restore a mosaic of healthy floodplain communities, as indicated by: <ul style="list-style-type: none"> + 80% of permanent or semi-permanent wetlands in healthy condition + 30% of river red gum forest in healthy condition + successful breeding of thousands of colonial waterbirds in at least 3 years in 10 + healthy populations of resident native fish in wetlands.
Hattah Lakes	Restore healthy examples of all original wetland and floodplain communities, as indicated by: <ul style="list-style-type: none"> + restore the aquatic vegetation zone in and around at least 50% of the lakes to increase fish and bird breeding and survival + increase successful breeding events of threatened colonial water birds to at least 2 in 10 years (spoonbills; little, intermediate and great egrets; night herons; and bitterns) + increase the population size of and breeding events of the endangered Murray hardyhead, Australian smelt, gudgeons and other wetland fish.
Chowilla Floodplain and Lindsay–Wallpolla Islands	Maintain high biodiversity values of the Chowilla Floodplain, as indicated by: <ul style="list-style-type: none"> + high-value wetlands maintained + current area of river red gum maintained + at least 20% of the original area of black box vegetation maintained.
Lower Lakes, Coorong and Murray Mouth	A healthier Lower Lakes and Coorong estuarine environment, as indicated by: <ul style="list-style-type: none"> + open Murray Mouth + more frequent estuarine fish spawning + enhanced migratory wader bird habitat in the Lower Lakes.
River Murray Channel	<ul style="list-style-type: none"> + Increase the frequency of ecologically significant higher flows in spring. + Overcome barriers to the migration of native fish species between the sea and Hume Dam. + Maintain current levels of channel stability. + Expanded ranges of many species of migratory fishes. + Levels of channel erosion that are similar to or lower than those currently observed.

Source: Living Murray Business Plan, Annex D.

46 Murray–Darling Basin Commission (MDBC), *Living Murray Business Plan*, MDBC publication no. 23/07, MDBC, Canberra, 2007, available at the archived MDBC website: <http://publications.mdbc.gov.au/index.php?category=40>

Figure 8. The Living Murray first-step Icon sites



Source: Spatial data provided under a Data licence Agreement between the National Water Commission and the Murray–Darling Basin Authority.

4.3 Commitment of environmental water

The Basin Plan and environmental watering plan

The Water Act established the Murray–Darling Basin Authority to develop the Basin Plan for the management of the water resources in the Murray–Darling Basin. At 30 June 2010, the Guide to the proposed Basin Plan had not been released, however certain elements of the Basin Plan have been stipulated under the Water Act, since it came into force in 2008. The Basin Plan will provide a framework for setting environmentally sustainable diversion limits on the amount of surface water and groundwater that can be taken from the basin. The limits are required to be set 'based on the best available scientific knowledge and socio-economic analysis and cultural information' (Water Act, s. 21(4)).

Under section 22(1) of the Water Act, the Basin Plan must include an environmental watering plan, which will provide for the protection and restoration of rivers, wetlands and other environmental assets and the protection of biodiversity dependent on the basin water resources. Under section 28(2) of the Act, the environmental watering plan must specify:

- a) the overall environmental objectives for the water-dependent ecosystems of the Murray–Darling Basin;
- b) targets by which to measure progress towards achieving the environmental objectives specified in accordance with paragraph (a);
- c) an environmental management framework for planned environmental water and held environmental water;
- d) the methods to be used to identify environmental assets in the Murray–Darling Basin that will require environmental watering;
- e) the principles to be applied, and methods to be used, to determine the priorities for applying environmental water (including applying that water to environmental assets that are identified using the methods specified under paragraph (d)); and
- f) the principles to be applied in environmental watering.

Commonwealth environmental water holdings

All environmental water held by the Commonwealth Environmental Water Holder is in the form of water access entitlements, regardless of whether they are acquired through direct purchase or through investment in water saving measures. These entitlements are those created pursuant to state/territory legislation, as the Commonwealth Act does not of itself create water entitlements or rights. The Commonwealth is subject to the same rules, restrictions and fees as other holders of the same kind of water access entitlement.

Environmental water delivery is managed at each site by the relevant state department or local NRM body, which also monitors ecological responses and reports results to the Commonwealth.

Following decisions on the use of entitlements, the Commonwealth Environmental Water Holder coordinates water delivery with the relevant state government and with other water holders or CMAs to maximise the efficiency of water use. As explained in the Commonwealth Environmental Water Holder Business Plan 2010–11:

In regulated rivers, water is currently delivered to the location of priority environmental assets using water trading. As the volume of water held for the environment increases, in-stream watering will become critical to efficient delivery of water to meet environmental objectives. This means that increasingly, environmental watering will need to be integrated into river operations.

In unregulated rivers, water shepherding (used in conjunction with water trading) will be required to ensure that in-stream environmental flows are directed to priority environmental needs and protected from consumption.

The Living Murray

Water acquired through The Living Murray initiative is held and managed by the Murray–Darling Basin Authority. Decisions on environmental watering are made collectively by The Living Murray Environmental Watering Group (made up of representatives from each Living Murray partner government), guided by an annual environmental watering plan developed at the start of each financial year. Environmental watering decisions and actions are managed adaptively in response to changing circumstances throughout the year.

Lake Eyre Basin Intergovernmental Agreement

Under the *Lake Eyre Basin Intergovernmental Agreement*, each state retains responsibility for its water policy, administration and legislation within the Lake Eyre Basin Agreement Area, but to the fullest extent that it is able, each state should comply with the agreement (and any applicable policies and strategies). The guiding principles of the agreement include:

that the water requirements for ecological processes, biodiversity and ecologically significant areas within the Lake Eyre Basin Agreement Area should be maintained, especially by means of flow variability and seasonality (*Lake Eyre Basin Intergovernmental Agreement 2000* Part III – Guiding Principles 3.1(d)).

4.4 Compliance with environmental water delivery

Commonwealth environmental water holdings

The Commonwealth's environmental water holdings are reported on the website of the Department of Sustainability, Environment, Water, Population and Communities and in the Commonwealth Environmental Water Holder's annual report. The department maintains a water register that provides an up to date record of the Commonwealth environmental water holdings.

The Commonwealth Environmental Water Holder annual report, which is tabled in parliament, must provide information on environmental water delivered. When the Basin Plan comes into effect, the Commonwealth Environmental Water Holder must provide information on achievements against the objectives of the environmental watering plan.

Environmental water delivery is managed at each site by the relevant state department or local NRM body, which also monitors ecological responses and reports the results to the Commonwealth.

The Living Murray

The Authority reports on the data collected through the large stream-flow gauge network in the basin. Weekly operations reports are available from the Murray–Darling Basin Authority.⁴⁷ Provision of environmental water is reported on an annual basis in *The Living Murray annual implementation report*.⁴⁸

4.5 Review of environmental water

Basin Plan

As noted in section 4.3, at 30 June 2010, the Guide to the proposed Basin Plan had not been released, however the Water Act requires certain content to be included in the plan. A mandatory component of the Basin Plan is the development of a program for monitoring and evaluating the effectiveness of the plan. That program will set out the principles and framework to be used to monitor and evaluate the effectiveness of the Basin Plan in achieving its purpose, objectives and outcomes. The Water Act provides that the program must include reporting requirements for the Commonwealth and the basin states, as well as five-year reviews of water quality and salinity targets and the environmental watering plan.

The monitoring and evaluation program will establish the framework for evaluating the effectiveness of the Basin Plan's various elements, including:

- + the accreditation and implementation of the states' and territories' water resource plans
- + compliance with the sustainable diversion limits
- + progress towards the objectives and targets of the environmental watering plan and the water quality and salinity management plan.

An integral part of the monitoring and evaluation program will be to assess the current condition of basin water resources and to track progress towards the Basin Plan's stated objectives and outcomes. The assessment will include an evaluation of ecosystem and water resource responses to management actions, in addition to assessments of how well the Basin Plan and water resource plans have been implemented.

In addition, the National Water Commission will audit the effectiveness of implementation of both the Basin Plan and state water resource plans at least every five years. The results of those independent audits must be provided to the Australian Government minister and to ministers in basin states (Water Act, ss 87–90).

⁴⁷ Available on the Murray–Darling Basin Authority website at: http://www.mdba.gov.au/water/river_info/weekly_reports

⁴⁸ Murray–Darling Basin Authority, *The Living Murray annual implementation report 2008–2009*, MDBA, Canberra, 2010, available on the MDBA website: <http://www.mdba.gov.au/services/publications/more-information?publicationid=67>

Commonwealth Environmental Water Holder

Monitoring and evaluation of outcomes of Commonwealth environmental water delivery is undertaken through Commonwealth Environmental Water Holder partners (that is the Murray-Darling Basin Authority, state governments and local NRM bodies such as CMAs). The level of detail recorded for environmental objectives and the connection to watering requirements vary for each site.

During 2009–10, the Commonwealth Environmental Water Holder prepared an inaugural monitoring and evaluation report on watering actions and the environmental outcomes from Commonwealth environmental watering in 2008–09.⁴⁹ With input from the Environmental Water Scientific Advisory Committee and stakeholders, the Commonwealth Environmental Water Holder is developing a longer term monitoring, evaluation and reporting framework that will align with the requirements of the Basin Plan under the Water Act.

The Living Murray

The Living Murray Business Plan requires the development of a comprehensive monitoring and evaluation plan that will provide a consistent approach to monitoring and reporting across the six Icon sites. The Outcomes Evaluation Framework will guide the development of monitoring, evaluation and reporting arrangements across the six sites.

The overriding principle of the Outcomes Evaluation Framework is to provide the bare minimum information needed to report to the Murray-Darling Basin Ministerial Council and the community on the success of The Living Murray first-step decision. The framework is split into four programs:

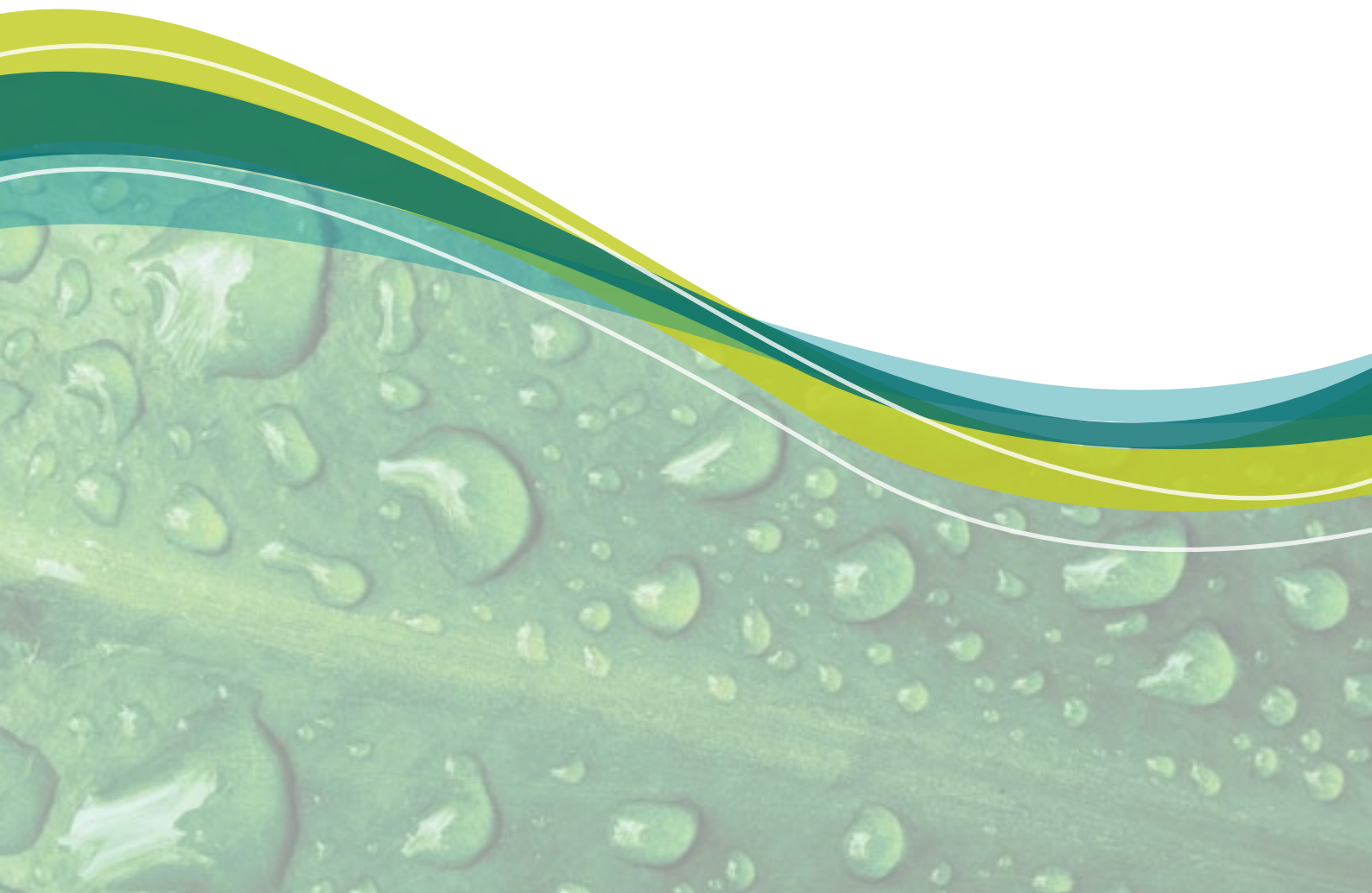
- + River Murray system-scale monitoring, to determine whether the health of the system improves following implementation of The Living Murray's first step
- + Icon site condition monitoring, to determine the change in environmental condition of each Icon site as a result of The Living Murray
- + intervention monitoring, to assess the ecological responses to specific Living Murray interventions (such as environmental watering)
- + compliance monitoring, to determine whether the agreed works and water regime at an Icon site have been achieved.

In addition, implementation of The Living Murray (including environmental watering activities and outcomes) are independently reviewed on an annual basis by the Independent Audit Group. The group's report is published on the Authority's website.

49 Available on the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/policy-programs/cewh/index.html>

5 Australian Capital Territory

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5 Australian Capital Territory

5.1 Summary

Overview of the jurisdiction

The Australian Capital Territory (ACT) is the smallest Australian jurisdiction in area (2400 km²), and had a population of 345 900 at the end of 2009.⁵⁰ Canberra, at an elevation of 580 metres, is the largest city in the ACT and also in the Murray–Darling Basin. Average annual rainfall across the ACT is relatively consistent compared to other jurisdictions, in the range of 600–900 mm per year.⁵¹ In the more elevated south (up to 1900 metres), snow cover is common over the winter months.

The Murrumbidgee River, the major river flowing through the ACT, originates in the alpine area to the south of the territory. The headwaters of the Murrumbidgee are largely diverted to the Snowy River scheme from Tantangara Reservoir for irrigation and power generation. All rivers and creeks in the ACT drain to the Murrumbidgee River.

Apart from the city of Canberra, the main land uses in the ACT are agricultural (sheep, dairy cattle, vineyards and small amounts of crops) and national parks. The availability of water resources for use in the ACT for urban and agricultural supplies is strongly influenced by rainfall, and most water used is derived from surface sources.

In the ACT, the statutory instrument that gives legal authority to take surface or groundwater is the *Water Resources Act 2007* (ACT). The major licensed water resource in the ACT is surface water. At 30 June 2010 there were 109 surface water licences on issue, with a total entitlement volume of 75 GL. A further 140 groundwater licences for less than 1 GL were also on issue.

Overview of environmental water management arrangements

The Water Resources Act provides for the identification and management of water for ecosystems, which are detailed in the *2006 Environmental flow guidelines*.⁵²

The Act provides for the management of water resources in the ACT through the issuing of water access entitlements and water licences, and includes a requirement for the preparation of a water-sharing plan. In relation to environmental water, the objectives of the Act are to:

- + ensure that management and use of the water resources of the Territory sustain the physical, economic and social wellbeing of the people of the ACT while protecting the ecosystems that depend on those resources
- + protect aquatic ecosystems and aquifers from damage and, where practicable, to reverse damage that has already happened.

Environmental water in the jurisdiction is delivered in two ways:

- + by releases or spills from dams and
- + by putting restrictions on the volume of water that can be abstracted from a catchment.

The volume of water available for abstraction is limited to the volume remaining after environmental flow volumes have been provided. Rules are also applied to ensure that licensed abstractors do not adversely affect rivers during very low flow periods.

Environmental water in the ACT is managed by the Department of the Environment, Climate Change, Energy and Water and the Environment Protection Authority.

50 Australian Bureau of Statistics (ABS), *3101.0 – Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

51 Available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>.

52 Environment ACT, *Environmental flow guidelines 2006*, ACT Government, Canberra, 2006, available from the department's website: http://www.environment.act.gov.au/water/act_water_resources/environmental_flows.

Table 11. Australian Capital Territory: environmental water statutory framework (30 June 2010)

Legislation	<i>Water Resources Act 2007</i> (ACT) <i>Water resources environmental flow guidelines 2006</i> (No. 1) <i>Territory Plan 2008</i>
Responsible minister	Minister for Environment, Water and Climate Change
Environmental water manager	Environment Protection Authority (Department of the Environment, Climate Change, Energy and Water)
Other relevant institutions	ACTEW Corporation Limited
Method of securing environmental water	Planned: planned environmental water is defined through the statutory <i>Environmental flow guidelines</i>

Table 12. Australian Capital Territory: environmental water terminology (30 June 2010)

Term	Type	Definition
Water access entitlement	Statutory instrument	A statutory instrument specified in the <i>Water Resources Act 2007</i> (ACT) that provides a right to take a specified volume of surface or groundwater. A licence to take water, which specifies the location from which water can be taken, must accompany a water access entitlement.
Water allocation	Management tool	A specific volume of water allocated to a water access entitlement.
Water resources management plan	Management tool	A plan required under the <i>Water Resources Act</i> to include a description of the territory's water resources, proposed water allocations for the next 10 years, water allocations to be created, and action to be taken to manage water resources (the plan, <i>Think water, act water</i> , was published in 2004 ⁵³).
Water sharing plan	Management tool	Replaced part of the <i>Think water, act water</i> plan to define water management areas and allocate shares of water to different uses.
Water management area	Area	A defined area, comprising a number of grouped subcatchments or one larger subcatchment, which has a specified volume of water available for use and for environmental purposes.

Table 13 shows the 14 statutory water management areas in the ACT, each of which has specified volumes of water available for use and environmental purposes. The areas comprise a number of grouped subcatchments or one larger subcatchment defined by the *Water Resources (Water Management Areas) Determination 2007 No. 1* made under the Act. In setting water management area boundaries, groundwater and surface water resources are considered as the same resource, but the sources are accounted for separately.

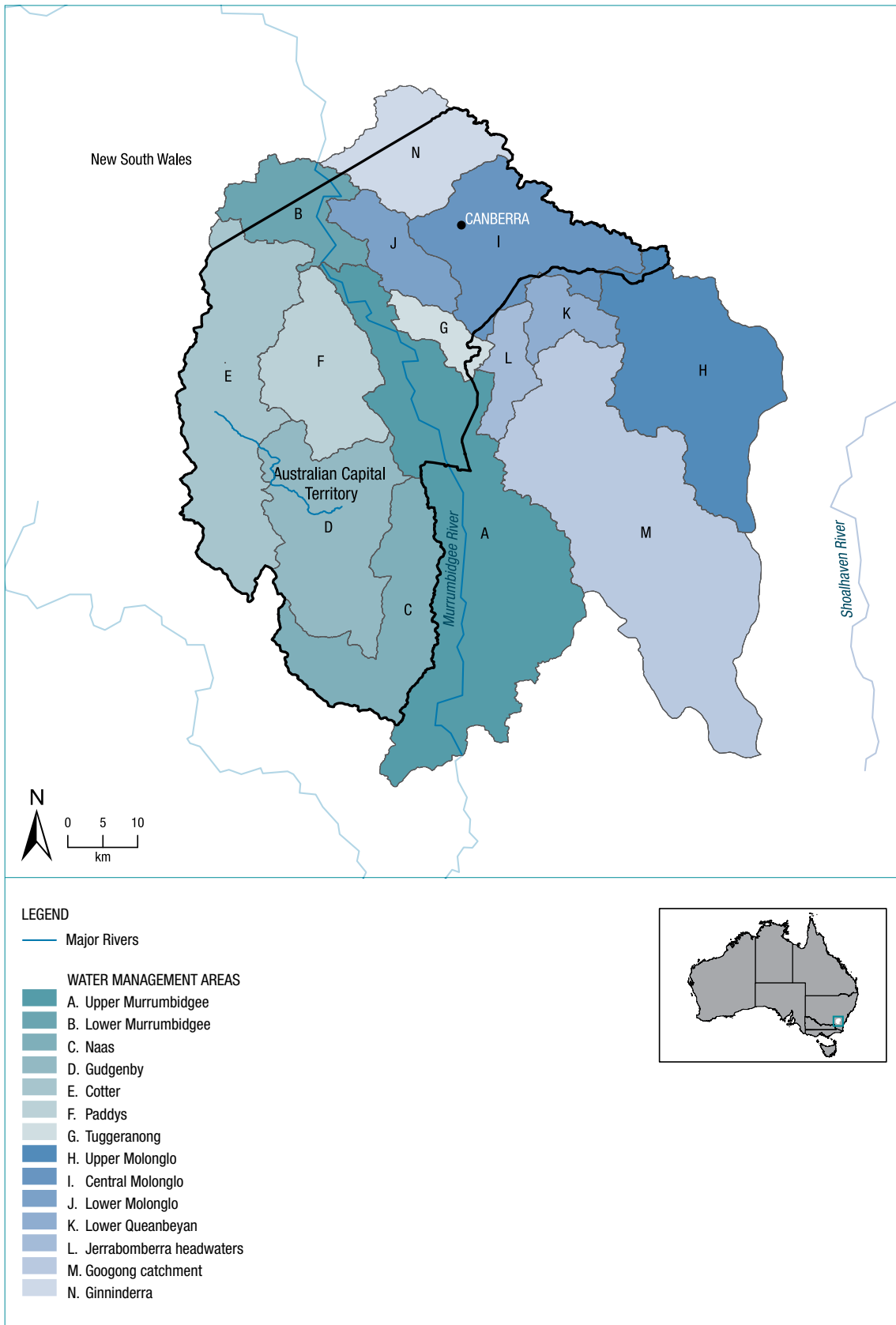
53 ACT Government, *Think water, act water, Volume 1: Strategy for sustainable water resource management in the ACT*, Canberra, 2004.

Where boundaries of catchments do not align with the territory boundary, areas of New South Wales are shown to be included in the water management areas (see Figure 9). The ACT has rights to water from the Googong Dam Area, located in the Googong catchment in NSW, and has responsibility for managing that area. The inclusion of an area of New South Wales is to assist understanding and does not imply that the ACT has any rights or responsibilities in that area.

Table 13. Australian Capital Territory: water management areas and subcatchments (30 June 2010)

Water management area	Subcatchment area
1. <i>Upper Murrumbidgee</i>	Michelago
	Tharwa
	Kambah
	Guises
	Tennet
2. <i>Lower Murrumbidgee</i>	Uriarra
	Woodstock
3. <i>Naas</i>	Naas
4. <i>Gudgenby</i>	Gudgenby
5. <i>Cotter</i>	Corin
	Bendora
	Lower Cotter
6. <i>Paddys</i>	Paddys
7. <i>Tuggeranong</i>	Tuggeranong
8. <i>Upper Molonglo</i>	Upper Molonglo
9. <i>Central Molonglo</i>	Kowen
	Fyshwick
	Jerrabomberra
	Lake Burley Griffith
	Woolshed
	Sullivans
10. <i>Lower Molonglo</i>	Coppins
	Woden
	Weston
11. <i>Lower Queanbeyan</i>	Lower Queanbeyan
12. <i>Jerrabomberra headwaters</i>	Jerrabomberra headwaters
13. <i>Googong catchment</i>	Tinderry
	Googong
	Burra
14. <i>Ginninderra</i>	Gungahlin
	Lake Ginninderra
	Parkwood

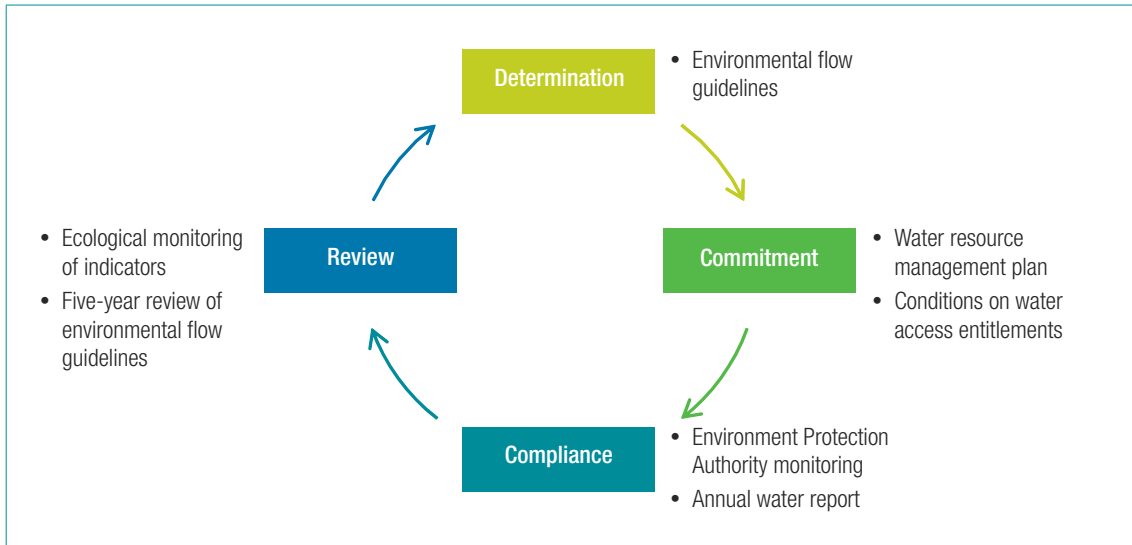
Figure 9. Australian Capital Territory: water management areas (30 June 2010)



Source: Water management areas: ACT Department of the Environment, Climate Change, Energy and Water, 2009. Topographic data: Geoscience Australia (2002–08).

The four elements of the environmental water management framework are applied to the ACT in sections 5.2–5.5 and summarised in Figure 10.

Figure 10. Australian Capital Territory: summary environmental water management framework (30 June 2010)



5.2 Determination of environmental water

The *2006 Environmental flow guidelines* set out the environmental flow requirements needed to maintain aquatic ecosystems. The purpose of the guidelines is to identify the 'components' of flow from the variable flow regime that are necessary to maintain stream health.

The approach adopted by the ACT to determine environmental water requirements is based on the identification of essential components of the flow regime, including natural variability, seasonal variation, floods and intermittent dry periods. The components are:

- + *base flows*—the quantity of water that flows down a waterway during periods between rainfall events
- + *riffle maintenance flows*—an increase in flows necessary to keep riffles clear of sediment
- + *pool maintenance flows*—an increase in flows necessary to keep pools clear of sediment
- + *channel maintenance flows*—an increase in flows necessary for the maintenance of the channel's physical form
- + *special purpose flows*—volumes of water designed to meet specific ecosystem requirements (no special purpose flows have been designated, except for a requirement for spawning flows in the Cotter River)
- + *maintenance of reservoir levels*—maintenance of water levels in lakes, ponds and reservoirs.

The *Environmental flow guidelines* identify the flows, or management, required to provide the components. A threshold that defines base flows is the 80 percent exceedence flow (referred to as the '80th percentile flow' in the guidelines). Where groundwater is extracted, a diversion limit of 10% of the average annual recharge is applied to protect base flows.

For the higher flow components (riffle, pool and channel maintenance flows—collectively called 'flooding flows') in unregulated systems, a diversion limit of 10% of the volume of flows above the 80th percentile is established to protect flooding flows.

In existing urban lakes, a maximum drawdown limit of 0.20 metres was set to protect macrophytes as an important ecological component of such systems. No limits are placed on draw-downs in reservoirs.

The level of environmental flows was determined by a scientific panel in 1999, and a 2004 review of the guidelines suggested that the base-flow level, together with other flow components, could maintain aquatic ecological values with moderate confidence.

The guidelines establish broad ecological objectives for four different ecosystem types in the ACT (Table 14). Specific objectives are also set for individual reaches in water supply catchments (for example, to maintain populations of Macquarie perch below Cotter Dam). The defined environmental flows are applied in three of the ecosystem types, while specific measures are in place for the water supply catchments.

Table 14. Australian Capital Territory: ecosystem types, objectives and environmental water requirements (30 June 2010)

Ecosystem type	Ecological objectives	Environmental water requirements
Water supply catchments	<p><i>To maintain healthy aquatic ecosystems in terms of biota.</i></p> <p><i>To prevent degradation of riverine habitat through sediment deposition.</i></p>	<p><i>Base flows</i>—specified volume or percentile.</p> <p><i>Flooding flows</i>—specified volume and duration.</p> <p><i>Special purpose flows</i>—the 50th percentile monthly flow during the spring months (September, October and November) and the 80th percentile monthly flow for August and December to March in two out of every five years.</p> <p><i>Groundwater</i>—groundwater abstraction is limited to 10% of the long-term recharge.</p>
Natural ecosystems	<p><i>To maintain healthy aquatic ecosystems in terms of biota.</i></p> <p><i>To prevent degradation of riverine habitat through sediment deposition.</i></p>	<p><i>Base flows</i>—maintain 80th percentile monthly flow in all months. The rate of abstraction may not exceed the flow rate.</p> <p><i>Flooding flows</i>—protect 90% of the volume in events above the 80th percentile from abstraction.</p> <p><i>Groundwater</i>—groundwater abstraction is limited to 10% of the long-term recharge.</p>
Modified ecosystems	<p><i>To maintain healthy aquatic ecosystems in terms of biota.</i></p> <p><i>To prevent degradation of riverine habitat through sediment deposition.</i></p> <p><i>To prevent degradation of macrophytes in urban lakes and ponds.</i></p>	<p><i>Base flows</i>—maintain 80th percentile monthly flow November–May, and 90th percentile monthly flow June–October inclusive. The rate of abstraction may not exceed the flow rate.</p> <p><i>Flooding flows</i>—protect 90% of the volume in events above the 80th percentile from abstraction.</p> <p><i>Groundwater</i>—groundwater abstraction is limited to 10% of the long-term recharge.</p>
Created ecosystems	<p><i>To maintain healthy aquatic ecosystems in terms of biota.</i></p> <p><i>To prevent degradation of riverine habitat through sediment deposition.</i></p> <p><i>To prevent degradation of macrophytes in urban lakes and ponds.</i></p>	<p><i>Base flows</i>—maintain 80th percentile monthly flow in all months. The rate of abstraction may not exceed the flow rate.</p> <p><i>Flooding flows</i>—protect 90% of the volume in events above the 80th percentile from abstraction.</p> <p><i>Groundwater</i>—groundwater abstraction is limited to 10% of the long-term recharge.</p>

Modifications to the environmental water requirements are made for drought conditions in water supply ecosystems when restrictions are in place, in line with domestic measures to reduce water use, and so ensure the ongoing security of the water supply.

5.3 Commitment of environmental water

The ACT is divided into 14 statutory water management areas (see Table 13), each of which has specified volumes of water available for consumptive use and for environmental purposes. Environmental water is included as an allocation based on the *Environmental flow guidelines*. Delivery of environmental water is through the use of conditions on licences to divert water, or through releases from reservoirs and dams.

Water access entitlements are required for the taking of water from rivers and groundwater in the ACT. An entitlement holder can access whichever is the lesser of a maximum volume or a percentage of total available surface and groundwater, as stated in the water access entitlement. The Water Resources Act requires that the volume of water available under an entitlement must take into account the *Environmental flow guidelines* (s. 16). In addition to the water access entitlement, a licence to take water is required to extract water. The licence states the location from which water can be taken and used, and conditions related to the taking and use of that water.

The ACT Environment Protection Authority is responsible for implementing environmental water requirements through placing conditions on water access entitlements and enforcing those conditions. The Environment Protection Authority may license the taking of both surface and groundwater. Licences are issued subject to conditions that ensure compliance with environmental flow requirements outlined in the guidelines.

The *Environmental flow guidelines* also set out rules for releases or spills from dams to ensure the delivery of passing flows. Environmental flows from dams are generally considered backup for periods when flows drop below environmental water requirements.

Table 15. Australian Capital Territory: ecosystem types and environmental commitments (30 June 2010)

Ecosystem type	Environmental water commitment
Water supply catchments	Environmental flows below impoundments are implemented through a combination of releases and water flowing over the dam spillway. Rules are based on base flow, riffle maintenance flows, and pool maintenance flows. Special rules for drought periods apply in this catchment type.
Natural ecosystems	Limits are set on the quantity of water that can be abstracted in order to protect environmental flows. Rules are based on base flow, flooding flows and maintenance of impoundment levels.
Modified ecosystems	Limiting the quantity of water that can be abstracted protects environmental flows. The National Capital Authority is responsible for the implementation of environmental flows within Lake Burley Griffith and for releases from Scrivener Dam to meet downstream flow requirements as needed. Rules are based on base flow and flooding flows.
Created ecosystems	Limiting the quantity of water that can be abstracted protects environmental flows. Rules are based on base flow, flooding flows and maintenance of impoundment levels.

5.4 Compliance with environmental water delivery

Environmental water is provided by the implementation of rules and licence conditions. Monitoring of environmental water delivery is undertaken through assessing compliance with licence conditions. The ACT Environment Protection Authority conducts a compliance program to monitor volumes extracted by licensed extractors and detect unlicensed extraction. Compliance reports are not publicly accessible.

The ACT Government also has 14 groundwater monitoring bores in high-demand areas within the ACT, and monitoring continues to assess the aquifer response to abstraction and rainfall.

The Department of the Environment, Climate Change, Energy and Water produces an annual *Water report* that provides information on the state of water resource management in the ACT, including quantity and quality.⁵⁴

5.5 Review of environmental water

The *Environmental flow guidelines* outline a monitoring, assessment and review strategy to:

- + confirm the flow requirements of local aquatic biota and ecological processes
- + to determine whether the indicators and ecological objectives nominated in the guidelines are the most appropriate for individual water bodies.

Using this information to refine the environmental flows is integral to the 'whole of resource' approach adopted in the ACT.

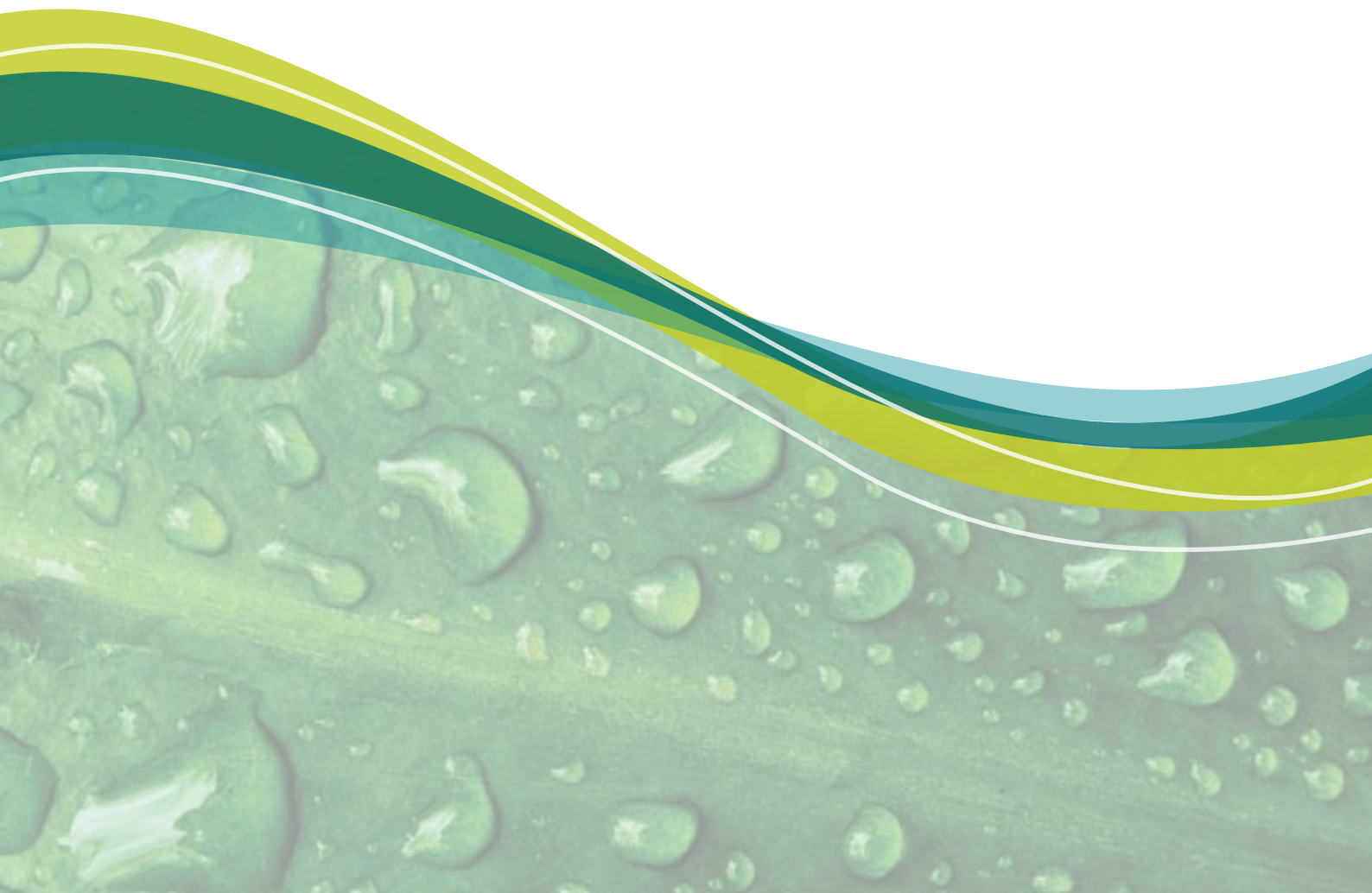
The guidelines stipulate that the assessment process will be based on a continuation of the licence-based monitoring that occurs in water supply catchments, and on the ongoing biological and water quality monitoring program in other catchments. However, the ACT Government has explicitly acknowledged knowledge gaps that are not covered by those programs, and has recognised that additional research is needed to evaluate the effectiveness of environmental flows.

It is intended that the monitoring and evaluation will inform the five-yearly reviews of the *Environmental flow guidelines*. The current guidelines (published in 2006) are the result of the five-year review of the first guidelines (published in 1999). The current guidelines will be reviewed and republished in 2011.

⁵⁴ Available at the ACT Department of the Environment, Climate Change, Energy and Water website: http://www.environment.act.gov.au/water/act_water_reports

6 New South Wales

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6 New South Wales

6.1 Summary

Overview of the jurisdiction

New South Wales (NSW) is the fifth largest Australian jurisdiction in area (809 400 km²), and had the largest state or territory population (7 191 500) at the end of 2009.⁵⁵ Over 63% of the population resides in the Sydney Statistical Division, and a further 20% reside in coastal local government areas.⁵⁶

The jurisdiction is divided into three distinct climatic zones – a semi-arid to arid zone to the west of the Great Dividing Range, a temperate zone along the south coast and a humid zone along the north coast.

Precipitation varies from east to west and from north to south. In the north-east, Byron Bay receives an average annual rainfall of 1737 mm, with the maximum in March and the minimum in September. In the south-east, Green Cape has an annual rainfall of 759 mm, spread evenly through the year. On the western slopes of the Great Dividing Range that form the headwaters of the River Murray catchment, precipitation is high relative to arid zones further west. Cabramurra in the Snowy Mountains receives an average of 1631 mm. In the far west, Broken Hill receives an annual average of 213 mm and Tibooburra receives 176 mm.⁵⁷ Most of the rainfall across the state occurs around February, with the lowest rainfall around August–September.

The main land use in NSW is agriculture. In the Murray–Darling Basin, cattle, sheep, pigs, grains, fruit, vegetables and cotton dominate production, while the coastal areas are mainly used for cattle, grapes and fruit.

In NSW, the statutory instruments that give authority to take surface or groundwater are provided under the *Water Act 1912* (NSW) and the *Water Management Act 2000* (NSW). The major licensed water resource in NSW is surface water. At 30 June 2010, there were 22 855 surface water licences across the jurisdiction with a total entitlement volume of 9940 GL. A further 91 660 groundwater licences for 1970 GL were on issue (including 87 368 groundwater licences issued under the previous *Water Act 1912* (NSW) totalling 816 GL).

Overview of environmental water management arrangements

Table 16 sets out the environmental statutory framework in NSW. Table 17 lists relevant terminology used in the jurisdiction.

Table 16. New South Wales: environmental water statutory framework (30 June 2010)

Legislation	<i>Water Management Act 2000</i> (NSW) <i>Water Act 1912</i> (NSW)
Responsible minister	Minister for Water Minister for Climate Change and Environment
Water manager⁵⁸	NSW Office of Water (within the Department of Environment, Climate Change and Water)
Environmental water manager⁵⁹	Department of Environment, Climate Change and Water
Other relevant institutions	CMAs State Water Corporation Environmental water advisory groups
Method of securing environmental water	Planned: Statutory water sharing plans establish extraction limits and environmental water rules. Held: Water licences have been purchased or recovered for environmental purposes.

55 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

56 ABS, 3218.0—*Regional population growth, Australia, 2008–09*, issued 30 March 2010, ABS, Canberra.

57 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>.

58 Responsible for establishing legislative water sharing framework, including establishment of environmental rules.

59 Responsible for decisions about application of available discretionary environmental water established in water sharing plans and held environmental water (known as adaptive environmental water).

Table 17. New South Wales: environmental water terminology (30 June 2010)

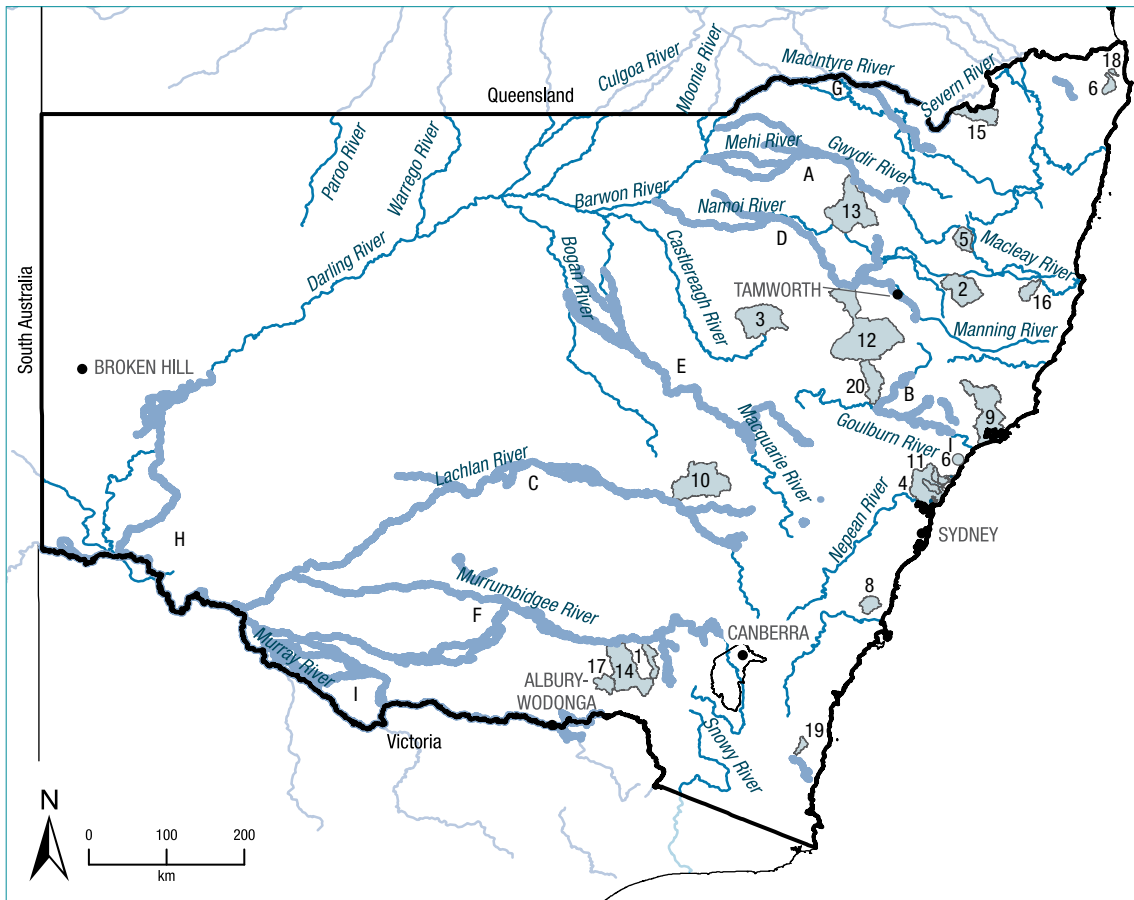
Term	Type	Definition and National Water Initiative equivalent
Water sharing plan	Statutory instrument	A statutory plan that shares water between the environment and various uses for a specified water source or area.
Water access licence	Statutory instrument	A licence that provides the right to extract a share of available water from a specified water source.
Macro water sharing plan	Statutory instrument	A water sharing plan that applies to a number of water sources across catchments or different types of aquifers.
Adaptive environmental water	Management tool	Water that is committed by the conditions of access licences for specified environmental purposes, either generally or at specified times or in specified circumstances.
Planned environmental water	Management tool	Water that is committed by water sharing plans for fundamental ecosystem health or other specified environmental purposes, and that cannot, to the extent committed, be taken or used for any other purpose.
Implementation plan	Management tool	An implementation plan is developed at the discretion of the Minister to set out the means by which the objectives of a water sharing plan are to be achieved and reviewed on an annual basis.
Annual watering plan	Management tool	Descriptive nonstatutory plan that summarises environmental water applications, monitoring activities, conditions of ecological assets and volumes of held environmental water.
Adaptive environmental water use plan	Management tool	Essentially planning documents that describe how adaptive environmental water conditions imposed on water access licences are to be implemented.
Water source	Natural	Any set of rivers, aquifers, lakes etc. that is defined by a gazetted water sharing plan to be a water source. A water source is characterised as being either regulated, unregulated or groundwater and has a geographical boundary.

NSW organises and manages its water resources using a number of management units:

- + 22 surface water management areas which are subdivided into water sources, largely based on the Australian Water Resources Council basins, which include regulated rivers, unregulated rivers and where appropriate, alluvial groundwater sources in particular valleys. In some areas, additional management zones have been identified to accommodate variations in the risk to the resource and required management intensity.
- + 31 groundwater management areas, used to classify and manage hydrologically connected aquifers which are further divided into water sources and management zones based on hydrogeological units and management intensity.

These management units are shown in Table 18 and the associated water sharing plans are shown in Figures 11 and 12.

Figure 11. New South Wales: surface water sharing plan areas (30 June 2010)



LEGEND

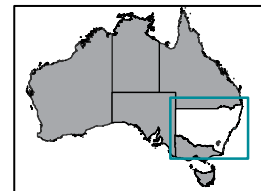
— Major Rivers

■ GAZETTED UNREGULATED WATER SHARING PLANS

1. Adelong Creek Water Source
2. Apsley River Water Source
3. Castlereagh River above Binnaway Water Source
4. Central Coast Unregulated River Water Sources
5. Commissioners Waters Water Source
6. Coopers Creek Water Source
7. Jiliby Jiliby Creek Water Source
8. Kangaroo River Water Source
9. Karuah River Water Source
10. Mandagery Creek Water Source
11. Ourimbah Creek Water Source
12. Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources
13. Rocky Creek, Cobbadah, Upper Horton and Lower Horton Water Source
14. Tarcutta Creek Water Source
15. Tenterfield Creek Water Source
16. Toorumbec Creek Water Source
17. Upper Billabong Water Source
18. Upper Brunswick River Water Source
19. Wandella Creek Unregulated Water Source
20. Wybong Creek Water Source

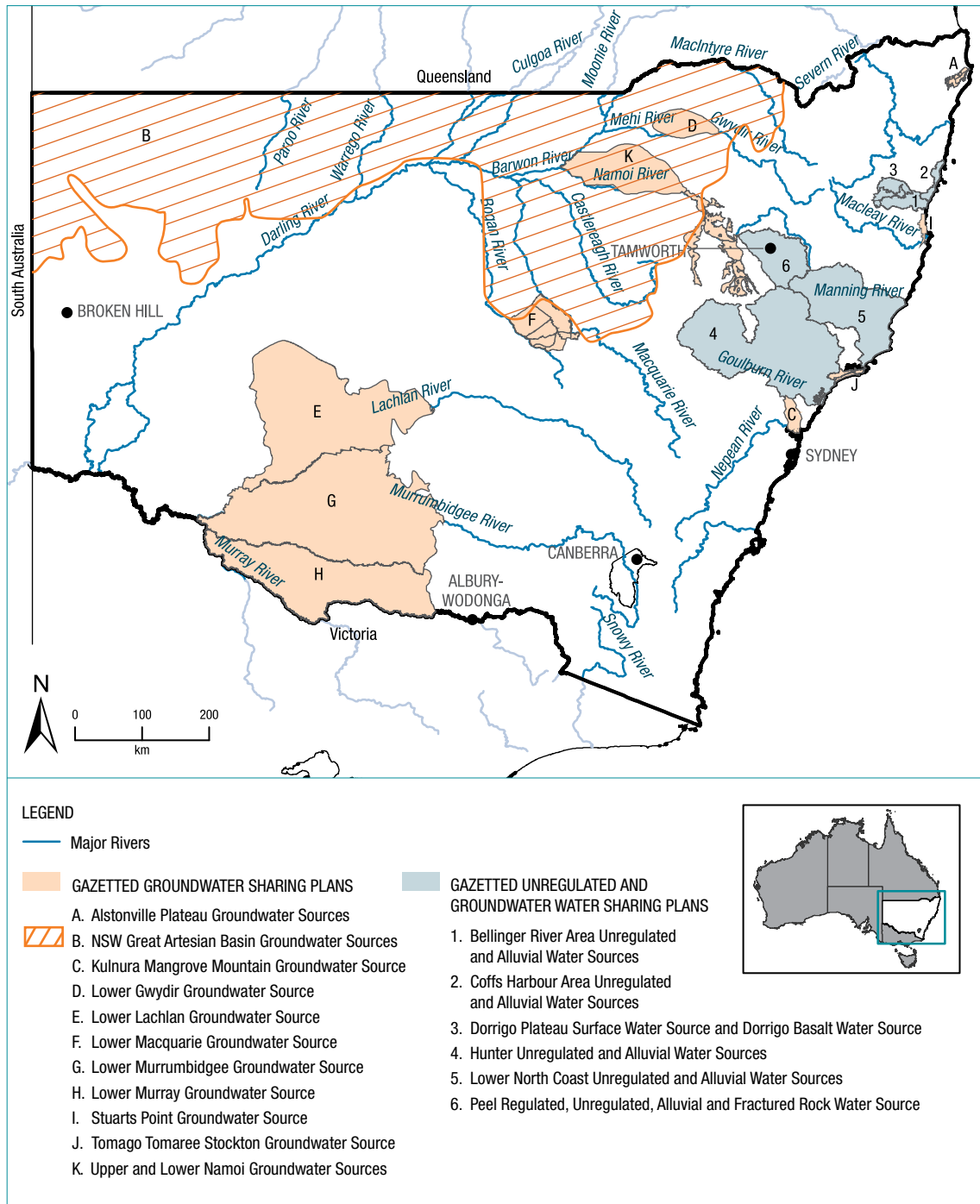
■ GAZETTED REGULATED WATER SHARING PLANS

- A. Gwydir Regulated River Water Source
- B. Hunter Regulated River Water Source
- C. Lachlan Regulated River Water Source
- D. Upper Namoi and Lower Namoi Regulated River Water Sources
- E. Macquarie and Cudgong Regulated River Water Sources
- F. Murrumbidgee Regulated River Water Source
- G. NSW Border Rivers Regulated River Water Source
- H. NSW Murray–Lower Darling Regulated River Water Sources
- I. Paterson Regulated River Water Source



Source: NSW Office of Water.

Figure 12. New South Wales: groundwater sharing plan areas (30 June 2010)



Source: NSW Office of Water.

The Water Management Act provides for the development of water sharing plans by the NSW Office of Water. A plan can be prepared either as an individual plan covering a specific river or groundwater system within a management unit or as a macro plan covering a number of rivers or groundwater systems.

At 30 June 2010, 54 water sharing plans had commenced in NSW (covering approximately 80% of the water extracted in the state). Unregulated river and groundwater macro water sharing plans are now being developed at a broader scale to cover the remaining water sources in the state. Water sharing plans developed under the Act aim to:

- + share water between all water users and the environment
- + protect, enhance and restore water sources
- + provide security of access for water users
- + meet the social and economic needs of regional communities
- + facilitate water trading.

Table 18 shows that five of water sharing plans were under suspension at 30 June 2010 because of ongoing drought, during which time water management decisions are made under the critical water planning process. The NSW Government suspended the plans to ensure that town supplies and selected high-security entitlements were protected. This required a divergence from the access rules and trade rules set out in water sharing plans, which govern how flows are taken. Where possible however, this critical water planning management reflects the requirements of the water sharing plans, within the constraints of water availability.

Table 18. New South Wales: status of water sharing plans (30 June 2010)

Water management area	Water sharing plan	Status	Type of water source
All inland WMAs	Murray Darling Basin Fractured Rock	Under Development	Groundwater
Gwydir Namoi Lower Murray Darling Western	Murray Darling Basin Porous Rock	Under Development	Groundwater
Border Rivers Gwydir / Namoi / Central West Western	Great Artesian Basin Cap Rock and Alluvial Groundwater Sources	Under Development	Groundwater
Border Rivers	NSW Border Rivers Regulated River Water Source Gazetted Plan	Commenced 1 July 2009	Regulated
	Tenterfield Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	NSW Great Artesian Basin Groundwater Sources Gazetted Plan	Commenced 1 July 2008	Groundwater
	Gwydir Regulated River Gazetted Plan	Commenced 1 July 2004	Regulated
	Border Rivers Unregulated and Alluvial	Under Development	Unregulated and groundwater
Central Coast	Jilliby Jilliby Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Ourimbah Creek Gazetted Plan	Commenced 1 July 2004 Suspended 22 December 2006 Recommended 9 April 2010	Unregulated
	Kulnura Mangrove Mountain Groundwater Source Gazetted Plan	Commenced 1 July 2004	Groundwater
	Central Coast Unregulated Water Sources Gazetted Plan	Commenced 1 August 2009	Unregulated

Water management area	Water sharing plan	Status	Type of water source
Central West	Macquarie and Cudgegong Regulated Rivers Gazetted Plan	Commenced 1 July 2004 Suspended 27 July 2007	Regulated
	Castlereagh River above Binnaway Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower Macquarie Groundwater Gazetted Plan	Commenced 1 October 2006	Groundwater
	NSW Great Artesian Basin Groundwater Sources Gazetted Plan	Commenced 1 July 2008	Groundwater
	Castlereagh Unregulated and Alluvium	Under Development	Unregulated and groundwater
	Macquarie Unregulated and Alluvium	Under Development	Unregulated and groundwater
Gwydir	Gwydir Regulated River Gazetted Plan	Commenced 1 July 2004	Regulated
	Rocky Creek, Cobbadah, Upper Horton and Lower Horton Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower Gwydir Groundwater Gazetted Plan	Commenced 1 October 2006	Groundwater
	NSW Great Artesian Basin Groundwater Sources Gazetted Plan	Commenced 1 July 2008	Groundwater
	Gwydir Unregulated and Alluvial	Under Development	Unregulated and groundwater
Hunter	Hunter Regulated River Water Source Gazetted Plan	Commenced 1 July 2004 Suspended 29 December 2006 Recommended 20 February 2009	Regulated
	Hunter Unregulated and Alluvial Water Sources Gazetted Plan	Commenced 1 August 2009	Unregulated and groundwater
	Wybong Creek Gazetted Plan	Commenced 1 July 2004 Suspended 18 August 2006	Unregulated
	Tomago Tomaree Stockton Groundwater Source Gazetted Plan	Commenced 1 July 2004	Groundwater
	Paterson Regulated River Gazetted Plan	Commenced 1 July 2007	Regulated
Lachlan	Lachlan Regulated River Gazetted Plan	Commenced 1 July 2004 Suspended 1 July 2004 Critical water planning	Regulated
	Mandagery Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower Lachlan Groundwater Gazetted Plan	Commenced 1 February 2008	Groundwater
	Belubula Regulated and Alluvial	Under Development	Regulated and groundwater
	Lachlan Unregulated and Alluvial	Under Development	Unregulated and groundwater

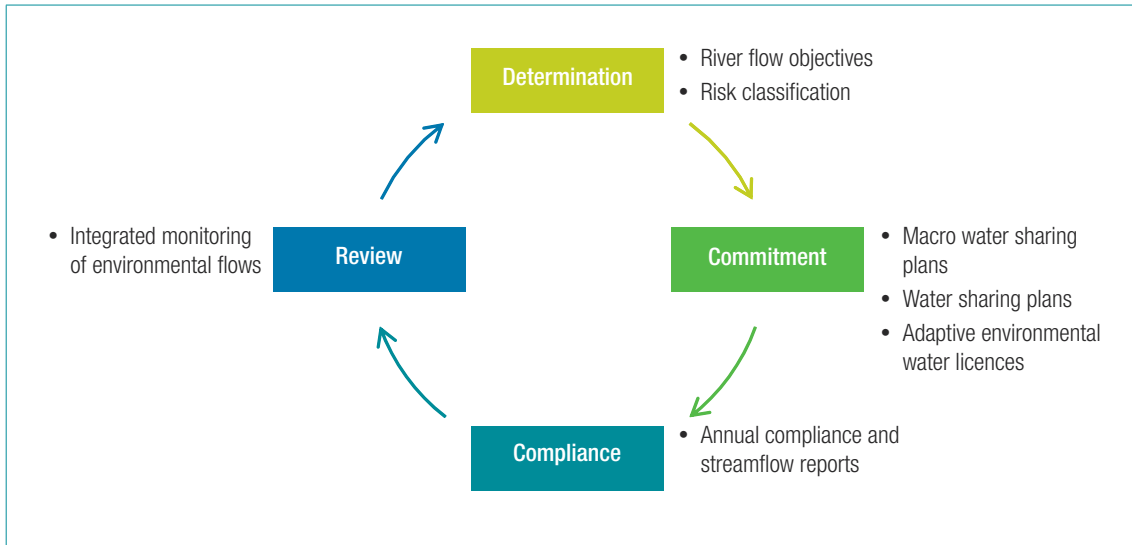
Water management area	Water sharing plan	Status	Type of water source
Lower Murray Darling	NSW Murray–Lower Darling Regulated Rivers Gazetted Plan	Commenced 1 July 2004 Suspended 10 November 2006 Critical water planning	Regulated
	Lower Murray Darling Unregulated and Alluvial	Under Development	Unregulated and groundwater
Lower North Coast	Karuah River Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower North Coast Unregulated and Alluvial Water Sources Gazetted Plan	Commenced 1 August 2009	Unregulated and groundwater
	Tomago Tomaree Stockton Groundwater Source Gazetted Plan	Commenced 1 July 2004	Groundwater
Mid North Coast	Apsley River Gazetted Plan	Commenced 1 July 2004	Unregulated
	Commissioners Waters Gazetted Plan	Commenced 1 July 2004	Unregulated
	Toorumbree Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Stuarts Point Groundwater Source Gazetted Plan	Commenced 1 July 2004	Groundwater
	Dorrigo Plateau Surface Water Source and the Dorrigo Basalt Groundwater Source Gazetted Plan	Commenced 1 July 2004	Unregulated and groundwater
Murray	NSW Murray—Lower Darling Regulated Rivers Gazetted Plan	Commenced 1 July 2004 Suspended 10 November 2006 Critical water planning	Regulated
	Upper Billabong Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower Murray Groundwater Gazetted Plan	Commenced 1 November 2006	Groundwater
	Lower Murray Shallow Alluvium	Under Development	Groundwater
	Murray Unregulated and Alluvial	Under Development	Unregulated and groundwater
Murrumbidgee	Murrumbidgee Regulated River Gazetted Plan	Commenced 1 July 2004 Suspended 10 November 2006 Critical water planning	Regulated
	Adelong Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Tarcutta Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Lower Murrumbidgee Groundwater Gazetted Plan	Commenced 1 October 2006	Groundwater
	Lowbidgee Floodplain	Under Development	Unregulated
	Murrumbidgee Unregulated and Alluvial	Under Development	Unregulated and groundwater

Water management area	Water sharing plan	Status	Type of water source
Namoi	Upper Namoi and Lower Namoi Regulated River Gazetted Plan	Commenced 1 July 2004	Regulated
	Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010 Gazetted Plan	Commenced 1 July 2010	Unregulated and groundwater
	Phillips Creek, Mooki River, Quirindi Creek, and Warrah Creek Water Sources Gazetted Plan	Commenced 1 July 2004	Unregulated
	Upper and Lower Namoi Groundwater Gazetted Plan	Commenced 1 November 2006	Groundwater
	NSW Great Artesian Basin Groundwater Sources Gazetted Plan	Commenced 1 July 2008	Groundwater
	Namoi Unregulated and Alluvial	Under Development	Unregulated and groundwater
Northern Rivers	Upper Brunswick River Gazetted Plan	Commenced 1 July 2004	Unregulated
	Coopers Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
	Alstonville Basalt Plateau Groundwater Source Gazetted Plan	Commenced 1 July 2004	Groundwater
South East	Wandella Creek Gazetted Plan	Commenced 1 July 2004	Unregulated
Southern	Kangaroo River Gazetted Plan	Commenced 1 July 2004	Unregulated
Upper North Coast	Dorrigo Plateau Surface Water Source and the Dorrigo Basalt Groundwater Source Gazetted Plan	Commenced 1 July 2004	Unregulated and groundwater
	Bellinger River Area Unregulated and Alluvial Water Sources Gazetted Plan	Commenced 1 July 2008	Unregulated and groundwater
	Coffs Harbour Area Unregulated and Alluvial Water Sources Gazetted Plan	Commenced 1 August 2009	Unregulated and groundwater
Western	NSW Great Artesian Basin Groundwater Sources Gazetted Plan	Commenced 1 July 2008	Groundwater
	Barwon Darling Unregulated and Alluvial	Under Development	Unregulated and groundwater
	Intersecting Streams Unregulated	Under Development	Unregulated
	North West NSW	Under Development	Unregulated and groundwater

Note: Plans under development or suspension at 30 June 2010 are shaded.

The four elements of the environmental water management framework are applied to NSW in sections 6.2–6.5 and summarised in Figure 13.

Figure 13. New South Wales: summary environmental water management framework (30 June 2010)



6.2 Determination of environmental water

Environmental outcomes are specified in the water sharing plans. Water requirements to achieve those objectives are not stated, however they are to an extent implicit in the water management rules set out in the plans. Environmental flow rules in initial surface water plans were developed based on 12 broad ‘river flow objectives’ and the environmental flow rules were tailored to reflect the ecological, hydrologic and water quality conditions in each water source. The river flow objectives used in the initial water sharing plans in NSW are:

1. Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flow.
2. Protect natural low flows.
3. Protect or restore a proportion of moderate flows, ‘freshes’ and high flows.
4. Maintain or restore the natural inundation patterns and distribution of floodwaters supporting natural wetland and floodplain ecosystems.
5. Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways.
6. Maintain or mimic natural flow variability in all rivers.
7. Maintain rates of rise and fall of river heights within natural bounds.
8. Maintain groundwater within natural levels, and variability, critical to surface flows or ecosystems.
9. Minimise the impact of in-stream structures.
10. Minimise downstream water quality impacts of storage releases.
11. Ensure that river flow management provides for contingencies.
12. Maintain or rehabilitate estuarine processes and habitats.⁶⁰

⁶⁰ Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Water-sharing/Environmental-rules/Rivers/Rivers/default.aspx>

Environmental rules for groundwater systems are similarly based on broad objectives, including:

- + Maintain groundwater within natural levels and variability
- + Minimise the impact of extraction on GDEs
- + Ensure that groundwater quality does not decline due to extraction
- + Protect structural integrity of groundwater sources.

More recently, environmental rules in unregulated river water sharing plans have been developed using a risk based classification which considers

- + instream values, such as threatened fish that are likely to be affected by flow extraction
- + the hydrologic stress – the amount of water extracted relative to river flow
- + the sensitivity of estuaries to the removal of fresh water
- + the extraction value – the economic value of using the extracted water
- + the economic dependency of the local community on water extraction
- + current NSW Government Policy.

Indicative access rules are firstly developed by balancing the instream values with the economic dependence of local communities on extraction. The greater the risk to instream values the stronger the environmental flow rules. The higher the economic dependency the less stringent the access rule. Where economic dependency and instream values are both high, more intensive management is proposed. Rivers are also classified according to their geomorphology, to determine the appropriateness and effectiveness of proposed rules. These indicative rules are then modified where appropriate based on the advice of regional panels.

Environmental rules in more recent groundwater sharing plans are similarly based on consideration of:

- + Nature and extent of GDEs (including base flows to streams)
- + Hydrogeological characteristics
- + Hydrologic stress
- + Extraction value
- + Economic dependence of the local community on water extraction
- + Current NSW Government policy.

The greater the risk to GDEs due to factors such as declining groundwater levels, altered levels of groundwater level fluctuations, duration and extent of periods of low flows in connected rivers, changes in water quality arising from groundwater extraction and changes in the structural integrity of the groundwater source, the stronger the environmental rules. The higher the economic dependency, the less stringent the access rule. Where economic dependency and groundwater values are both high, more intensive management is proposed.

Report cards, which summarise the outcomes of this risk assessment for each water source covered by a water sharing plan developed using this macro approach are published on the NSW Office of Water web site.

Environmental rules in water sharing plans for both surface and groundwater are identified as:

- + *planned environmental water*, which has specified environmental rules or
- + *adaptive water*, which places conditions on licensed water subject to water buybacks or created as a result of water savings or system improvements which are committed for environmental purposes.

The Water Management Act (s. 8) states that management plans are to commit water as 'planned environmental water' and must contain provisions for the identification, establishment and maintenance of planned environmental water ('environmental water rules'). Planned environmental water is committed for ecosystem health or other specified environmental purposes, and cannot be taken or used for any other purpose.

The specific scientific methods by which environmental water requirements are determined are not identified in water sharing plans but were provided in the background documents that were developed for each draft water sharing plan. These reports are published on the NSW Office of Water website.⁶¹

61 Available at the NSW Office of Water website: http://www.water.nsw.gov.au/Water-management/Water-sharing/plans_committed/default.aspx

6.3 Commitment of environmental water

Water sharing plans are developed to protect the total volume of water for the environment and, in surface water plans, the natural variability in flows. The environmental rules in the water sharing plans are designed to:

- + limit extractions so that the environmental share of water is protected
- + replicate natural flow patterns or events so as to provide water when and where it will best meet environmental needs
- + protect identified high priority GDEs by limiting localised drawdown and water quality declines
- + limiting extractions so that the structural integrity of the groundwater source is maintained.

A range of different types of planned environmental water appears in water sharing plans, covering surface water (regulated and unregulated) and groundwater.

Unregulated rivers

Water sharing plans for unregulated rivers may include rules that:

- + require a visible flow at licensed pump sites or other locations before water users can extract water—a minimum level of environmental protection that will apply to all plans
- + introduce a cease-to-pump condition when river flows drop below a specified level—all plans will include cease-to-pump conditions for licensed users
- + set daily limits on extraction for different flows (low, medium and high flows)—where there is a high number of extractors or a high level of environmental protection is required
- + recognise that some alluvial aquifers are highly connected to their parent streams and that the goal of water sharing rules in those circumstances is to manage the surface water and highly connected groundwater as one resource.

Daily extraction limits on licences are defined based on flow classes (intended as a means to deliver river flow objectives). For each management zone, the flow classes are redefined to take into account local hydrology, identified conservation values, specific environmental requirements and practical considerations. Typically, the recommended flow thresholds for classes A, B and C are the 80th, 50th and 30th percentile, respectively, of the daily flow regime. In two plans, classes D and E (representing higher flow ranges) have also been included. The daily extraction limit is then defined as the proportion of water that can be extracted from each flow class without adversely affecting river health.

Daily flow classes, although provided for, have not been implemented in all plans. Following a risk assessment of all 20 initial plans, consistent with the macro-planning approach, the NSW Office of Water has prioritised implementation activities to ensure equity across water sources and efficient and appropriate use of NSW Office of Water resources. Those plan areas with high community dependence or ecological risk will be given priority for implementation activities and therefore a higher level of management. In some areas, daily flow sharing may no longer be practical or necessary, and relevant plans will either require amendment or this will be considered during plan reviews.

Environmental water commitments for unregulated rivers in NSW are outlined in Table 19.

Table 19. New South Wales: planned environmental water rules—unregulated water sources (30 June 2010)

Water sharing plan	Environmental water commitment								
	Extraction only when visible flow	Long-term extraction limit	Daily extraction limits for flow classes					Other rules	
			VLF	A	B	C	D		E
Adelong Creek Gazetted Plan	✓	1	✓	✓	✓	✓			
Apsley River Gazetted Plan	✓	2	✓		✓	✓			
Castlereagh River above Binnaway Gazetted Plan	✓	1	✓	✓	✓				
Central Coast Unregulated Water Sources Gazetted Plan	✓	2	✓	✓	✓	✓			
Commissioners Waters Gazetted Plan	✓	2	✓	✓	✓	✓			
Coopers Creek Gazetted Plan	✓	2	✓	✓	✓	✓		Protection of freshes	
Dorrigo Plateau Surface Water Source and Dorrigo Basalt Groundwater Source Gazetted Plan	✓	2	✓	✓	✓				
Jilliby Jilliby Creek Gazetted Plan	✓	2	✓	✓	✓	✓			
Kangaroo River Gazetted Plan	✓	2	✓	✓	✓	✓			
Karuah River Gazetted Plan	✓	2	✓	✓	✓	✓		Stroud Weir fish passage supplementary flows	
Mandagery Creek Gazetted Plan	✓	1	✓	✓	✓	✓			
Ourimbah Creek Gazetted Plan	✓	2	✓	✓	✓	✓			
Phillips Creek, Mooki River, Quirindi Creek, and Warrah Creek Water Sources Gazetted Plan	✓	1	✓			✓	✓	✓ ⁶²	
Rocky Creek, Cobbadah, Upper Horton and Lower Horton Gazetted Plan	✓	1	✓	✓	✓	✓			
Tarcutta Creek Gazetted Plan	✓	1	✓	✓	✓	✓			
Tenterfield Creek Gazetted Plan	✓	1	✓	✓		✓	✓		
Toorumbie Creek Gazetted Plan	✓	2	Limit of 0.025 ML/day total daily extraction in all flows						
Upper Billabong Gazetted Plan	✓	1	✓	✓	✓	✓			
Upper Brunswick River Gazetted Plan	✓	2	✓		✓	✓			
Wandella Creek Gazetted Plan	✓	2	✓		✓	✓	✓	Protection of first flush	
Wybong Creek Gazetted Plan	✓	2	✓	✓	✓	✓	✓	✓	

VLF = very low flows.

1 = Long-term average extraction limited to estimated average extraction of water over period from July 1993 to June 1999, and estimated annual extraction under domestic and stock rights at the commencement of the plan.

2 = Long-term average extraction limited to the maximum quantity of water available under statutory rights and licences immediately prior to commencement of the plan, and estimated annual extraction under domestic and stock rights at the commencement of the plan.

62 Only for flows in Mooki River.

Groundwater

Typically, groundwater plans include rules that:

- + reserve the storage component of the aquifer
- + protect a proportion of the natural recharge—that is, the volume of water added to a groundwater system naturally, usually by infiltration from rainfall and river flows for the environment based on assessment of the GDEs
- + review recharge estimates and, if necessary, reduce entitlements in those systems that are overallocated
- + set distance limits between any new bores and groundwater-dependent ecosystems
- + provide for local water restrictions where necessary to manage the impact of draw downs and water quality declines on GDEs.

Groundwater commitments outlined in current water groundwater sharing plans are listed in Table 20.

Table 20. New South Wales: planned environmental water rules—groundwater sources (30 June 2010)

Water sharing plan	Environmental water commitment	
	Reservation of water in storage	Reservation of a proportion of average annual recharge
Alstonville Basalt Plateau Groundwater Source Gazetted Plan	The long-term average storage component of each groundwater source, minus basic landholder rights, is reserved for the environment.	80% of the annual recharge in each of zones 1–6 (Alstonville, Tuckean, Bangalow, Coopers, Wyrallah and Lennox) is reserved for the environment.
Kulnura Mangrove Mountain Groundwater Source Gazetted Plan	The long-term average storage component of each groundwater source is reserved for the environment.	100% of the average annual recharge to Zone 1 and between 72 and 89% for the other 7 zones.
Lower Gwydir Groundwater Gazetted Plan	Physical water contained in the storage component of the groundwater sources, minus the amount required for supplementary water access until 2016, is reserved for the environment.	15% of the average annual recharge minus basic landholder rights is reserved for the environment.
Lower Lachlan Groundwater Gazetted Plan	Physical water contained in the storage component of the groundwater sources, minus the amount required for supplementary water access until 2017, is reserved for the environment.	
Lower Macquarie Groundwater Gazetted Plan	Physical water contained in the storage component of the groundwater sources, minus the amount required for supplementary water access until 2016, is reserved for the environment.	15% of the average annual recharge to these groundwater sources, excluding Zone 5, minus basic landholder rights, is reserved for the environment and Aboriginal cultural heritage.
Lower Murray Groundwater Gazetted Plan	Physical water contained in the storage component of the groundwater sources, minus the amount required for supplementary water access until 2016, is reserved for the environment.	
Lower Murrumbidgee Groundwater Gazetted Plan	Physical water contained in the storage component of the groundwater sources, minus the amount required for supplementary water access until 2016, is reserved for the environment.	65 000ML/yr of the average annual recharge to the deep groundwater source is reserved for the environment. 55 000ML/yr of the average annual recharge to the shallow groundwater source is reserved for the environment.

Water sharing plan	Environmental water commitment	
	Reservation of water in storage	Reservation of a proportion of average annual recharge
Stuarts Point Groundwater Source Gazetted Plan	The long-term average storage component of each groundwater source, minus basic landholder rights, is reserved for the environment.	45% of the average annual recharge is reserved for the environment.
Tomago Tomaree Stockton Groundwater Source Gazetted Plan	The long-term average storage component of each groundwater source, minus basic landholder rights, is reserved for the environment.	30% of the average annual recharge to each groundwater source is reserved for the environment.
Upper and Lower Namoi Groundwater Gazetted Plan	<p>The long-term average storage component of the groundwater contained in the aquifers of the Lower Namoi groundwater source, minus the amount required for supplementary water access until 2015, is reserved for the environment.</p> <p>Physical water contained in the storage component of the groundwater sources (zones 1–12), minus the amount required for supplementary water access until 2016, is reserved for the environment.</p>	
NSW Great Artesian Basin Gazetted Plan	<p>Planned environmental water in the Eastern Recharge is the long-term average storage component of the respective groundwater source, plus 30% of the long-term average annual net recharge to the respective groundwater source in the Southern Recharge Groundwater Sources is reserved for the environment; and</p> <p>The sustainable pressure estimate equivalent, minus the increased extraction from 1990 until the commencement of this Plan, plus the water savings made through the capping and piping of any water bores from 1990 to 30 June 1999, in Surat, Warrego and Central Groundwater Sources is reserved for the environment.</p>	

Regulated rivers

The environmental flow rules in the water sharing plans for the regulated rivers vary from valley to valley. The range of rules that apply is set out in Table 21.

Table 21. New South Wales: planned environmental water rules—regulated rivers (30 June 2010)

Environmental flow rules in the regulated rivers	Purpose	Valleys where rule applies
Extraction limit	Sets a limit on the long-term average annual volume of water that can be extracted, thus protecting the major share of water for the environment.	All regulated rivers
End-of-system flow	Requires a flow to be retained at the end of the river system. This ensures that flow is maintained below the areas of major extraction.	Gwydir Namoi Macquarie Murrumbidgee Hunter Paterson
Transparent dam release	Requires all dam inflows occurring at certain times to be passed immediately downstream, as though no dam were present. This maintains natural flow variability for that part of the year (usually the winter months) when dam releases would otherwise be minimal.	Murrumbidgee
Translucent dam release	Requires a proportion of dam inflows occurring at certain times to be passed immediately downstream. This restores the natural flow variability associated with specific flow ranges (usually freshes and minor floods).	Lachlan Macquarie* Murrumbidgee
Limits on taking high flows	Limit pumping when the dam spills or high flows enter the regulated river from unregulated tributaries. This protects either some or all of these naturally occurring high flows, which are important for flooding of wetland areas.	Lachlan** Namoi** Gwydir** Hunter Paterson Murrumbidgee**
Environmental water allowances or releases	Create a 'bank' or volume of water stored in the dam that can be released for specific environmental purposes, such as flushing blue-green algal blooms, reducing salinity or supporting bird breeding or fish spawning events.	Gwydir Macquarie Lachlan Murray Murrumbidgee Hunter Paterson

Explanatory notes

* These flows are included as part of the environmental water allowance.

** The water sharing plan does not explicitly identify rules which limit extraction by supplementary access licence holders during high-flow events as planned environmental water, however there are benefits in maintaining more natural flow patterns and triggers.

Source: NSW Office of Water⁶³

63 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Water-sharing/Environmental-rules/Rivers/Rivers/default.aspx>

Licence entitlement

Government agencies (NSW, Murray–Darling Basin Authority and the Australian Government Department of Sustainability, Environment, Water, Population and Communities) and Water for Rivers have recently purchased water access licences through various water recovery programs, with the intention of using them for environmental purposes. The Water Management Act provides a specific mechanism whereby such licences can be committed to environmental purposes. A condition is imposed on the licences, specifying that water allocations accruing to the licence must be committed to the environmental purposes set out in a specified environmental water use plan. Once a nomination has been processed, the entitlement cannot be used for any purpose other than environmental benefit, as outlined in an adaptive environmental water use plan.

While there is nothing to stop any water access licence being used for environmental purposes, the imposition of this condition formally makes a licence an ‘adaptive environmental water’ licence. The objectives for such licences are set out in the environmental water use plan specified in the condition, which must in turn be consistent with the objectives of the relevant water sharing plan for the area.

New South Wales RiverBank Program

RiverBank is a \$105 million project that uses funds raised from the NSW Waste and Environment Levy to buy water from licence holders that is then used to provide water for the environment. This project is administered by the NSW Department of Environment, Climate Change and Water. At 30 June 2010 32 GL of water had been purchased in the Macquarie Valley, Gwydir, Lachlan and Murrumbidgee Valleys.

The Act also provides for licences with adaptive environmental water conditions to be created by the Minister as a result of water savings or system improvements.

Adaptive environmental water licences are listed in the NSW environmental water register (and shown in Table 22 as at 30 June 2010).

Table 22. New South Wales: adaptive environmental water access licences (30 June 2010)⁶⁴

Water management area	Category	Number of licences	Licence share (ML)	Adaptive environmental water manager	Adaptive environmental water plan
Central West	Regulated River (general security)	2	1355.5	NSW Department of Environment, Climate Change and Water	Riverbank Macquarie River
	Regulated River (high security)	1	0		
	Supplementary water	4	143.1		
Lachlan	Regulated River (general security)	1	12 000	NSW Department of Environment, Climate Change and Water	Adaptive environmental water use plan for Lake Brewster
	Regulated River (high security)	1	1000	NSW Department of Environment, Climate Change and Water	Riverbank Lachlan Water Management Area
Lower Murray–Darling	Supplementary water	1	100 000	Murray–Darling Basin Authority	The Living Murray Water Plan
Murray	Supplementary water	1	100 000	Murray–Darling Basin Authority	The Living Murray Water Plan
Murrumbidgee	Regulated River (high security)	1	0	Murray–Darling Basin Authority	Riverbank Murrumbidgee Water Management Area

64 Available at the NSW Office of Water website: <http://ewr.water.nsw.gov.au/ewr/main/ewrHome>

Any water access licence can be used for environmental water purposes, regardless of whether it is nominated as an adaptive environmental water access licence. The register records only those licences that have been specifically nominated, and does not include any other WAL that is used for environmental purposes. Therefore the NSW Department of Environment, Climate Change and Water also provides a valley listing of NSW Government environmental water holdings, shown in Table 23.

Table 23. New South Wales: environmental water entitlement holdings by water recovery program (30 June 2010)⁶⁵

Regulated water source	NSW RiverBank			Rivers Environmental Restoration Program		NSW Wetland Recovery Program		The Living Murray Market Purchase Measure	Sub-total per source
	HS*	GS**	SA***	GS	SA	GS	SA	LTCE****	
Gwydir		8044		6858		2190			17 092 GS 441 SA
Macquarie and Cudgegong		19 366		20 809		5891			47 766 GS 1442 SA
Lachlan	1000			472					1000 HS 24 575 GS
Murrumbidgee		15 617						48 917	64 534 GS 5 679 SA
Murray			5679					51 561	51 561 LTCE
Lower Darling								14 275	14 275 LTCE
Sub-total per program	1000	67 130	5691	28 139	569	8081	1302	114 753	
									Environmental water purchased in the market (ML) – Total 225 664 ML
									Other Environmental water recovered under The Living Murray Initiative projects – Total 106 217 ML
									GRAND TOTAL 332 881 ML

Explanatory notes

Water shares

Each water licence has a specified component of the total shares distributed for a regulated water source for a particular category. A licence is a share of the storage capacity in that system. The different categories reflect the long-term average reliability of water allocation accrued to that licence, depending on seasonal dam storage and inflows. Water is accrued to the account of a licence as the storage fills with river inflows.

* **High Security (HS)** shares are likely to receive close to 100% of their allocation in most years.

** **General Security (GS)** shares which are dependent on carry-over of dam storage and seasonal inflows and are recognised in the Water Management Act as having a lower priority of access to water than high security licences during times of constrained supply.

*** **Supplementary Access (SA)** shares which are a conversion of older 'high-flow' or 'off-allocation' licences and are extraction rights for tributary and high river flows that are not captured by storage. Holders of supplementary water access licences are able to extract water only during announced flow events, with rostered or managed access in place in most water sources. Supplementary Access events are typically announced when flows exceed those required to meet other licensed obligations and environmental needs, for example as a result of high tributary inflows downstream of a dam or when the dam is spilling.

Units of measure: entitlements

Units of measure for entitlement recovered are expressed in unit shares. Currently one unit share at full allocation is equivalent to one megalitre (ML) in all valleys except the Lachlan, which has a maximum 0.7 ML per unit share.

**** **Long-term Cap Equivalent (LTCE)**. Units of measure for entitlement purchased under The Living Murray Initiative which are converted by a modelled long-term reliability (CAP) factor and expressed as 'Long-term Cap Equivalent (LTCE)', as per the The Living Murray Business Plan, and include all entitlement categories (HS, GS, SA, Conveyance).

65 Available at the NSW Department of Environment, Climate Change and Water website: <http://www.environment.nsw.gov.au/environmentalwater/waterpurchase.htm>

The Commonwealth under its *Water for the Future* program has chosen to not specify its licences as adaptive environmental water licences, but to retain them with the characteristics of the original licence although the water is intended to be used for environmental purposes. Its purchases in NSW amount to over 500 GLs. The total purchases in each region of the Murray–Darling Basin are listed on the Commonwealth’s website.⁶⁶

6.4 Compliance with environmental water delivery

Adaptive environmental water is registered on the adaptive environmental water register managed by the NSW Office of Water. The register provides a record of:

- + water access licences dedicated as sources of adaptive environmental water
- + environmental water set aside as ‘rules’ in water sharing plans
- + adaptive environmental water use plans approved by the minister.

The register also provides reports on:

- + the assignment of water allocations to and from adaptive environmental water access licences
- + changes in the share component of adaptive environmental water access licences over time.

Managers of adaptive environmental water are not compelled under legislation or water sharing plans to monitor and report on environmental water outcomes, however regular reports are published.⁶⁷

The NSW Department of Environment, Climate Change and Water produces *Water for the Environment News* which outlines environmental water actions and events across NSW.⁶⁸

Information on delivery of all other types of environmental water is recorded solely in statutory water sharing plans, which are publicly accessible. *Water for the Environment News* are published on the department’s website and outline environmental releases, actions and outcomes for both planned water and AEW licences managed by the NSW Government. The only formal arrangements for reporting on activity or compliance with the rules are through the general water plan audit and review processes. The first audit of water sharing plans which commenced in 2004 was completed in 2010. A report has yet to be published. The only other formal arrangement is the annual Murray–Darling Basin cap audits, which audit compliance with extraction limit rules in the major Murray–Darling Basin rivers.⁶⁹

Periodic reports on the implementation of specific water sharing plans, which include details of environmental water delivery have been published by the NSW Office of Water.⁷⁰

Water sharing plans are reviewed between years five and nine of their ten year duration to assess their contribution to state natural resource management standards and targets. At 30 June 2010, no such review had been conducted.

NSW has produced reports according to AWAS for Murrumbidgee (independently of the National Water Account), and are currently preparing reports using AWAS for six regulated rivers.

66 Available at the Australian Government Department of Sustainability, Environment, Water, Population and Communities website: <http://www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html>

67 Available at the NSW Department of Environment, Climate Change and Water website: <http://www.environment.nsw.gov.au>

68 Available at the NSW Department of Environment, Climate Change and Water website: <http://www.environment.nsw.gov.au/environmentalwater/newsletters.htm>

69 Available at the Murray–Darling Basin Authority website: <http://www.mdba.gov.au/services/publications?show=all>.

70 Available at the NSW Department of Environment, Climate Change and Water website: <http://www.water.nsw.gov.au>

6.5 Review of environmental water

For the regulated river plans, NSW has adopted an approach called 'Integrated Monitoring of Environmental Flows'. The program assesses the environmental water provisions of the water sharing plans for the major regulated rivers to:

investigate relationships between water regimes, biodiversity and ecosystem processes ... ; to assess responses in hydrology, habitats, biota and ecological processes associated with specific flow events targeted by environmental flow rules; to use the resulting knowledge to estimate likely long-term effects of environmental flow rules (planned environmental water) and provide information to assist in future adjustment of rules.⁷¹

The program is largely aimed at assessing the environmental water provisions of the water sharing plan to determine their effectiveness in meeting the ecological objectives of the plan.

Environmental water provisions in the unregulated river water sharing plans are different to those for regulated rivers. Generally, in unregulated rivers the environmental flow rules consist mainly of annual extraction limits and 'cease to pump' levels which prevent pumping when river flow drops below a specified level.

The protection of these low flows is important to the survival of many aquatic species. For unregulated river plans, monitoring is undertaken over a number of strands which largely focus on low flow issues. These strands examine issues such as fish passage, predictive modelling of fish and macroinvertebrates, low flow verification, pool refugia, and inflows to estuaries.

Some groundwater sharing plans include provision for recharge calculations and the proportion of recharge identified as planned environmental water to change throughout the life of the plan. Monitoring and modelling of groundwater condition is used to inform such changes. This information will also be used to assess outcomes of these plans at the end of their term.

Reports which include environmental outcomes of held and adaptive environmental water application in target areas in regulated rivers have been published and are accessible through the Office of Water website.⁷² Progress reports on monitoring of planned environmental water⁷³ and details of the regulated and unregulated monitoring programs are also available on the Office of Water website.⁷⁴

The Commonwealth Environmental Water Holder produces an outcomes report annually, documenting environmental outcomes where watering actions were implemented in the Murray–Darling Basin, including in NSW, and to which NSW contributes. NSW has also contributed to the former Murray- Darling Basin Commission's Sustainable Rivers Audit.

71 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-management/Monitoring/Regulated-rivers/Regulated-rivers/default.aspx>

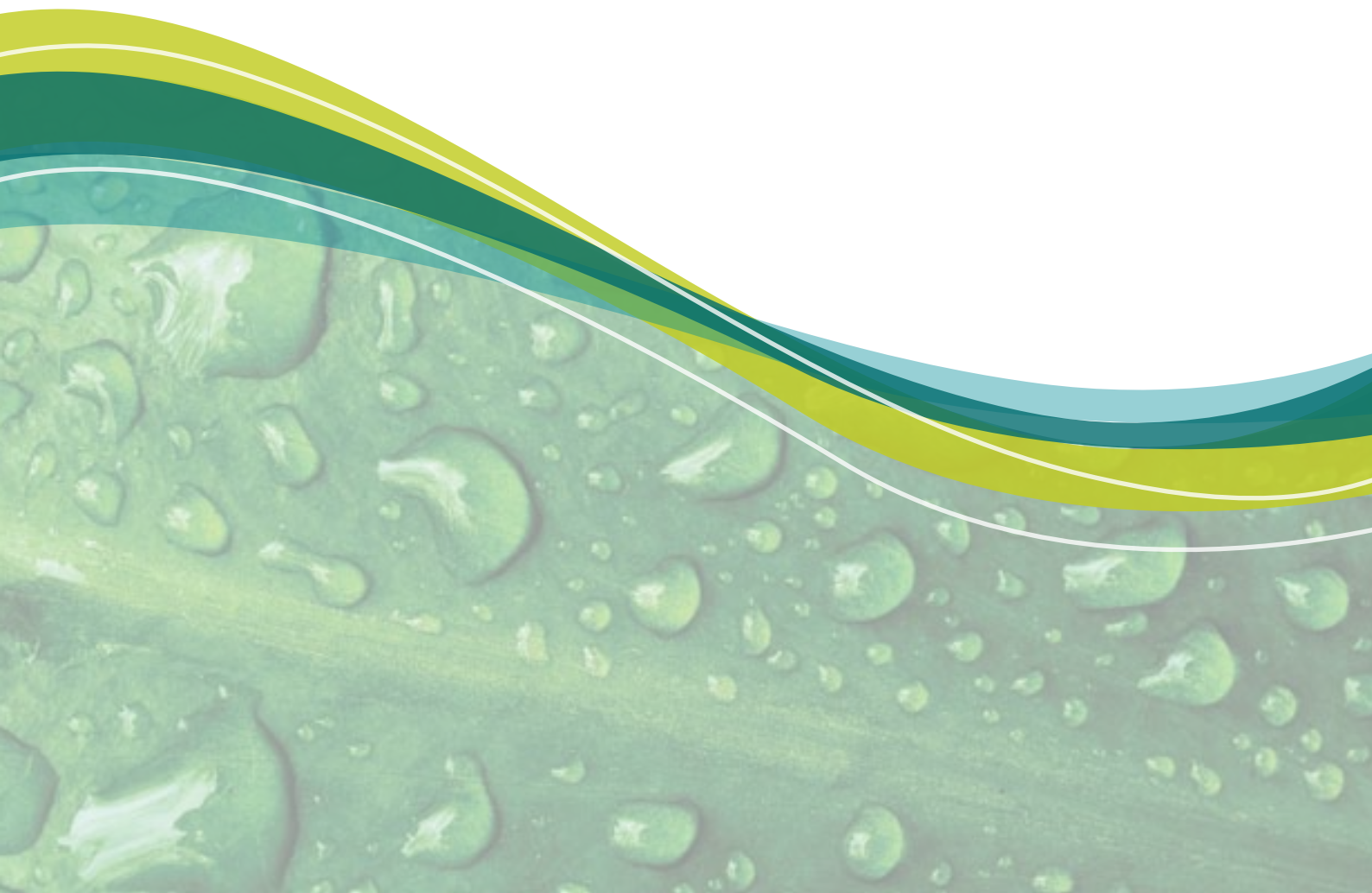
72 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Monitoring/Regulated-rivers/IMEF-publications/default.aspx>

73 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-management/Monitoring/Valley-progress-reports/Valley-progress-reports/default.aspx>

74 Available at the NSW Office of Water website: <http://www.water.nsw.gov.au/Water-Management/Monitoring/default.aspx>

7 Northern Territory

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7 Northern Territory

7.1 Summary

Overview of the jurisdiction

The Northern Territory is the third largest Australian jurisdiction in area (1.35 million km²), but has the smallest population (227 700 at the end of 2009).⁷⁵ Over half of the Northern Territory's population resides in Darwin, and the remainder of the territory is sparsely populated. Water resource development is largely focused around small regional centres and mining developments. Indigenous communities comprise a significant proportion of the population and place strong cultural value on water and water-dependent ecosystems such as rivers, wetlands and springs.

The relief of the Northern Territory is generally flat, with the highest point only 1531 metres above sea level. Surface water drainage is composed of numerous relatively small catchments along the coast and larger inland catchments. Groundwater resources are found throughout the territory in sedimentary basins.

The Northern Territory is divided climatically into humid (northern third) and arid (southern two-thirds) zones. The humid zone is tropical, with high temperatures year round and highly seasonal rainfall. Darwin has a mean annual rainfall of 1775 mm, with January the wettest month (average of 431 mm) and July the driest (1.3 mm). In the south, rainfall is lower and less seasonal. Alice Springs has a mean annual rainfall of only 276 mm, with a smaller variation between the wettest month (February—39 mm) and driest month (September—8.1 mm).⁷⁶ Importantly, this climatic division is reflected in the territory's water planning arrangements.

The CSIRO Northern Australia Sustainable Yields project⁷⁷ found that, unlike climate records for south-eastern Australia, the Northern Territory's climate records (1930–2007) indicate that the recent past (1996–2007) has been wetter than the previous 66 years (in fact, 24% wetter). Importantly, from an environmental water requirements perspective, the project found that 'the consequences of flow changes on ecological systems are largely unknown.'

In the Northern Territory, the statutory instrument that gives authority to take surface or groundwater is a water extraction licence issued under the *Water Act 1992* (as amended 2008) (NT). Around 90% of water used in the Northern Territory is groundwater, however there are similar volumes of surface and groundwater licences on issue. At 30 June 2010, there were 220 groundwater licences across the territory with a total entitlement volume of 126 GL. A further 70 surface water licences amounting to 132 GL were on issue.

Overview of environmental water management arrangements

Section 22 of the Water Act allows the Minister for Natural Resources, Environment and Heritage to declare a part of the Northern Territory to be a water control district, and may include a requirement for the preparation of a water allocation plan. Section 22B specifies that:

a water allocation plan is to ensure in the water control district that . . . water is allocated within the estimated sustainable yield to beneficial uses [including] an allocation to the environment.

Under the Act, water control districts can be declared in regions that require close management of water resources to avoid stressing groundwater reserves, river flow or wetlands. At 30 June 2010, eight districts had been declared in the Alice Springs, Daly Roper, Darwin Rural, Gove, Tennant Creek, Ti Tree, Western Davenport and Great Artesian Basin regions (as shown in Figure 14).

Three of the districts have finalised water allocation plans, as shown in Table 26. A water resource strategy (similar to a water allocation plan) is being prepared for the Tiwi Islands, even though the islands are not part of a declared water control district, due to pressure on the water resources from the growing population.

75 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

76 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

77 CSIRO (2009). *Water in northern Australia: Summary of reports to the Australian Government from the CSIRO Northern Australia Sustainable Yields Project*, CSIRO, Australia, 2009. Summary report and other Northern Australia Sustainable Yields documents are available from the CSIRO website: <http://www.csiro.au/partnerships/NASY.html>

The Act is currently under a review that aims to make it compliant with the NWI by ensuring a consistent methodology for issuing licences and the provision of environmental water. Under the review, the approach to licensing is likely to result in a register for surface water and groundwater. The review is also investigating the potential for creating a water control district for the entire Northern Territory so that groundwater bore construction can be more effectively controlled across the jurisdiction.

Specific environmental water provisions are made within the water allocation plan process. Currently, there is limited scientific understanding of the environmental water requirements of the territory, particularly within groundwater systems. In the absence of detailed scientific knowledge, the Northern Territory Government uses a generic approach to allocate around 80%–95% of the water resource to the environment. The most recently developed management plan in the Katherine area used detailed scientific investigations to set more ‘sophisticated’ management rules, based on the prevailing conditions at the start of the water year.⁷⁸

Table 24. Northern Territory: environmental water statutory framework (30 June 2010)

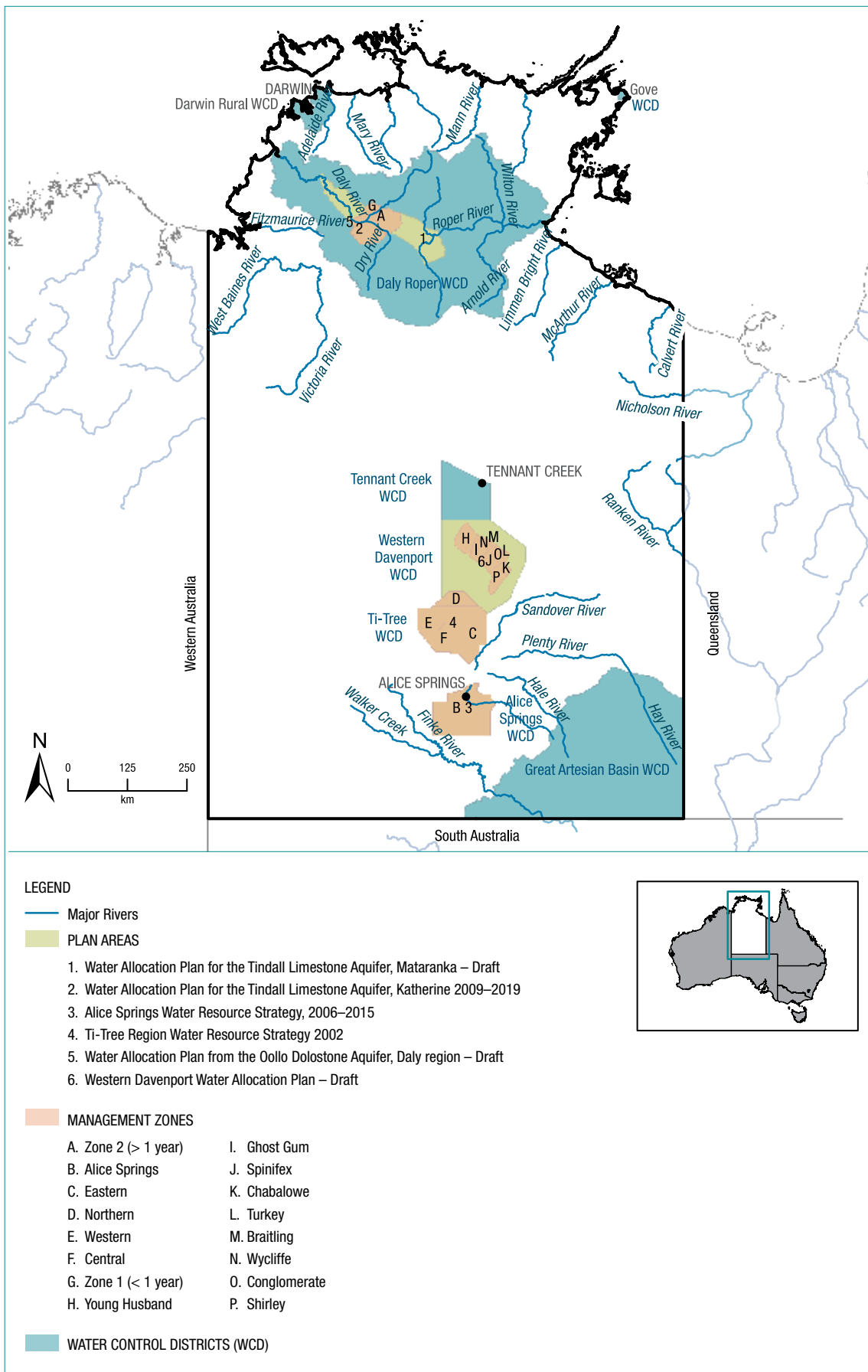
Legislation	<i>Water Act 1992 (as amended 2008)</i> (NT) <i>Lake Eyre Basin Intergovernmental Agreement Act 2009</i> (NT)
Responsible minister	Minister for National Resources, Environment and Heritage
Environmental water manager	Department of Natural Resources, Environment, The Arts and Sport (Controller of Water Resources)
Other relevant institutions	Environmental Protection Authority Lake Eyre Basin Intergovernmental Agreement
Method of securing environmental water	Planned: statutory water allocation plans must include an environmental allocation that is within the estimated sustainable yield.

Table 25. Northern Territory: environmental water terminology

Term	Type	Definition
Water control district	Macro management area	A district declared under statute when there are signs that groundwater reserves, river flows or wetlands may be at risk of becoming stressed due to water extraction. Legislation covers all aspects of sustainable water resource management in water control districts, including the investigation, use, control, protection and allocation of the water resource.
Water allocation plan	Management tool	A water allocation plan directs the management of water in a declared water control district. It provides the planning framework for determining consumptive and environmental shares and trading rules.
Water allocation plan area	Management area within a water control district	An area for which a statutory water allocation plan must be developed, defined by hydrogeological boundaries based on one or more aquifers that share common characteristics. A water allocation plan area can include an entire water control district or only part of one.
Water licence	Statutory instrument	The statutory instrument for managing access to the water resource. It is an authority to take and use surface or groundwater for purposes other than stock and domestic, subject to conditions. Water licences are issued, transferred or amended in accordance with the requirements of the applicable water allocation plan.
Water year	Timing	The Northern Territory water year runs from 1 May until 30 April.

78 Further information available on the Northern Territory Department of Natural Resources, Environment, The Arts and Sport website: <http://www.nt.gov.au/nreta/water/plans/index.html>

Figure 14. Northern Territory: water control districts (30 June 2010)



Source: Data supplied by the Department of Natural Resources, Environment, The Arts and Sport. © Northern Territory of Australia.

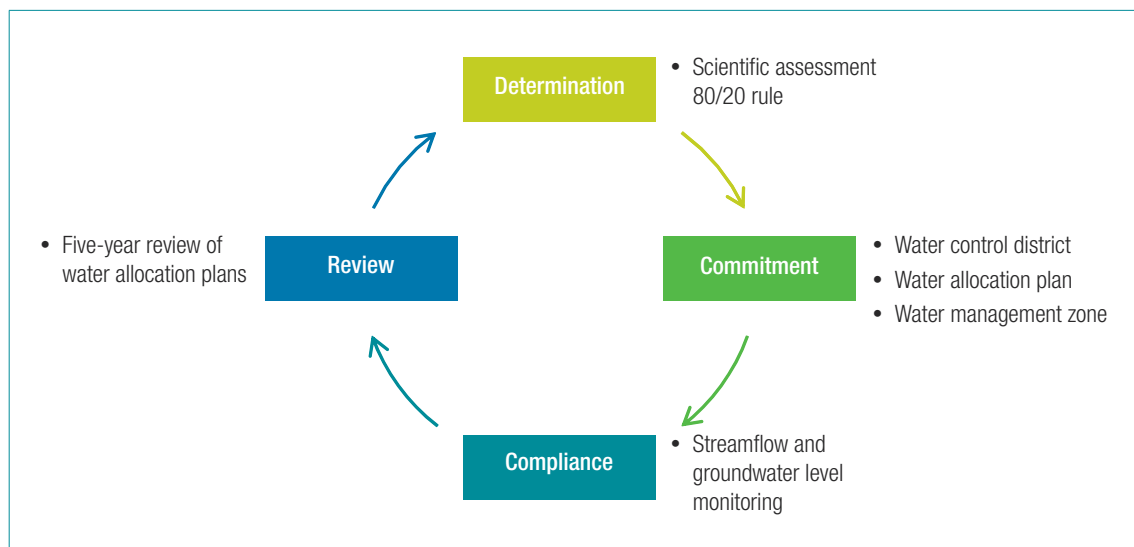
Table 26. Northern Territory: water control districts and associated management plans (30 June 2010)

Water control district	Water allocation plan	Status and comments
Alice Springs	Alice Springs Water Resource Strategy 2006–2015	Declared in 2007. Covers the entire Alice Springs Water Control District. Includes an environmental provision, determined by a generalised flow-sharing rule.
Ti Tree	Ti Tree Region Water Allocation Plan 2009	Update of 2002 Ti-Tree Region Water Resource Strategy. Declared in 2009. Covers the entire Ti Tree Water Control District. Includes an environmental provision, determined by a generalised flow-sharing rule.
Daly Roper	Water Allocation Plan for the Tindall Limestone Aquifer, Katherine, 2009–2019	Declared in 2009. Covers a high-yielding, good quality aquifer within the Daly Roper Water Control District. Uses surface water environmental requirements to limit groundwater extractions. Scientific study determined environmental water requirements.
Western Davenport	Draft Water Allocation Plan for Western Davenport Water Control District 2010–2020	Comments on draft closed on 15 July 2010. Includes an environmental provision, determined by a generalised flow-sharing rule.

Note: Plans under development at 30 June 2010 are shaded.

The four elements of the environmental water management framework are applied to the Northern Territory in sections 7.2–7.5 and summarised in Figure 15.

Figure 15. Northern Territory: summary environmental water management framework (30 June 2010)



7.2 Determination of environmental water

The Water Act provides for declaring the environment as a beneficial use of the territory's water resource. Section 4 of the Act defines the beneficial use of the environment as 'to provide water to maintain the health of aquatic ecosystems'. The environment is included as one of two non-consumptive and five consumptive 'beneficial uses' of water that must be considered in the development of a water allocation plan (the other non-consumptive use is 'cultural').

Environmental water is protected through a hierarchical system, with the environment having first call on available water. The hierarchy of use is as follows:

1. Environmental requirements
2. Stock and domestic requirements
3. Cultural requirements
4. Development water requirements.

The water requirements to achieve each of the beneficial uses are to be determined using scientific assessments, and then incorporated into environmental water allocation planning. Where scientific assessments are not available, environmental allowances use a generalised flow-sharing rule. The rule states that at least 80% of natural flow in watercourses (increased to 95% in the southern arid zone) or groundwater resources must be left for environmental purposes (see Table 27).

The 2009–2019 water allocation plan for the Tindall Limestone Aquifer, Katherine, is the only plan in the territory that makes use of a scientific assessment, being based on studies of the water requirements of the aquatic macrophytes *Vallisneria spiralis* and *Spirogyra*, the pig-nosed turtle and other aquatic flora and fauna in the Daly River in 2004. The study sites were downstream of the area covered by the water allocation plan. Recommendations were also made to ensure that the water requirements of riparian vegetation could be supplied at times of extreme water stress. Modelling of flows and estimates of the contribution of the Tindall aquifer discharge to the Daly River were used to determine the proportion of surface flow that could be diverted and still meet the downstream requirements. Rules developed in the water allocation plan are based on a proportion of flow, but are modified depending on whether the year is predicted to be wet, dry or normal. In very dry years, 87% of the flow in the Katherine River is allocated to the environment, reducing to 80% in dry years and 70% in normal and wet years. Maximum groundwater diversions are altered each year to take account of the resulting flow in the Katherine River.

Table 27. Northern Territory: environmental allocations (30 June 2010)

Region	Allocations for environmental and other public benefit		Licences	
	Rivers	Aquifers	Rivers	Aquifers
Humid zone—northern third of the Northern Territory	At least 80% of flow at any time in any part of a river.	At least 80% of annual recharge.	No new licences granted if consumptive use demand exceeds 20% threshold. ⁷⁹	No new licences granted if consumptive use demand exceeds 20% threshold. ⁷⁹
Arid zone—southern two-thirds of the Northern Territory	At least 95% of flow at any time in any part of a river.	There will be no deleterious change in groundwater discharges to dependent ecosystems, and total extraction over a period of at least 100 years will not exceed 80% of the total storage at start of extraction.	No new licences granted if consumptive use demand exceeds 5% threshold. ⁷⁹	No new licences granted if consumptive use demand exceeds 80% threshold or if discharges to groundwater-dependent ecosystems are affected. ⁷⁹

⁷⁹ Unless supported by directly related scientific research.

7.3 Commitment of environmental water

Section 22 of the Water Act allows the minister to declare a part of the Northern Territory to be a water control district, and may include the requirement for the preparation of a water allocation plan. Section 22B specifies that:

a water allocation plan is to ensure in the water control district that . . . water is allocated within the estimated sustainable yield to beneficial uses [including] an allocation to the environment.

The water allocation plans are developed under the direction of water advisory committees, which are statutory bodies formed under the Act and specific to each plan. Members of the community are appointed to the committees based on their particular expertise in relation to the relevant water resource. Under the Act, licences are generally required to take and use water from waterways or aquifers. The Act does not make provision for specific licences or allocations for an environmental purpose.

Environmental water provisions are accounted for by specifications in the water allocation plans, which are publicly available.⁸⁰ Environmental water is accounted for in the plans through a rules-based approach to allocations. In the adoption of water allocation plans, the Department of Natural Resources, Environment, The Arts and Sport oversees the implementation of those rules through the issuing of licences and the enforcement of licence conditions and any associated seasonal allocations. At 30 June 2010, three of the water control districts had final water allocation plans that detail surface water or groundwater environmental water provisions (Table 28). The Western Davenport water allocation plan remained in draft form at that date.

Table 28. Northern Territory: environmental water commitment in water allocation plans (30 June 2010)

Water allocation plan	Groundwater environmental water commitment	Surface water environmental water commitment
Alice Springs Water Resource Strategy 2006–2015	<i>Alluvial</i> —total extraction equal to estimated average recharge. <i>Amadeus Basin</i> —total extraction over a period of no less than 320 years not to exceed 80% of the total aquifer storage.	At least 95% of flow at any time in any part of a river is allocated to the environment.
Ti Tree Region Water Allocation Plan 2009	Annual limit to groundwater extraction to protect ‘the health of water dependent ecosystems that support environmental and cultural values’. Condition on licences in the Eastern Zone to protect specific groundwater-dependent ecosystems (e.g. Stirling Swamp)	At least 95% of flow at any time in any part of a river is allocated to the environment.
Water Allocation Plan for the Tindall Limestone Aquifer, Katherine, 2009–2019	Annual limits to groundwater extraction to protect surface flows.	Variable allocation to the environment depending on year: + <i>Very dry years</i> —87% of annual groundwater discharge will be reserved for the environment. + <i>Dry years</i> —80% of annual groundwater discharge will be reserved for the environment. + <i>Normal and wet years</i> —70% of annual groundwater discharge will be reserved for the environment.

7.4 Compliance with environmental water delivery

The three completed water allocation plans all have measures to ensure compliance with the environmental water commitments (Table 29). Under the Alice Springs Water Resource Strategy 2006–2015, an implementation plan will be established to outline how provisions made in the water allocation plan will be achieved through stream-flow, groundwater and usage monitoring. The implementation plan shows that the intent is to conduct regular compliance inspections and that public reporting will occur. Public reporting had not commenced at 30 June 2010.

80 Available from the Northern Territory Department of Natural Resources, Environment, The Arts and Sport website: <http://www.nt.gov.au/nreta/water/plans/index.html>

For the Ti Tree Region Water Allocation Plan 2009, a commitment was made to ongoing stream-flow and groundwater monitoring, and usage monitoring was established in the 2002 strategy, but no reporting has been published since 2006.

The 2009–2019 water allocation plan for the Tindall Limestone Aquifer, Katherine, contains the intent to develop an implementation plan to outline how provisions made in the water allocation plan will be achieved through stream-flow, groundwater and usage monitoring.

Table 29. Northern Territory: environmental water compliance in existing water allocation plans

Water allocation plan	Compliance reporting
Alice Springs Water Resource Strategy 2006–2015	Assess, monitor and report every two years on regional rainfall, surface water flow, groundwater levels and water quality in each of the management zones. Institute water level, salinity, crop area and pump monitoring, as appropriate, by all licence holders in the Alice Springs Water Control District.
Ti Tree Region Water Allocation Plan 2009	Continue regional rainfall, stream flow, groundwater levels and water quality monitoring established in the 2002 strategy, and report in the <i>Health of the Ti Tree Basin</i> report. There is a requirement outlined in individual licences for licence holders to report on water level, salinity and pump monitoring. Compliance with licence conditions is monitored by Department of Natural Resources, Environment, The Arts and Sport.
Water Allocation Plan for the Tindall Limestone Aquifer, Katherine, 2009–2019	A range of performance indicators are listed in Appendix 2 of the water allocation plan, including the annual discharge from the water source to the Katherine River relative to other years and annual extraction from the water source.

7.5 Review of environmental water

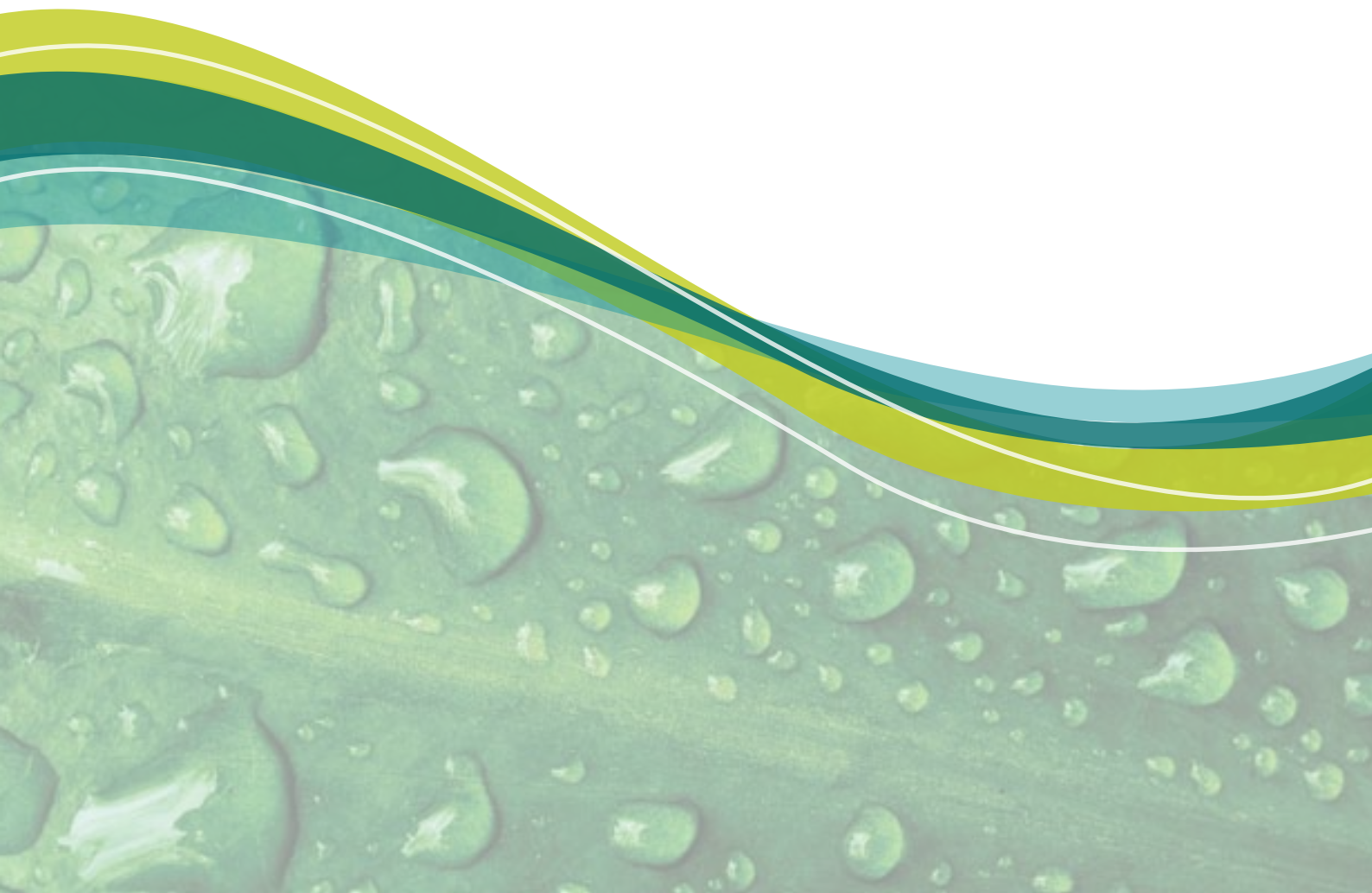
Section 22B(3) of the Water Act requires that water allocation plans must be reviewed at least every five years. For the three water allocation plans in operation, monitoring and review processes as detailed in Table 30 are stipulated.

Table 30. Northern Territory: environmental water review processes in water allocation plans (30 June 2010)

Water allocation plan	Review of environmental water requirements
Alice Springs Water Resource Strategy 2006–2015	Under Section 6.3 of the strategy, elements to ‘improve knowledge’ include: + identify groundwater-dependent ecosystems and develop indicators to determine operational definitions of sustainable yield (2007–2011). + determine quantitative values for environmental water requirements sourced from surface and groundwater resources and prepare management rules for sustaining ecosystems in relevant management zones, including monitoring and regular program review (2007–2011).
Ti Tree Region Water Allocation Plan 2009	Appendix 1 of the Water Allocation Plan Implementation Plan includes: + determine environmental water requirements for surface and groundwater resources in each zone of the Ti Tree Water Control District (2009–2012). + develop and implement programs to monitor health of key environmental GDEs that are vulnerable to change due to water extraction (ongoing).
Water Allocation Plan for the Tindall Limestone Aquifer, Katherine, 2009–2019	Appendix 2 of the Water Allocation Plan (Monitoring Program) includes: + river health + identification of specific environmental water requirements that maintain ecological processes in the Katherine and Daly rivers. Details of the monitoring program are to be developed in the implementation plan. Based on the initial monitoring program, an annual written report that includes performance indicators is to be prepared.

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8 Queensland

8.1 Summary

Overview of the jurisdiction

Queensland is the second largest jurisdiction in area (1 852 600 km²), with a population of approximately 4 473 000 at the end of 2009.⁸¹ South-east Queensland, comprising Brisbane, the Gold Coast, the Sunshine Coast and West Moreton, made up two-thirds (66%) of Queensland's total population in June 2007.⁸²

There is significant variation in climate across the state, from low rainfall and hot summers in the inland west, to a monsoonal wet season in the far north and warm temperate conditions along the coastal strip. Similarly, rainfall across the jurisdiction is very variable. In the south-east, Brisbane receives average annual rainfall of 1024 mm, while in the west Birdsville receives 165 mm. In the far north, Bamaga receives an average of 1834 mm per year.⁸³ Most rainfall across the state occurs around February, and the lowest rainfall is around August–September.

Queensland has a wide variety of land uses, including tropical and temperate fruit and vegetables, grain crops, wineries, cattle raising, cotton, sugar cane, wool and mining.

In Queensland, the statutory instrument that gives authority to take surface or groundwater is the *Water Act 2000* (Qld). The major licensed water resource in Queensland is surface water. At 30 June 2010, there were 41 102 surface water licences across the jurisdiction with a total entitlement volume of 5544 GL. A further 15 320 groundwater licences amounting to 899 GL were on issue.⁸⁴

Overview of environmental water management arrangements

The Department of Environment and Resource Management manages water planning activities in Queensland. Among other goals, the department aims to provide for the health of rivers and ecological values that are dependent on groundwater water. It has expressly recognised the need for a sustainable balance between meeting human needs and meeting those of the environment. The water resource planning process in Queensland is shown in Figure 16.

Section 46 (4b) of the Water Act provides for the development of water resource plans to establish environmental flow objectives. Resource operations plans describe how managers operationally meet the water resource plan environmental flow objectives.

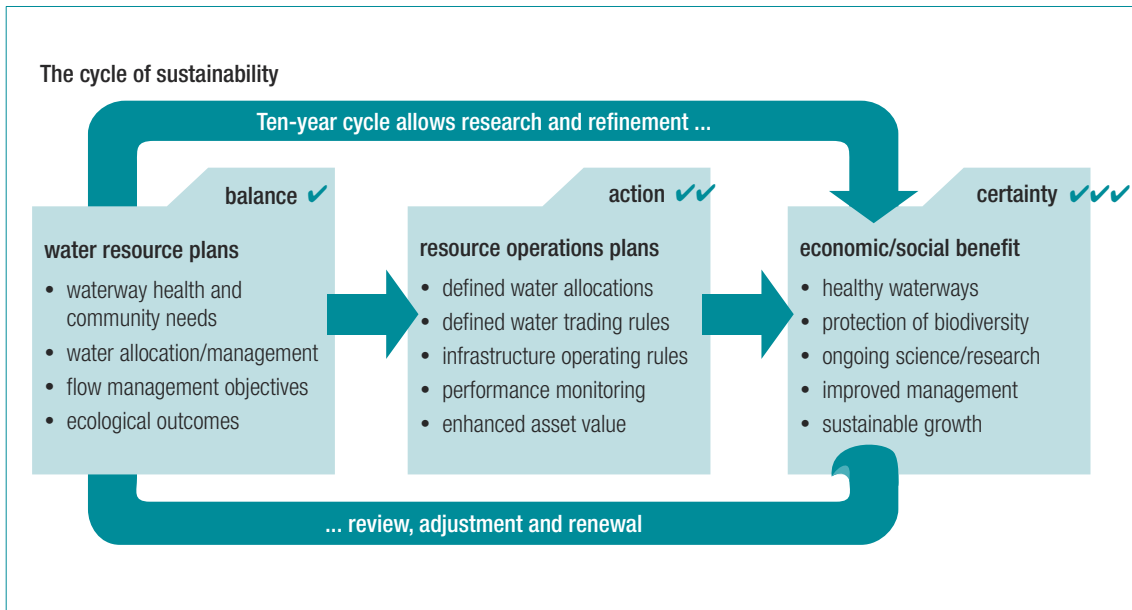
81 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

82 ABS, 3218.0—*Regional population growth, Australia, 2008–09*, issued 30 March 2010, ABS, Canberra.

83 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

84 These figures for Queensland exclude area-based licences.

Figure 16. Queensland: water resource planning process (30 June 2010)



Source: Department of Environment and Resource Management, Understanding water resource planning fact sheet, 2009, available: http://www.derm.qld.gov.au/wrp/pdf/general/understanding_wrp_09.pdf

Table 31. Queensland: environmental water statutory framework

Legislation	<i>Water Act 2000</i> (Qld) <i>Environmental Protection Act 1994</i> (Qld) <i>Lake Eyre Basin Agreement Act 2001</i> (Qld)
Responsible minister	Minister for Natural Resources, Mines and Energy Minister for Climate Change and Sustainability
Environmental water manager	Department of Environment and Resource Management
Other relevant institutions	Sunwater Queensland Water Commission Lake Eyre Basin Intergovernmental Agreement
Method of securing environmental water	Planned: concept of 'environmental water' not explicitly defined. However, statutory water resource plans must include environmental flow and water allocation security objectives, while statutory resource operations plans contain rules that achieve environmental objectives. In practice, resource operations plans incorporate a range of rules that are consistent with 'planned environmental water'.

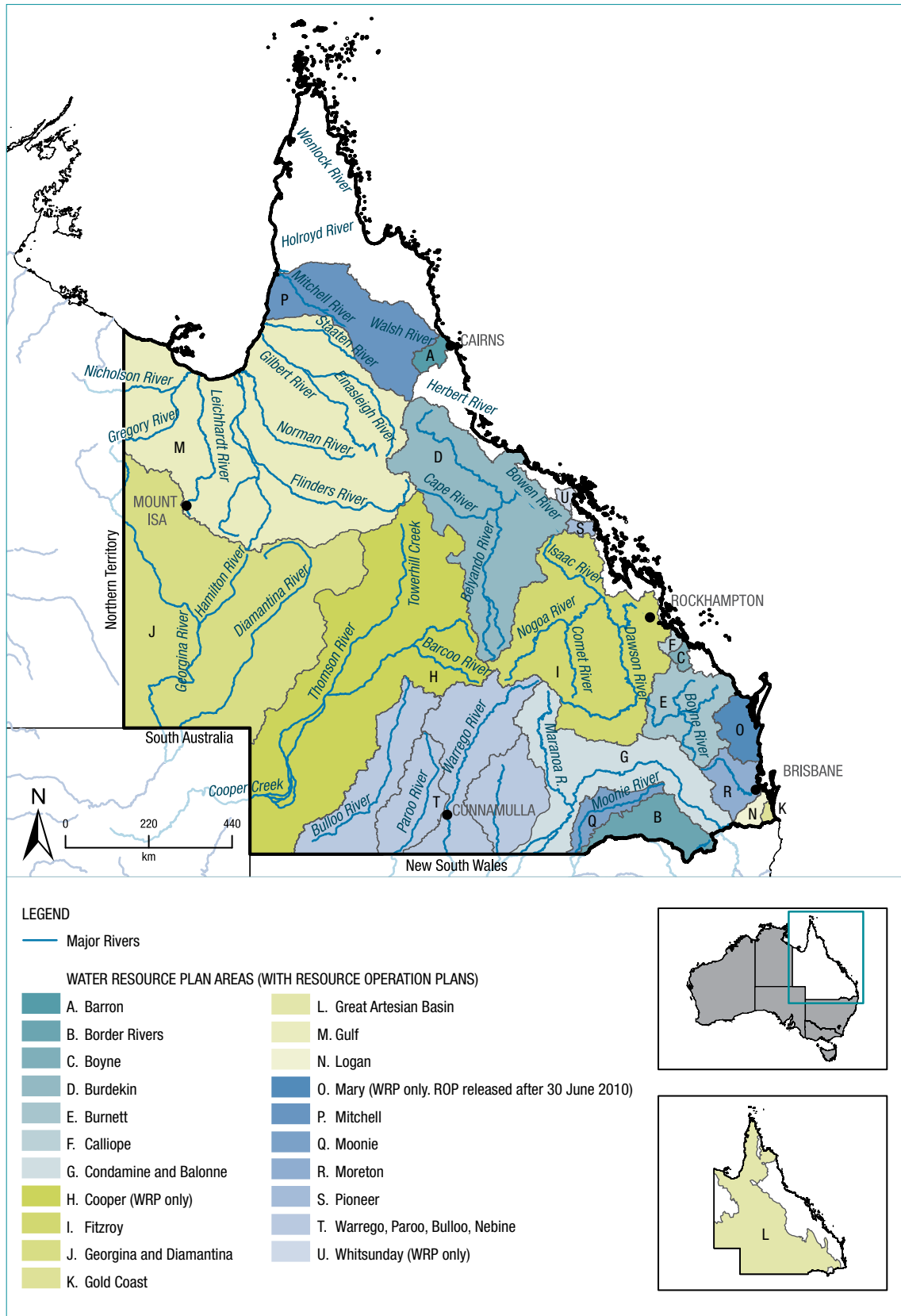
Table 32. Queensland: environmental water terminology

Term	Type	Definition
Water resource plan	Statutory instrument	As required under the Water Act (s. 38), a water resource plan outlines the sustainable water resource management and environmental water requirements within a defined zone. It specifies management strategies to achieve specific outcomes, monitoring and evaluation requirements, environmental flow objectives and water allocation security objectives within the region.
Water allocation	Statutory instrument	A water allocation is a right to take water; the allocation is unbundled from land.
Water licence	Statutory instrument	A water licence is a right to take or interfere with water. A water licence is attached to land, and the water must only be used on the land to which it is attached.
Resource operations plan	Implementation plan	As defined under the Water Act, a resource operations plan is a plan that provides the strategy to achieve the objectives in the relevant water resource plan. It can establish rules for trading, for how water will be managed and allocated, and for infrastructure management. It can also establish responsibilities for monitoring and reviewing ecological outcomes.
Environmental flow objective	Target	An environmental flow objective for a water resource plan is a flow requirement designed to protect the health of natural ecosystems for the achievement of environmental outcomes. An environmental flow objective sets ranges for various flow parameters (such as low flows, mean annual flow or the number of no-flow periods of various durations) that should be provided.
Environmental outcome	Target	An environmental outcome, as outlined in a water resource plan, is a description of an ecological health target. For example, a water resource plan may state that water is to be managed and allocated to maintain pool habitats.
Environmental Flows Assessment Program	Monitoring program	The Environmental Flows Assessment Program assesses the rules and strategies specified in water resource plans and their effectiveness in achieving the ecological and community outcomes articulated in those plans.
Supplemented water	Supply	A water supply in which reliability is enhanced by releases of stored water from infrastructure. Equivalent to a regulated water supply.
Unsupplemented water	Supply	A water supply in which reliability is not enhanced by releases of stored water from infrastructure. Equivalent to an unregulated water supply.

There are 23 water resource plan areas in Queensland (Figure 17). Of those catchments, 21 have water resource plans. Eighteen of the water resource plans have resource operations plans, as shown in Table 33.⁸⁵

85 Available at the Queensland Department of Environment and Resource Management website: http://www.derm.qld.gov.au/services_resources/item_list.php?category_id=80&topic_id=27

Figure 17. Queensland: water resource plans and resource operations plans (30 June 2010)



Source: Queensland Department of Environment and Resource Management.

Table 33. Queensland: catchments and associated management plans (30 June 2010)

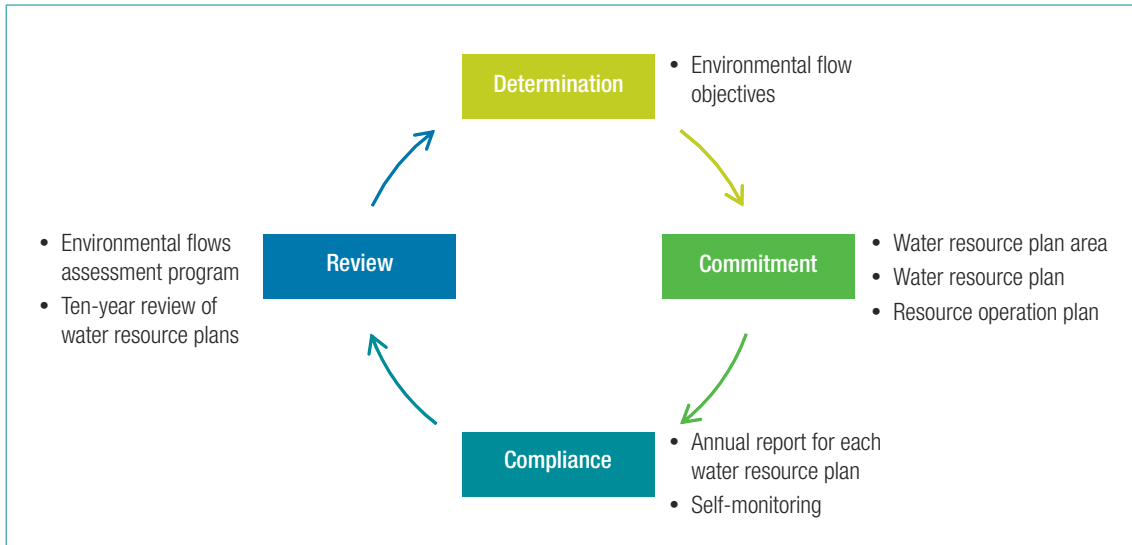
Catchment	Water resource plan status	Resource operations plan status
Baffle	Draft released March 2010	Intent to prepare resource operations plan announced March 2010
Barron	Final released December 2002 Water resource amendment plan released November 2009	Final released June 2005 Draft amendment released April 2010
Border Rivers	Final released December 2003 Water resource amendment plan released June 2007	Final released March 2008
Boyne	Final released December 2000	Final released July 2003 Amended July 2006
Burdekin	Final released August 2007	Final released December 2009
Burnett	Final released December 2000 Water resource amendment plan released November 2007	Final released May 2003 Intention to amend resource operations plan to include groundwater January 2007
Calliope	Final released December 2006	Final released May 2008
Condamine and Balonne	Final released August 2004 Notice of intent to prepare water resource plan amendment announced August 2009	Final released December 2008 Resource operations plan amendment to include Lower Balonne released March 2010
Cooper	Final released February 2000 Ten-year review and replacement of water resource plan announced July 2008	Resource operations plan not required for first generation water resource plan
Fitzroy	Final released December 1999 Amended July 2005 Ten-year review and replacement of water resource plan announced June 2008	Final released January 2004 Amended April 2006 and July 2009
Georgina and Diamantina	Final released August 2004	Final released July 2006
Gold Coast	Final released December 2006	Final released December 2009 Draft amendment released April 2010
Great Artesian Basin	Final released March 2006	Final released February 2007
Gulf	Final released November 2007	Final released June 2010
Logan	Final released March 2007	Final released November 2009 Intent to prepare amendment May 2010
Mary	Final released July 2006 Water resource amendment plan released December 2007	Intent to prepare November 2005 ⁸⁶
Mitchell	Final released November 2007	Final released November 2009
Moonie	Final released December 2003	Final released January 2006
Moreton	Final released March 2007	Final released December 2009
Pioneer	Final released December 2002 Water resource amendment to include groundwater finalised October 2009	Final released June 2005 Amended June 2007
Warrego, Paroo, Bulloo, Nebine	Final released December 2003	Final released January 2006
Wet Tropics	Notice of intent to prepare draft water resource plan announced February 2010	
Whitsunday	Final released February 2010	Intent to prepare September 2008

Note: Plans under development at 30 June 2010 are shaded.

86 Draft resource operation plan released in August 2010 – after 30 June 2010 reporting period for this report.

The four elements of the environmental water management framework are applied to Queensland in sections 8.2–8.5 and summarised in Figure 18.

Figure 18. Queensland: summary environmental water management framework (30 June 2010)



8.2 Determination of environmental water

Water resource plans outline the targeted environmental outcomes for the specific plan area. Most plans have both general and specific ecological outcomes. General ecological outcomes relate to maintaining the integrity of aquatic ecosystems across the plan area. Specific ecological outcomes relate to particular spatial sections of a water resource plan area and often to a specific species. The Water Act requires water resource plans to consider environmental values established under the Environmental Protection (Water) Policy 2009.

The environmental outcomes outlined by a water resource plan are achieved by the establishment of environmental flow objectives for specified locations throughout the water resource plan area. An environmental flow objective is a rules-based mechanism for defining environmental flows. It sets ranges for various flow parameters that must be provided, such as low flows, mean annual flow, durations for which certain flow volumes should be exceeded, or the number of no-flow periods of various durations. For example, the Burnett Water Resource Plan states that the proportion of days a year that the daily flow is less than 2 ML must be between 2% and 18%. Importantly, the environmental flow objectives do not relate to a physical volume of water that must be delivered, but to a regime of flows that must be achieved.

Environmental flow objectives are defined by an independent scientific advisory panel for each water resource plan, using a benchmarking methodology. The methodology uses the natural or existing flow regime as a starting point and examines the consequences of altering or removing various components of the flow regime. Conceptual models are used to predict the impacts of flow changes. Environmental flow objectives are set as the flow required to ensure that the impacts of changes to the flow regime do not negatively affect the water resource plan environmental outcomes. The scientific studies used to develop environmental flow objectives are publicly available.⁸⁷

⁸⁷ Available at the Queensland Department of Environment and Resource Management website: http://www.derm.qld.gov.au/services_resources/item_list.php?category_id=80&topic_id=27

8.3 Commitment of environmental water

The Water Act establishes the arrangements for water planning in Queensland. Water allocation planning occurs in a two-stage process for each catchment, involving a water resource plan and a resource operations plan. The Act does not provide for environmental water to be held as a water allocation, but instead stipulates that planning and allocation of water must be ecologically sustainable. This is achieved through rules-based mechanisms, outlined in water resource plans and resource operations plans that ensure the provision of water to meet environmental flow objectives.

Water resource plans

Water resource plans have been finalised for 21 out of 23 planned catchment areas. They establish a framework to share water between consumptive use and the environment. The plans recognise and provide for non-consumptive uses, such as fisheries and tourism that are considered important for the state and regional economies.

Extraction is limited through the use of water licences and water allocations. In Queensland, either a water licence or a water allocation is required to take water, and both are regulated in accordance with water resource plans. A water licence is a right, attached to land, to take and use water. A water allocation is a right, unbundled from land, to take water; it is the equivalent of the nationally defined water access entitlement.

In unregulated systems, the water resource plan outlines a flow threshold-based condition that states when the water is able to be extracted from the unregulated system. The flow threshold is specified at levels above that required for the environmental flow objectives to ensure that all objectives are achieved. Queensland has a high proportion of unregulated systems compared to other jurisdictions.

The water resource plan may also declare sub-artesian areas and include the regulation of diversions. Twenty-six other areas have been declared under the Water Regulation 2002 (Qld). In those areas, a licence is required to take sub-artesian water (excluding for stock and domestic use).

Resource operation plans

Resource operations plans had been finalised for 18 water resource plans at 30 June 2010.⁸⁸ They contain the detail on how water resources are to be managed to meet specific environmental and consumptive objectives set out in each water resource plan. Each resource operations plan is structured to ensure that water in the plan area is managed in a way that delivers the outcomes and environmental flow objectives specified in the water resource plan. The resource operations plans include detailed rules and requirements for:

- + water sharing rules
- + environmental flow management rules
- + the operation of infrastructure
- + the issue and management of water licences and allocations
- + water and natural ecosystem monitoring and reporting
- + water trading rules.

Rules for environmental purposes are not explicitly designated in resource operations plans, because the set of rules in the resource operations plan is considered as a whole to achieve both environmental and resource security (water supply) objectives.

Principal responsibility for implementation of environmental water rules in resource operations plans lies with the Department of Environment and Resource Management. The responsibility for implementation of a large part of the rules is delegated to infrastructure operators through resource operations licences (Sunwater is the operator of most of Queensland's water infrastructure). Under the licences, they operate the infrastructure and supply water consistent with the resource operations plans.

A standard provision in resource operations plans requires resource operations licence holders to prepare critical water supply arrangements for water supply schemes. Those arrangements include triggers and set out how water is to be managed and shared during times of water shortage. They are approved by the department and then incorporated back into the resource operations plan. The arrangements have the effect of introducing modified rules for the critical period, including modifications to rules relating to environmental flow objectives. In recent years, critical water supply arrangements have been operative in several areas due to the recent drought.

Queensland has deliberately not adopted any form of manageable allocation of stored water for environmental purposes. Instead, the Department of Environment and Resource Management has determined that the regime defined by the various rules and limits on the management and extraction of water set out in the plans is sufficient, without discretionary allocations.

⁸⁸ The Mary catchment resource operations plan was subsequently released in August 2010.

Although the Water Act does not provide for environmental water to be held by the state as a water entitlement, it does not prohibit other parties from holding entitlements for environmental purposes. Those entitlements would be held on the Water Allocation Register along with other consumptive entitlements, so there is no purpose for a separate register of environmental water in Queensland. As a result, water entitlements purchased for environmental purposes can only be identified through information provided by the holders of the entitlements.

Over the next few years, it is likely that the Commonwealth will be purchasing water entitlements in the Queensland part of the Murray–Darling Basin for environmental purposes. Bilateral arrangements between the Australian and Queensland governments are being developed to ensure that environmental water can be delivered through the system.

8.4 Compliance with environmental water delivery

Monitoring of adherence to the rules outlined in the resource operations plan is the responsibility of resource operations licence operators (such as Sunwater). They are required to collect information and report to the Department of Environment and Resource Management on operations consistent with their licence. Those reports are not publicly available.

The Minister for Natural Resources prepares an annual report on the implementation of all water resource plans.⁸⁹ The report includes information for each plan on flows, water allocation and use; compliance with rules in resource operations plans (including those that are environmental); and ecological monitoring activity.

Queensland has prepared demonstration general purpose water accounting reports in accordance with the AWAS, including the disclosure of information about water related to environmental benefit for the Pioneer Valley. The Pioneer Valley general purpose water accounting reports are included in the Minister's Water Resource Plan annual report. Queensland is also supplying data and information for three South East Queensland water resource plans for inclusion in the first National Water Account 2010 being prepared by the Bureau of Meteorology as required by the *Water Act 2007* (Cwth).

The department's network of hydrology monitoring sites across the state includes about 400 surface water gauging stations and 6000 monitoring bores. The flow data from the network is used for the hydrological model in each catchment, which forms the basis for the water resource planning process. The network is also used to:

- + monitor water quantity, and the condition and trend of water quality
- + monitor compliance with certain resource operations plan requirements
- + inform decisions on day-to-day management, such as water harvesting announcements
- + provide information for flood warnings.

Scheme licence holders are also required to assess and manage the risk of environmental harm that may result from the operation of their storages and schemes. They are expected to collect and assess all data relevant to the risks being managed. The scheme licence holders regularly report on the results of their monitoring; a summary is reported in the Department of Environment and Resource Management's annual report.

8.5 Review of environmental water

The Queensland Environmental Flows Assessment Program is designed specifically to assess whether water resource plans are achieving environmental outcomes. To assess progress towards attaining a specific environmental outcome, the program uses selected ecological assets representative of the outcome. An ecological asset is a highly valued component of the environment that can be used as an indicator of the health of a system. It is not possible to monitor all parts of an ecosystem, so a range of assets that are representative of the plan area and the system as a whole is selected.

The representative ecological assets are assessed to:

- + confirm the critical flow requirements of ecological assets
- + determine whether current flow management strategies are providing critical water requirements
- + determine the risk to ecological assets and evaluate whether the ecological outcomes in a water resource plan are likely to be met under current flow management strategies.

89 Available at the Queensland Department of Environment and Resource Management website: http://www.derm.qld.gov.au/wrp/annual_reports.html

Issues identified within the Environmental Flows Assessment Program are evaluated as part of the environmental assessment component of the water resource plan review, which happens between years 8 and 10 of the 10-year water resource plan cycle. As part of that review, the effectiveness of the water resource plan and resource operations plan in achieving their planned ecological outcomes under a number of flow scenarios is assessed and reported. The outcomes are then used in the further development of water resource plans.

The minister's annual report on the implementation of all water resource plans also presents:

- + the findings of research and monitoring
- + assessments of the effectiveness of the implementation of the water resource plan in achieving its planned outcomes
- + an assessment of whether the water resource plan's objectives are effective in achieving sustainable management and the efficient use of water.

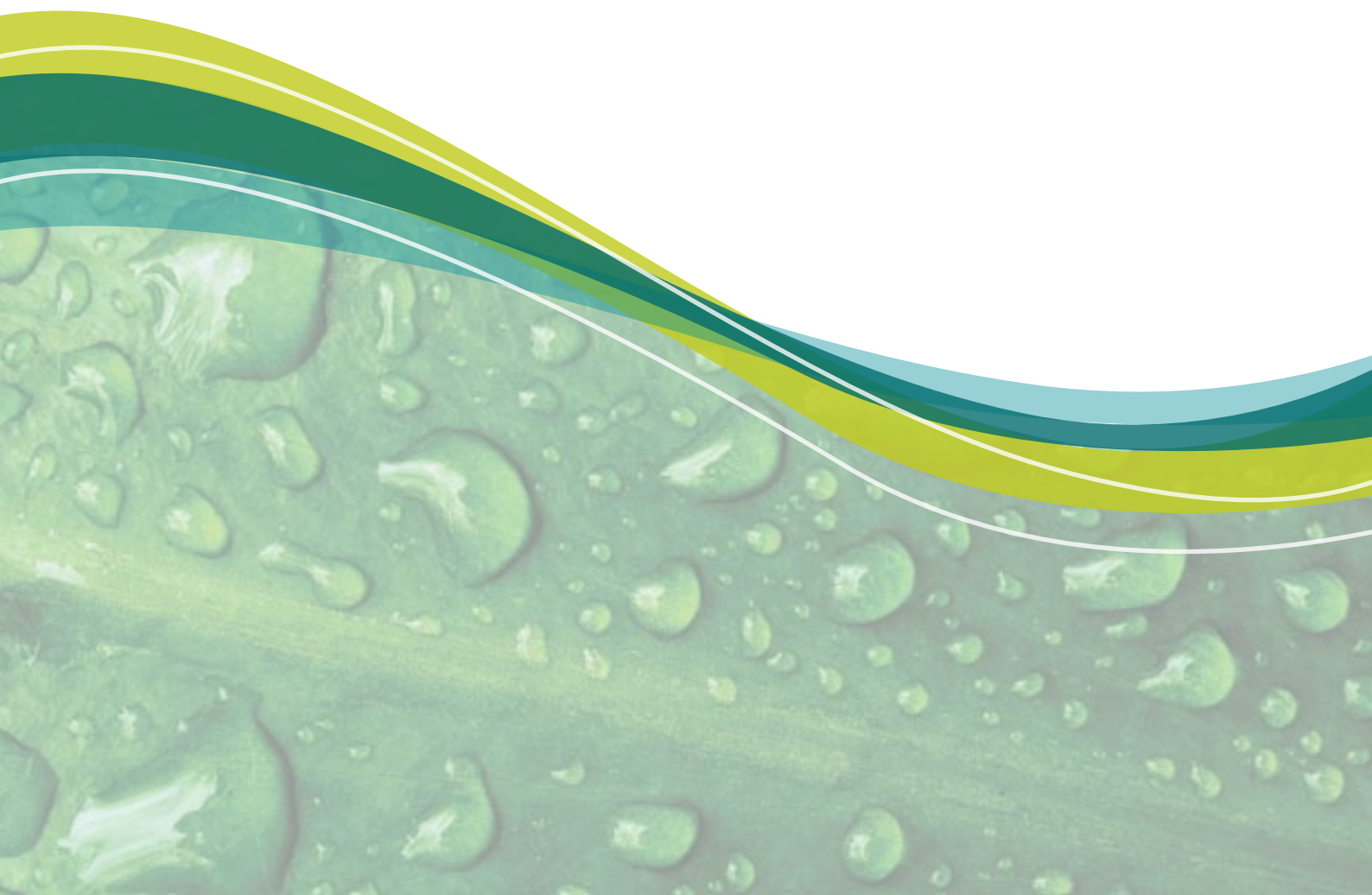
Comments in the minister's report on the effectiveness of environmental flows are currently limited because there is insufficient data to confidently draw conclusions.

Table 34. Queensland: environmental water review processes in water resource plans (30 June 2010)

Water resource plan area	Review of environmental water requirements
Barron	Monitoring of prioritised ecological assets: ribbonweed, in-stream primary production and respiration, stable low-flow spawning fish species (purple spotted gudgeon and eastern rainbowfish).
Border Rivers	Monitoring of prioritised ecological assets: waterholes as refuges, golden perch.
Boyne	Monitoring of prioritised ecological assets: sea mullet, barramundi, waterholes as refuges, estuaries.
Burdekin	Priority assets for monitoring not yet decided.
Burnett	Monitoring of prioritised ecological assets: Queensland lungfish, waterholes as refuges, estuaries.
Calliope	Monitoring of prioritised ecological assets: waterholes as refuges, diadromous fish guild.
Cooper	No specific monitoring undertaken. Monitoring undertaken as part of development of the Lake Eyre Basin Rivers Assessment report card is expected to be adequate.
Condamine and Balonne	Monitoring of prioritised ecological assets: river red gum, golden perch, refuge wetlands. An independent scientific review was conducted in 2009, five years into the water resource plan.
Fitzroy	Monitoring of prioritised ecological assets: Fitzroy golden perch, waterholes as refuges, riffles as habitat.
Georgina and Diamantina	Natural ecosystems monitoring for the condition of riverine habitats, including waterholes and lake ecosystems; stream-bed habitats; upper and in-channel riparian zones; floodplains; wetlands. Uses information from external monitoring programs due to low level of water resource development. No ecological monitoring under the Environmental Flows Assessment Program undertaken.
Gold Coast	Priority assets for monitoring not yet decided.
Great Artesian Basin	Monitoring of prioritised ecological asset: artesian springs.
Gulf	Priority assets for monitoring not yet decided.
Logan	Priority assets for monitoring not yet decided.
Mary	Priority assets for monitoring not yet decided.
Mitchell	Priority assets for monitoring not yet decided.
Moonie	Monitoring of prioritised ecological asset: waterholes as refuges.
Moreton	Priority assets for monitoring not yet decided.
Pioneer	Monitoring of prioritised ecological asset: eel-tailed catfish.
Warrego, Paroo, Bulloo, Nebine	Monitoring of prioritised ecological assets: waterholes as refuges, golden perch.
Whitsunday	Priority assets for monitoring not yet decided.

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9 South Australia

9.1 Summary

Overview of the jurisdiction

South Australia is the fourth largest jurisdiction in area (983 500 km²), with a population of approximately 1 663 900 (at the end of 2009).⁹⁰ The northern area of the state is semi-arid or desert and sparsely inhabited. Almost three-quarters of the state's population lives in the area surrounding Adelaide.

Rainfall across South Australia is very variable. In the south-east, Mt Gambier receives an average annual rainfall of 707 mm and Adelaide receives 542 mm. To the west and north, the Nullarbor has an annual rainfall of 247 mm and Mulka on Lake Eyre receives 122 mm a year.⁹¹ Most rainfall occurs from May to August.

The state has a wide variety of land uses, including livestock grazing, cropping, vegetable and orchard crops, vineyards and timber production.

In South Australia, the statutory instrument that gives authority to take surface or groundwater is the *Natural Resources Management Act 2004* (SA). The major licensed water resource in South Australia is surface water. At 30 June 2010, there were 5227 entitlements in prescribed water course areas (surface water courses, predominantly the River Murray) with a total volume of 834 GL. 4168 entitlements totalling 530 GL were on issue in prescribed wells areas (groundwater),⁹² and a further 18 GL of entitlements were on issue in prescribed water resource areas (surface water, watercourses and groundwater).⁹³

Overview of environmental water management arrangements

The Natural Resources Management Act may, by regulation, prescribe a watercourse, lake or well (s. 125(1)) or declare that a part of the state is a surface water prescribed area (s. 125(2)). To prescribe a watercourse, lake, well or area, the minister must be 'satisfied that the proposed regulation is necessary or desirable for the proper management of the water resource to which it will apply' (s. 125(6)).

When a water resource is prescribed, section 76(1) of the Act requires that a water allocation plan be prepared by one of the eight natural resources management boards (NRM boards) established in South Australia (Figure 19). The prescription may be placed on surface water areas (such as areas of farm dams), groundwater areas (areas of bores and wells) or watercourses (streams and rivers) or a combination of types. A water allocation plan includes objectives for the allocation of water that set out the environmental outcomes sought. The Act specifies that a water allocation plan must include 'an assessment of the quantity and quality of water needed by the ecosystems that depend on the water resource and the times at which, or the periods during which, those ecosystems will need that water' (s. 76(4a)) of the Act).

'Environmental water' is not defined or considered separately in the Natural Resources Management Act, but the Act requires water allocation plans to take the needs of the environment into account when determining the quantity of water available for consumptive use. However, most plans lack detailed commitments for the achievement of environmental water provisions.

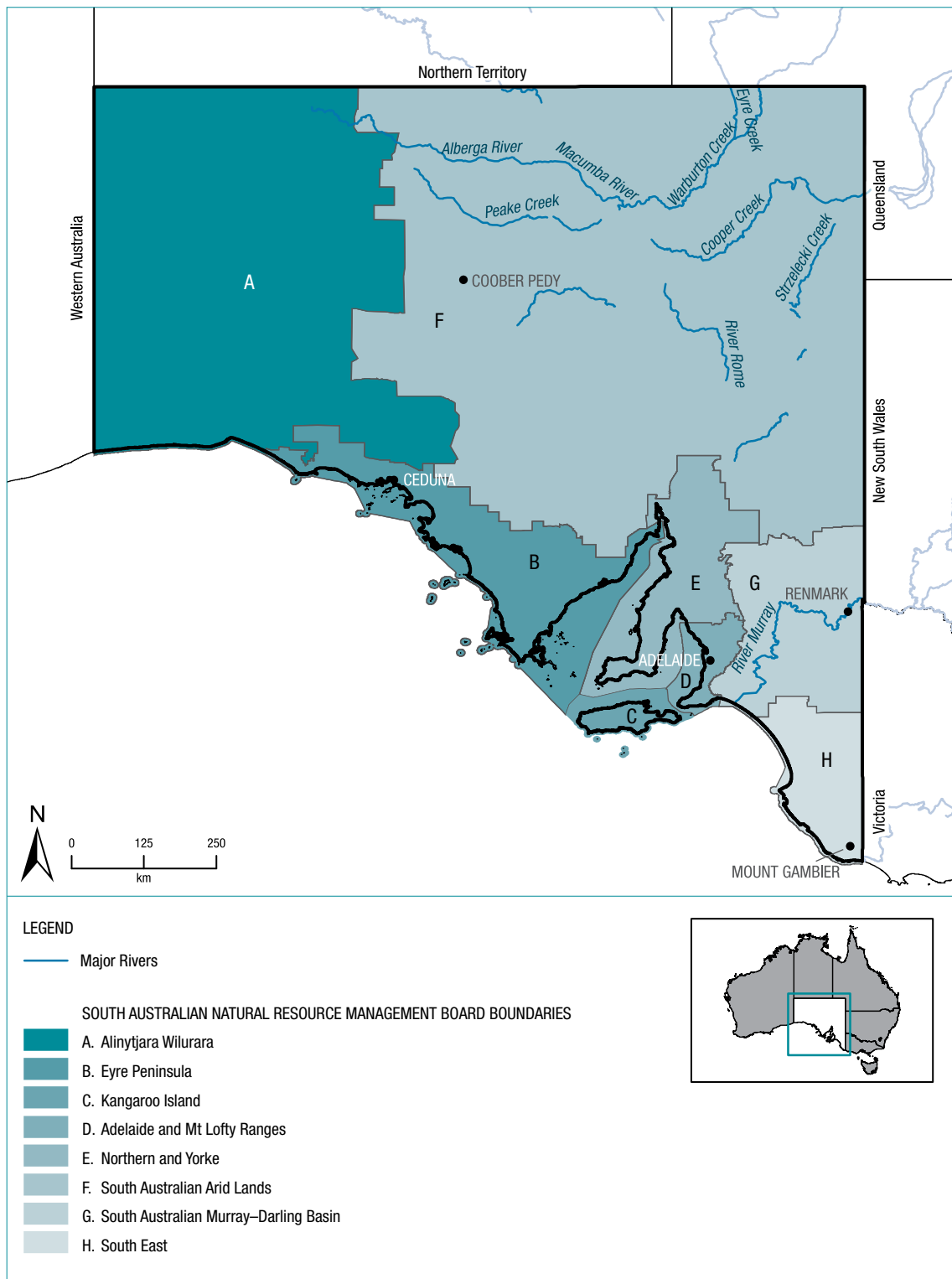
90 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

91 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

92 There were also 72 528 HaE (hectare irrigation equivalents) of entitlements in prescribed wells areas (expressed as area entitlements, not volumes).

93 There was also 2607 Ha of entitlements in prescribed water resource areas (expressed as area entitlements, not volumes).

Figure 19. South Australia: natural resource management boards (30 June 2010)



Source: South Australian Department for Water.

Table 35. South Australia: environmental water statutory framework (30 June 2010)

Legislation	<i>Natural Resources Management Act 2004 (SA)</i> <i>Water Resources Act 1997 (SA)</i> <i>Lake Eyre Basin (Intergovernmental Agreement) Act 2001 (SA)</i>
Responsible minister	Minister for Environment and Conservation Minister for the River Murray
Environmental water manager	Department of Water, Land and Biodiversity Conservation (from 1 July 2010, the Department for Water).
Other relevant institutions	Regional natural resource management boards Lake Eyre Basin Ministerial Forum Lake Eyre Basin Intergovernmental Agreement
Method of securing environmental water	Planned: Planned environmental water is not explicitly defined; however, statutory water allocation plans contain rules that achieve environmental objectives. Water allocations under water allocation plans can specify an environmental purpose. Held: Environmental water is also secured through The Living Murray and Commonwealth Environmental Water Holder programs. Minor volumes may be donated from private holdings.

Table 36. South Australia: environmental water terminology (30 June 2010)

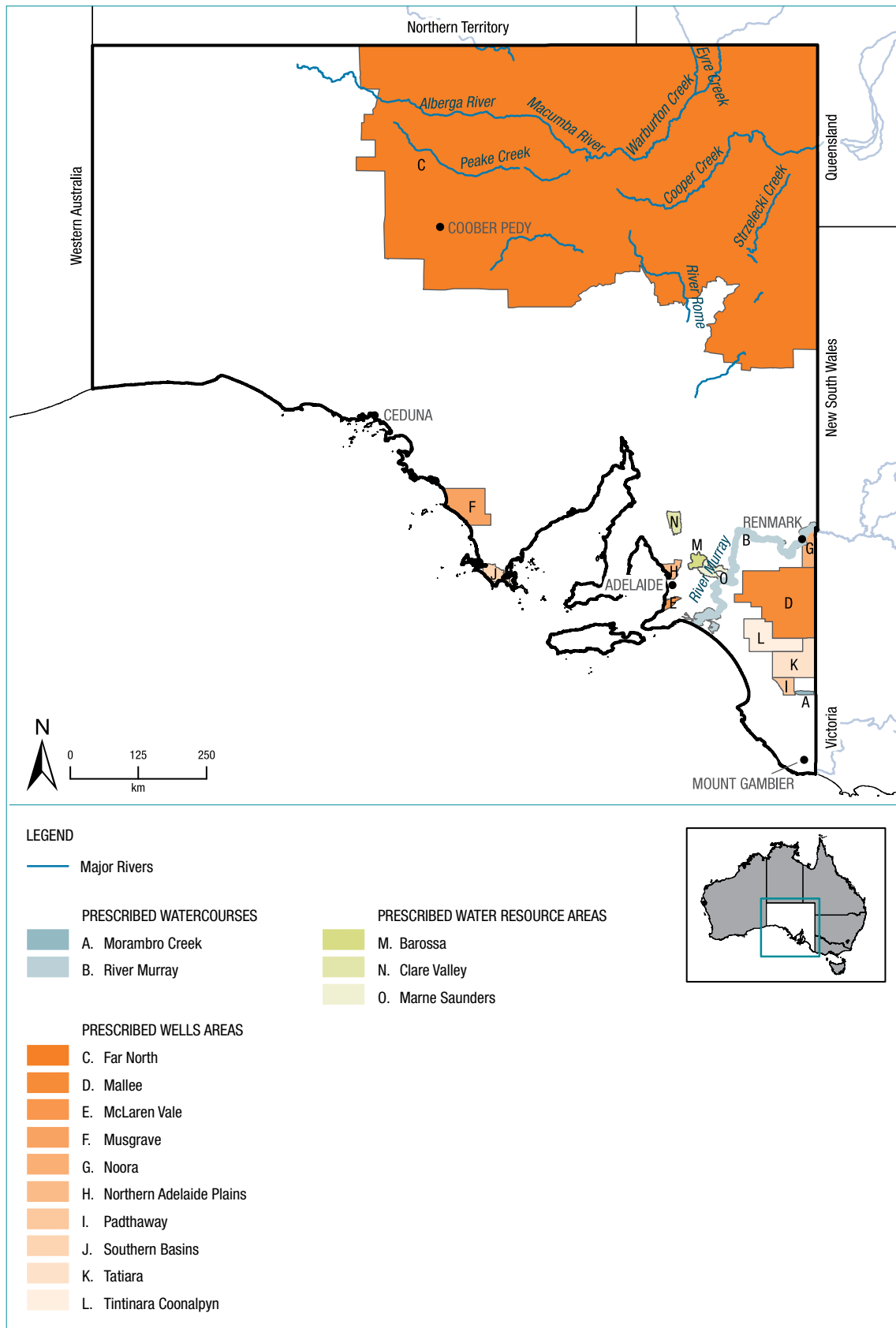
Term	Type	Definition and National Water Initiative equivalent
Prescription of water resources	Management tool	An area is prescribed under the Act when the level of water use in an area indicates that regulatory control is needed to secure sustainable management and support water-dependent ecosystems. The prescription is administered by the Department of Water, Land and Biodiversity Conservation (from 1 July 2010, the Department for Water).
Water resource management areas	Management area	'Prescribed' management areas under the Act. Once a water resource is prescribed, users need authorisation by licence or some other approval to extract water.
Water allocation plan	Management tool	Water allocation plans set the principles or rules under which consumptive pools, entitlements and allocations are created. The Act requires that the water needs of the environment must be taken into account when determining the quantity of water available for consumptive use.
Environmental water requirement	Management input	The water regime needed to sustain the ecological values of aquatic ecosystems at a low level of risk.
Environmental water provisions	Management output	The portion of environmental water requirements that can be met at any given time, taking into account existing users' rights as well as the social and economic impacts of limiting extractions.
Water allocation	Management tool	Endorsed on a water licence; gives access to a maximum volume of water annually.
Water licence	Statutory instrument	Entitles the licence holder to take water from a watercourse, lake or well or to take water from a surface water prescribed area.

Water allocation plans provide principles and rules that allocate water between consumptive and non-consumptive uses. Although water is not distinctly labelled as environmental or otherwise, environmental water is provided through the creation of these rules. Water allocations are normally specified by volume and purpose, and can have a designated purpose related to uses such as for environmental benefits. Environmental water provisions are recognised under legislation but are not tradable, unlike consumptive water licences and allocations. Licences can include one or more water allocations, which are ongoing rights to water in a designated water source. Water allocations can have a designated purpose related to uses such as for environmental benefits.

Substantial water allocations for the environment exist in the River Murray Prescribed Watercourse. Most are held by government agencies, but a few are held privately. There are also a small number of environmental water allocations in other areas. All water allocations, including environmental purpose water allocations, are recorded in the Water Information and Licensing Management Application (WILMA) register, which is maintained by the Department for Water. The information in the register is publicly available, but it is not accessible via the internet.

There are currently 27 prescribed water resources in South Australia. The regions and their associated plans are shown in Figure 20 and listed in Table 37. Of the 27 water allocation plans in Table 37, 15 have been completed.

Figure 20. South Australia: water allocation plan areas (30 June 2010)



Source: South Australian Department for Water.

Table 37. South Australia: water management planning (30 June 2010)

Region / NRM Board	Water allocation plan	Water resource prescribed (and date of water allocation plan)	Status and comment
Adelaide and Mount Lofty Ranges	Barossa Prescribed Water Resource Area	Groundwater (2009) Watercourses (2009) Surface water (2009)	Covers groundwater, surface water and watercourses in the prescribed area approximately 60 kilometres north-east of Adelaide. Review due June 2014.
	<i>Central Adelaide Prescribed Wells Area</i>	<i>Groundwater</i>	<i>No plan. Process commenced 2008, adoption 2013.</i>
	<i>Chapmans Creek Intake</i>	<i>Watercourses</i>	<i>No plan.</i>
	<i>Dry Creek Prescribed Wells Area</i>	<i>Groundwater</i>	<i>No plan.</i>
	<i>Little Para Prescribed Watercourse</i>	<i>Watercourses</i>	<i>No plan. To be included in Western Mount Lofty Ranges Plan.</i>
	McLaren Vale Prescribed Wells Area	Groundwater (2007)	Covers groundwater in the prescribed area centred on McLaren Vale, 40 kilometres south of Adelaide. Review will involve rolling plan into Western Mount Lofty Ranges Plan.
	<i>Middle Beach Intake</i>	<i>Watercourses</i>	<i>No plan.</i>
	Northern Adelaide Plains Prescribed Wells Area	Groundwater (2000)	Covers groundwater in the prescribed area approximately 30 kilometres north-east of Adelaide. Review due 2013. To be combined with the plan for the Central Adelaide Wells Board.
	<i>Northern Intake</i>	<i>Watercourse</i>	<i>No plan.</i>
Eyre Peninsula	<i>Western Mount Lofty Ranges</i>	<i>Groundwater</i> <i>Watercourses</i> <i>Surface water</i>	<i>No plan. Due June 2011.</i>
	Musgrave Prescribed Wells Area	Groundwater (2001)	Original plan prepared in 2001; review in June 2006. Covers groundwater in the prescribed area 180 kilometres north-west of Port Lincoln. Review due 2012. To be combined with the amended Southern Basins.
	Southern Basins Prescribed Wells Area	Groundwater (2000)	Original plan prepared in 2000, with review in June 2006. Covers groundwater in the prescribed area south-west of Port Lincoln. Review due 2012. To be combined with amended Musgrave plan.
Northern and Yorke	<i>Baroota Prescribed Water Resources Area</i>	<i>Groundwater</i> <i>Watercourses</i> <i>Surface water</i>	<i>No plan. Due late 2011.</i>
	Clare Valley Prescribed Water Resources Area	Groundwater (2009) Watercourses (2009) Surface Water (2009)	Covers groundwater, surface water and watercourses in the prescribed area approximately 100 kilometres north of Adelaide. Review due 2014.
SA Arid Lands	Far North Prescribed Wells Area	Groundwater (2009)	Covers groundwater in the prescribed area in the north-east, covering some 32% of the state. Review due 2014.

Region / NRM Board	Water allocation plan	Water resource prescribed (and date of water allocation plan)	Status and comment
SA Murray Darling Basin	<i>Angas Bremer Prescribed Wells Area</i>	<i>Groundwater</i>	<i>No plan. Being incorporated into the Eastern Mount Lofty Ranges plan. Due 2011.</i>
	Mallee Prescribed Wells Area	Groundwater (2000)	Covers groundwater in the prescribed area 150 kilometres east of Adelaide. Review due 2011.
	River Murray Prescribed Watercourse	Watercourses (2009)	Covers the River Murray and associated watercourses. Review due 2013, after release of Murray–Darling Basin Plan.
	Noora Prescribed Wells Area	Groundwater (2001)	Covers groundwater in the prescribed area in north-east South Australia to the east of Renmark. Review late 2010.
	<i>Peake, Roby and Sherlock Prescribed Wells Area</i>	<i>Groundwater</i>	<i>No plan. Due late 2010.</i>
	Marne Saunders Prescribed Water Resources Area	Groundwater, Watercourses Surface water (2010)	Covers groundwater, surface water and watercourses in the prescribed area approximately 70 kilometres north-east of Adelaide. Review due 2015.
	<i>Eastern Mount Lofty Ranges</i>	<i>Groundwater Watercourses Surface water</i>	<i>No plan. Due 2011.</i>
South East	Padthaway Prescribed Wells Area	Groundwater (2009)	Covers groundwater in the prescribed area 150 kilometres north of Mt Gambier. Review due 2014.
	Tatiara Prescribed Wells Area	Groundwater (2010)	Covers groundwater in the prescribed area 200 kilometres north of Mt Gambier. Review due 2015.
	Tintinara Coonalpyn Prescribed Area	Groundwater (2003)	Covers groundwater in the prescribed area 200 kilometres south-east of Adelaide. Review due 2011.
	<i>Lower Limestone Coast Prescribed Wells Area</i>	<i>Groundwater</i>	<i>In preparation since 2004. Original area comprises Comaun–Caroline, Lacepede–Kongorong and Naracoorte Ranges.</i>
	Morambro Creek	Surface water, watercourses (2006)	Covers surface water and watercourses in the prescribed area in the upper south-east of South Australia near Frances, 140 kilometres north of Mt Gambier. Review due 2011.

Note: Plans under development at 30 June 2010 are shaded.

River Murray Prescribed Watercourse

The management of water resources for the River Murray Prescribed Watercourse is recognised as a special case and is regulated through the *River Murray Act 2003* (SA). The River Murray Environmental Manager function was assigned to the South Australian Murray–Darling Basin NRM Board in October 2005. The environmental manager coordinated all environmental watering activities within the South Australian River Murray. This included the delivery, allocation and management of environmental water and Living Murray Icon site management. The environmental manager also had a key advocacy role in Murray–Darling Basin forums, facilitated environmental water donations and encouraged community involvement in flow management.

As a result of the Commonwealth *Water Act 2007* and the establishment of the Murray–Darling Basin Authority, the function of the Environmental Water Manager for the River Murray moved to the Department of Water, Land and Biodiversity Conservation (now the Department for Water).

Unbundling of water licences

From 1 July 2009, the *Natural Resources Management (Water Resources and other matters) Amendment Act 2007* (SA) enabled the unbundling of existing water licences in South Australia. Water rights and approvals had previously been reflected on a single water licence. The primary objective of this reform was to facilitate more efficient water trade in and between the states.

The legislative change means that water rights and approvals will be progressively unbundled and managed as four new and separate instruments:

1. *water access entitlement*—the ongoing right to a specified share of the water resource; an asset that can be sold or transferred
2. *water allocation*—the right to take a specific volume of water for a given period of time, not exceeding 12 months, based on the volume of water available in that period; also an asset that can be sold or transferred
3. *water resource works approval*—a permission to take water, from a prescribed resource, at a particular point, in a particular manner
4. *site use approval*—a permission to use water, taken from a prescribed resource, at a particular site, in a particular manner.⁹⁴

Nine classes of water access entitlement have been defined in South Australia: they reflect the different reliability and transferability attributes of the current water allocations. The classes align to former individual purpose-based allocations or to groupings of them. Class 7 (Environment) and Class 9 (Wetlands) relate to environmental water.

Water allocations issued pursuant to a Class 9 entitlement are for use in wetlands for which a management plan has been adopted. Water is used for wetland management if it will have (or will be likely to have) environmental benefits, for example in the River Murray Water Allocation Plan. Although the 2009 reforms unbundled water from land, Class 9 water access entitlements continue to be restricted to being taken and used on wetlands.

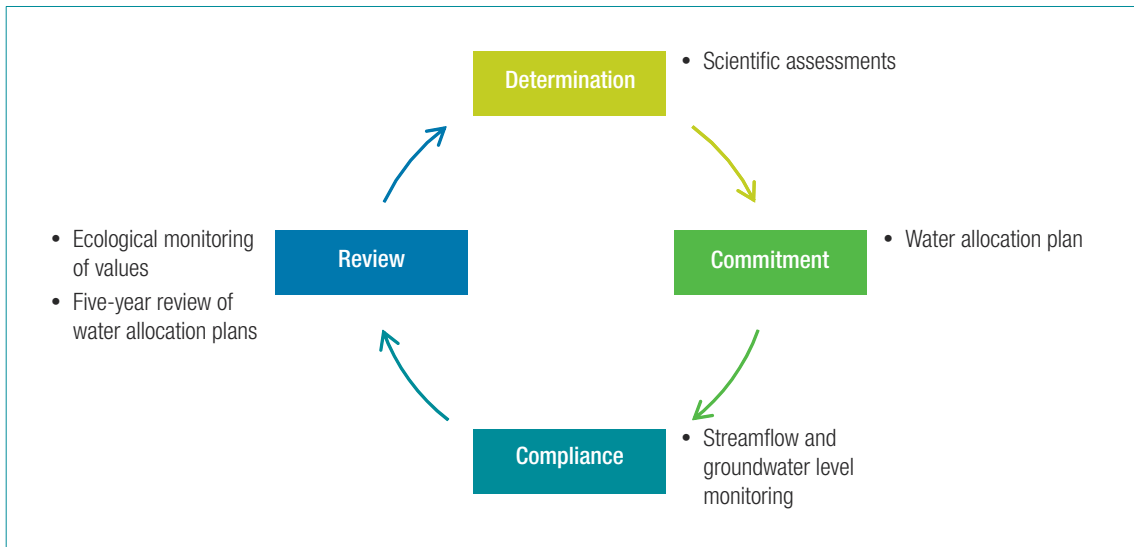
In the unbundled South Australian system, a limited number of unit shares is assigned to each class of water access entitlement. The minister determines the volume of water available to be allocated to each class of water access entitlement, taking into account prevailing conditions. The maximum volume that can be assigned to a class of entitlement is 1 kilolitre per unit share. Class 9 entitlements are eligible for more than 1 kilolitre per unit share in times of above entitlement flow to South Australia, as set out in the water allocation plan.

This reform is being progressively implemented across the state. River Murray water licence holders transitioned to the unbundled operating environment from 1 July 2009, and amendments to the River Murray Water Allocation Plan reflect those changes. Other areas of the state will follow between 2010 and 2014.

The four elements of the environmental water management framework are applied to South Australia in sections 9.2–9.5 and summarised in Figure 21.

94 Available from the South Australian Department for Water website:
<http://www.waterforgood.sa.gov.au/rivers-reservoirs-aquifers/river-murray/unbundling-water-rights/explaining-water-access-entitlement-classes/>

Figure 21. South Australia: summary environmental water management framework (30 June 2010)



9.2 Determination of environmental water

Environmental water requirements and provisions (2007 discussion paper)

The Adelaide and Mount Lofty NRM Board published a discussion paper, *Environmental water requirements and provisions*, in 2007.⁹⁵ The paper outlines a suite of water-dependent ecosystem requirements in different parts of the catchment and management options for meeting those requirements. Public consultation was continuing at 30 June 2010; when completed, it is intended that the chosen options will be applied across the state.

Defining environmental water

'Environmental water' is not defined or considered separately in the Natural Resources Management Act. The South Australian State Natural Resources Management Plan 2006 describes water for the environment as 'a catch-all phrase that describes environmental water requirements and provisions'.⁹⁶

There is no standard, state-wide approach in South Australia for determining environmental water requirements. In a water allocation plan, either new studies or previous reports, such as environmental water requirement assessments and surface water budgets, are used to provide an understanding of environmental water requirements in the plan area. Water allocation plans may include sustainable levels of extraction relating to environmental water requirements for GDEs.

This approach was outlined by the former Department for Water Resources in 2000, which stated that:

environmental water provisions will be determined on the best available scientific information. Where scientific understanding of environmental water requirements is limited, a conservative approach, based on the precautionary principle, will be used in determining water allocations and management arrangements.⁹⁷

95 Adelaide and Mount Lofty Ranges NRM Board, *Environmental water requirements and provisions discussion*, 2007, paper 3.

96 Department of Water, Land and Biodiversity Conservation, *State Natural Resources Management Plan 2006*, Government of South Australia, 2006, Glossary, p. 74.

97 Department for Water Resources, *State Water Plan 2000—South Australia. Volume 1: Policies for a sustainable future*, South Australian Government, 2000.

Table 38. South Australia: definition of environmental water requirements in water allocation plans (30 June 2010)

Water allocation plan	Defining environmental water requirements	
	Groundwater	Surface water
Barossa Prescribed Water Resource Area	No GDEs or associated water requirements defined.	Recommendations for six ecologically significant flow bands set in three reaches
McLaren Vale Prescribed Wells Area	Water quantity and quality requirements defined for priority GDEs.	Not applicable
Northern Adelaide Plains Prescribed Wells Area	Shallow aquifer recharge requirements defined.	Not applicable
Musgrave Prescribed Wells Area	Water quantity and quality requirements defined for priority GDEs as a percentage of annual recharge.	Not applicable
Southern Basins Prescribed Wells Area	Water quantity and quality requirements defined for priority GDEs as a percentage of annual recharge.	Not applicable
Clare Valley Prescribed Water Resources Area	Water quantity and quality requirements defined for priority GDEs, such as vegetation, fish and frogs.	Recommendations for six ecologically significant flow bands and for different geomorphic zones
Far North Prescribed Wells Area	Water quantity requirements defined for springs. Bore-fed wetlands identified, but environmental water requirements not defined.	Not applicable
Mallee Prescribed Wells Area	Aquifer too deep to support terrestrial vegetation or wetlands. No evidence of groundwater ecosystems.	Not applicable
River Murray Prescribed Watercourse	Not applicable	Water quantity and quality requirements defined for River Murray, Lower Lakes, wetlands and the floodplain
Noora Prescribed Wells Area	Saline ecosystems (GDEs) identified, but water quality and quantity requirements not defined.	Not applicable
Marne Saunders Prescribed Water Resources Area	No GDEs or associated water requirements defined.	Water quantity and quality requirements comprehensively defined
Padthaway Prescribed Wells Area	Water quantity requirements defined for GDEs, including karst, streams, wetlands and phreatophytic vegetation (plants that derive their water from groundwater).	Not applicable
Tatiara Prescribed Wells Area	Water quantity requirements defined for GDEs, including karst, streams, wetlands and phreatophytic vegetation.	Not applicable
Tintinara Coonalpyn Prescribed Wells Area	Water requirements defined for priority GDEs in Coastal Plain and Mallee Highlands land units.	Not applicable
Morambro Creek and Nyroca Channel prescribed watercourses, including Cockatoo Lake and the prescribed surface water area	Not applicable.	Water quantity and quality requirements defined for eight reaches based on channel structure and capacity, catchment area, soil types and vegetation

9.3 Commitment of environmental water

Commitment of environmental water to the requirements of water-dependent ecosystems is generally indirect in South Australia. Water requirements are generally met by limiting extraction under licences through annual allocation limits. In addition to allocation limits, water allocation plans also include a suite of water allocation criteria and transfer rules to help achieve sustainable management of the resource (Table 39).

Table 39. South Australia: environmental water commitment in water allocation plans (30 June 2010)

Water allocation plan	Environmental water commitment	
	Groundwater	Surface water
Barossa Prescribed Water Resource Area	No explicit commitment; a series of management principles	A suite of management principles
McLaren Vale Prescribed Wells Area	Annual allocation limit	Not applicable
Northern Adelaide Plains Prescribed Wells Area	Annual allocation limit	Not applicable
Musgrave Prescribed Wells Area	Annual allocation limit based on the average annual recharge	Not applicable
Southern Basins Prescribed Wells Area	Annual allocation limit based on the average annual recharge	Not applicable
Clare Valley Prescribed Water Resources Area	Water allocation criteria defined	Water allocation criteria defined
Far North Prescribed Wells Area	Allocation limits defined	Not applicable
Mallee Prescribed Wells Area	No explicit commitment; a series of management principles	Not applicable
River Murray Prescribed Watercourse	Not applicable	Annual allocations announced by minister and linked to entitlement class
Noora Prescribed Wells Area	Annual allocation limit	Not applicable
Marne Saunders Prescribed Water Resources Area	Allocation limits and extraction rules are set for each relevant aquifer	Allocation rules defined to aid sustainable water use and outline available runoff limits
Padthaway Prescribed Wells Area	'Acceptable level of extraction' was developed to maintain the condition of the resource (salinity levels and depth to watertable)	Not applicable
Tatiara Prescribed Wells Area	A number of allocation rules protect groundwater-dependent ecosystems	Not applicable
Tintinara Coonalpyn Prescribed Wells Area	Annual allocation limit	Not applicable
Morambro Creek and Nyroca Channel prescribed watercourses including Cockatoo Lake and the prescribed surface water area	Not applicable	Allocation rules defined to prevent changes to hydrological regime; in particular, a long-term reduction of more than 15% in the frequency, occurrence and duration of flows in each management area

9.4 Compliance with environmental water delivery

As part of the State NRM Plan 2006, South Australia has outlined a monitoring and evaluation framework that relates to NRM boards. The framework stipulates that all NRM plans, programs and projects are required to have a monitoring and reporting element that will inform strategic planning in the future. The State NRM Plan is reviewed every five years, and regional NRM boards have corresponding specific programs for monitoring.

Water allocation plans are therefore required to include provision for monitoring of the water resource. That information is used in five-yearly reviews of the water allocation plans, and may be published in technical reports associated with the reviews. Monitoring is not necessarily prescribed to target the effects of environmental water but instead aims to monitor the resource and its management as a whole. A number of recent water allocation plans outline extensive monitoring and reporting programs. Most water allocation plans developed prior to the 2006 State NRM Plan focus on monitoring water level and use as a whole, not water-dependent ecosystems independently.

Table 40. South Australia: environmental water compliance in water allocation plans (30 June 2010)

Water allocation plan	Compliance reporting requirement
Barossa Prescribed Water Resource Area	<p>Continuous streamflow data will be evaluated and reported on once in every three years.</p> <p>Monitoring of river health undertaken in the accordance with the protocols defined by Quantifying Health in Ephemeral Rivers Project.</p> <p>Underground water:</p> <ul style="list-style-type: none"> + monitor wells in lower, fractured and rock aquifer systems + monitor and record water level every three months + monitor salinity levels at beginning and end of irrigation season.
McLaren Vale Prescribed Wells Area	<p>Monitoring of underground water quantity and quality on annual basis.</p> <p>Water allocation plan states that resource condition indicators are to be prepared and implemented under a detailed underground ecosystem monitoring program in accordance with the National Natural Resource Management Monitoring and Evaluation Framework. Plan to be reviewed 2014.</p>
Northern Adelaide Plains Prescribed Wells Area	<p>Monitoring of underground water and salinity levels is outlined.</p>
Musgrave Prescribed Wells Area	<p>A defined monitoring program includes a number of ecologically significant facets of the prescribed area, including:</p> <ul style="list-style-type: none"> + environmental indicators, water level and quality measurements at points associated with significant ecosystems and underground water discharge points + biodiversity indicators (including macro-invertebrates) + variations in vegetation + salinity levels.
Southern Basins Prescribed Wells Area	<p>Extensive monitoring program outlined, including a number of environmental indicators associated with underground water-dependent ecosystems.</p> <p>Annual report on monitoring outcomes.</p>
Clare Valley Prescribed Water Resources Area	<p>Seven stream-flow and water quality monitoring sites throughout prescribed area.</p> <p>Monitoring network of underground water through catchment.</p>
Far North Prescribed Wells Area	<p>Monitoring program of underground water quality and quantity is outlined.</p> <p>Monitoring results are reported annually.</p>
Mallee Prescribed Wells Area	<p>Monitoring of quantity and quality of underground water is outlined.</p> <p>An annual water use report is produced.</p>

Water allocation plan	Compliance reporting requirement
River Murray Prescribed Watercourse	Water quantity and quality are continuously monitored.
Noora Prescribed Wells Area	Monitoring system in place in the Murray Group Limestone Aquifer for quantity and quality. No annual water report—suggested for inclusion in 2006 review.
Marne Saunders Prescribed Water Resources Area	An extensive monitoring program of water quantity and quality is outlined. This also includes water used for water-dependent ecosystems. A monitoring and reporting program must be defined by a licensee to assess water use for dependent ecosystems.
Padthaway Prescribed Wells Area	A comprehensive monitoring and evaluation program is outlined, considering the ecological and hydrological performance of the prescribed wells area. It was proposed to be consistent with the national Natural Resource Management Monitoring and Evaluation Framework and to be implemented through an investigations program in the NRM Plan.
Tatiara Prescribed Wells Area	A monitoring program for the water-dependent ecosystems has been defined, consistent with the National Natural Resource Management Monitoring and Evaluation Framework resource condition indicators. A number of water quality and quantity parameters are outlined to be measured, recorded, evaluated and reported on.
Tintinara Coonalpyn Prescribed Wells Area	Salinity and water level monitoring networks in place—measured quarterly or six-monthly. A series of parameters is outlined for inclusion in a program to monitor and evaluate the needs of water-dependent ecosystems.
Morambro Creek and Nyroca Channel prescribed watercourses including Cockatoo Lake and the prescribed surface water area	An ecological and hydrological monitoring program is recommended for the Morambro Creek prescribed area. It is focused on comparing the desired management outcomes with actual outcomes to evaluate the effectiveness and efficiency of water provisions. Water quantity and quality are monitored continuously throughout the year and for each flow event.

9.5 Review of environmental water

On-ground monitoring within the Murray–Darling Basin portion of the state is undertaken by the South Australian Murray–Darling Basin NRM Board. The *Monitoring, evaluation and reporting framework for the South Australian Murray–Darling Basin* describes the framework in detail.⁹⁸ The Living Murray Initiative is reviewed annually and the State Water Plan suggests that reviews of all environmental water provisions be undertaken at least in five-year cycles.

Water allocation plans generally focus monitoring programs on baseline monitoring for ecological values. Water quantity and quality are often measured in conjunction with the monitoring programs, with the primary aim of assessing the upper and lower limits required to maintain ecological function. Monitoring required at each wetland site is outlined in the relevant wetland management plan, and all the plans are available online.⁹⁹ These monitoring programs are based on the *Your wetland: monitoring manual*¹⁰⁰ and its accompanying documents, but are dependent on the specific objectives and watering regime at the site.

98 D McKane, L Schapel, J Kirk, P O'Connor and A Goodman, *Monitoring, evaluation and reporting framework for the South Australian Murray–Darling Basin*, South Australian Murray–Darling Basin Integrated Natural Resource Management Group, 2005.

99 Available at the South Australian Murray–Darling Basin Natural Resource Management Board website: <http://www.samdbnrm.sa.gov.au/BoardProjects/RiverMurrayEnvironmentManager/WetlandManagementPlans.aspx>

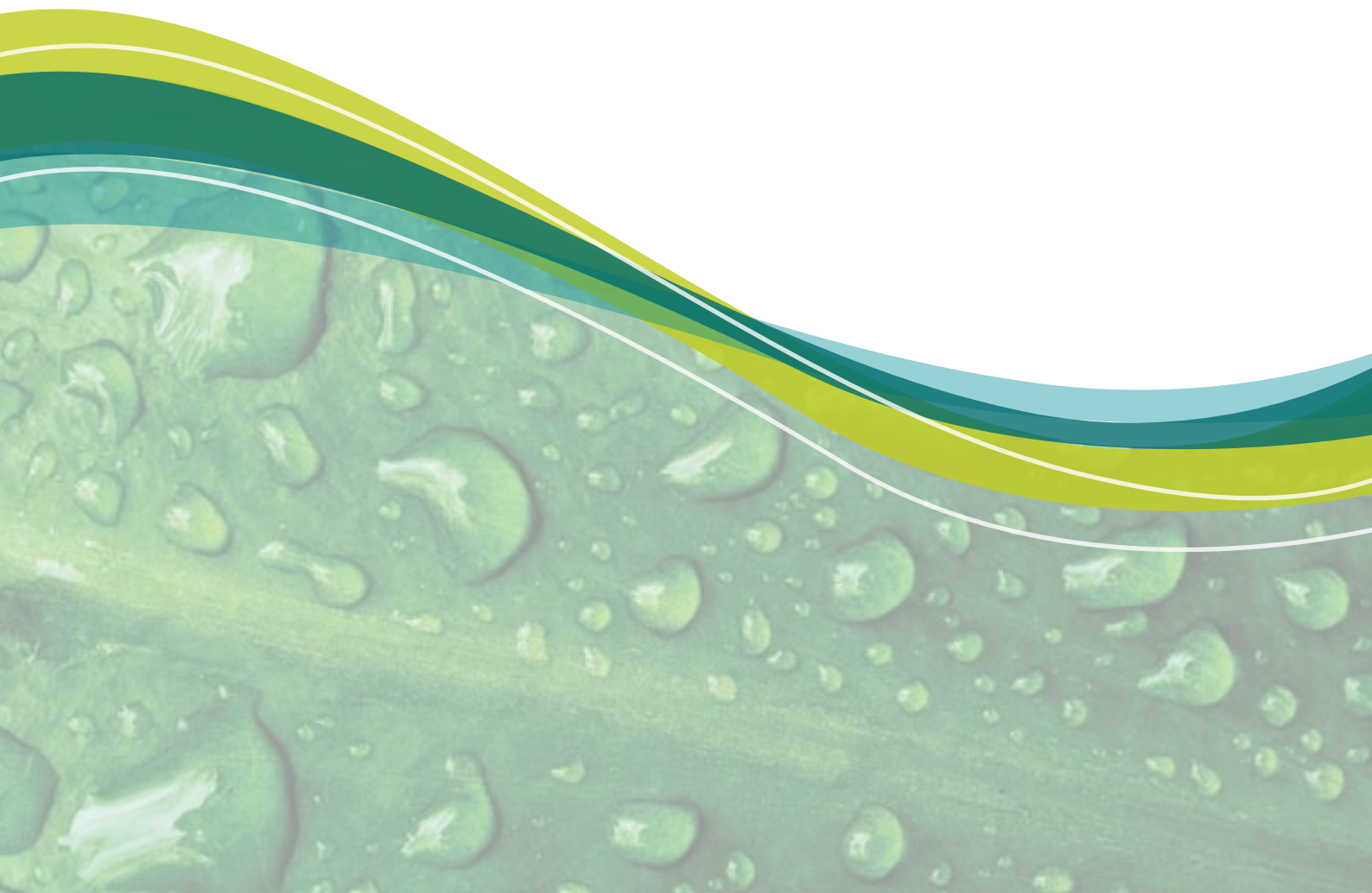
100 Available at the South Australian Murray–Darling Basin Natural Resource Management Board website: <http://www.samdbnrm.sa.gov.au/Portals/7/Monitoring%20Manual.pdf>

Table 41. South Australia: environmental water review processes in water allocation plans (30 June 2010)

Water allocation plan	Review of environmental water requirements in plan
Barossa Prescribed Water Resource Area	Five-year review of the water allocation plan due in June 2014. Results of river health monitoring will be evaluated and reported once in every three years. Regional underground water status report will be produced every two years.
McLaren Vale Prescribed Wells Area	Reviews of monitoring program results on annual basis. Plan to be incorporated with the Western Mount Lofty Ranges Plan in late 2010.
Northern Adelaide Plains Prescribed Wells Area	No review schedule of environmental impacts set in plan. Water allocation plan to be reviewed in 2013.
Musgrave Prescribed Wells Area	2006 review found that information on the water-dependent ecosystems and how they were monitored was very general and should be strengthened. New plan due in 2012.
Southern Basins Prescribed Wells Area	Although there is an extensive monitoring program outlined, there is little information on a review process. Five-year review of the plan stated that the environmental allocation was too broad and volumes needed to be refined. Water-dependent ecosystems need to be identified and benchmarked.
Clare Valley Prescribed Water Resources Area	Biennial evaluation by NRM Board.
Far North Prescribed Wells Area	Review of water allocation plan due in 2014.
Mallee Prescribed Wells Area	Water allocation plan currently under review. Due in 2011.
River Murray Prescribed Watercourse	Annual review of monitoring data.
Noora Prescribed Wells Area	2006 review suggested monitoring ecosystem health. Will require further investigation into resourcing, monitoring techniques and potential programs. Updated water allocation plan due in late 2010.
Marne Saunders Prescribed Water Resources Area	An extensive evaluation process is set out for water-dependent ecosystems. Monitoring triggers are defined for underground water, watercourse and surface water use. Each ecologically significant trigger (12 in total) is to be evaluated every two years.
Padthaway Prescribed Wells Area	Quarterly monitoring on underground water levels and salinity.
Tatiara Prescribed Wells Area	An annual monitoring and evaluation program is defined for water-dependent ecosystems, as well as water quality and quantity. Identification of knowledge gaps and further research into the needs of water-dependent ecosystems is required to consolidate sustainable water use in the future.
Tintinara Coonalpyn Prescribed Wells Area	An annual water report on water quality and quantity is outlined. The need for and components of a monitoring and evaluation program of ecosystem needs are outlined.
Morambro Creek and Nyroca Channel prescribed watercourses including Cockatoo Lake and the prescribed surface water area	A set of hydrological and ecosystem parameters has been outlined for the evaluation of whether the policies in the plan protect the needs of the water-dependent ecosystems.

10 Tasmania

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10 Tasmania

10.1 Summary

Overview of the jurisdiction

Tasmania is the second smallest Australian jurisdiction in area (68 400 km², including islands), with an estimated population of 505 400 (at the end of 2009¹⁰¹). Compared to the remainder of Australia, it has relatively high relief, resulting in a number of small discrete surface water catchments with little interconnection. Average annual rainfall across Tasmania is quite variable. On the western side, rainfall increases from around 1458 mm at Strahan on the south-west coast and 1064 mm at Marrawah in the north-west, up to 2690 mm at Cradle Valley in the highlands. On the east and north coasts, rainfall averages are lower, in the order of 566 mm in Hobart and 676 mm at Launceston.¹⁰²

There are approximately 157 000 kilometres of rivers in Tasmania. Widespread hydro-electricity development in the central highlands has resulted in an extensive network of dams and power generation infrastructure. Other major water uses are for irrigation and domestic supply, mostly from surface water sources.

In Tasmania, two statutory instruments give legal authority to take surface water or groundwater: water licences under the *Water Management Act 1999* (Tas.) and irrigation rights under the *Irrigation Clauses Act 1973* (Tas.). At 30 June 2010, there were 8560 surface water entitlements with a total volume of 1650 GL on issue in Tasmania. There is currently no licensing system established for the taking of groundwater in Tasmania.

Overview of environmental water management arrangements

In Tasmania, the Water Management Act provides for the identification and sustainable management of water for ecosystems. Section 6 of the Act notes that:

the objectives of this Act are to further the objectives of the resource management and planning system of Tasmania ...

The relevant objective is:

to promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity.

The Department of Primary Industries, Parks, Water and Environment is primarily responsible for the management of water resources in Tasmania. The department's overall objective for environmental flow recommendations is to provide water for riverine ecosystems that allows them to function as healthy systems.

The Tasmanian approach to environmental water management is to limit the amount of water extracted from river systems through the provisions of the Water Management Act (in particular, through the system of water entitlements). Water management plans provide the basis for determining how those provisions are to be applied for a particular water resource to meet environmental and other objectives set out in each plan (see Table 44).

The Act requires water management plans to identify ecosystem water requirements, water management rules and any likely detrimental effects resulting from water extraction. In addition, water management plans include monitoring arrangements to assess the effectiveness of the rules in place.

101 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

102 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

Table 42. Tasmania: environmental water statutory framework (30 June 2010)

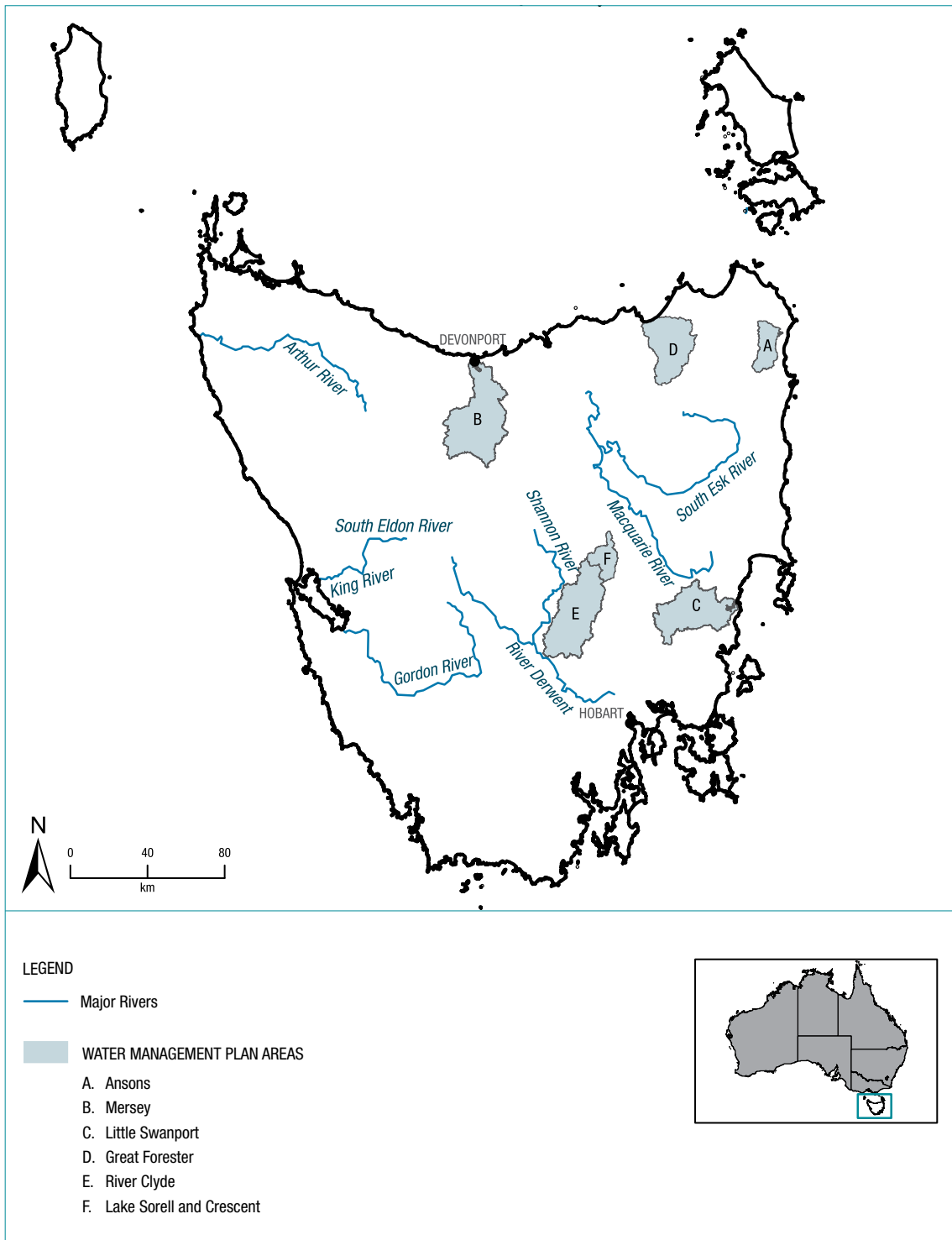
Legislation	<i>Water Management Act 1999 (Tas.)</i>
Responsible minister	Minister for Primary Industries and Water
Environmental water manager	Department of Primary Industries, Parks, Water and Environment
Other relevant institutions	Hydro Tasmania
Method of securing environmental water	Planned: water management plans and issuing of entitlements under the Act

Table 43. Tasmania: environmental water terminology (30 June 2010)

Term	Type	Definition
Water management plan	Management tool	Water management plans are developed in consultation with stakeholders to ensure the sustainable development and management of a water resource.
Sustainable water allocation limits	Management tool	Limits on the maximum volume of water that can be extracted from a catchment.
Water licence	Statutory instrument	The statutory instrument under the Act for managing access to the water resource (watercourse, lake or well). Licences are issued by the Department of Primary Industries, Parks, Water and Environment.
Water allocation	Management tool	A quantity of water that a licensee is entitled to take and use under a water licence.
Surety level	Management tool	The actual or relative probability with which a water allocation is expected to be available in any year, having regard to the natural variability of the supply of water

Historically, Tasmania’s environmental water management was focused on providing low flows. High flows are intact for most Tasmanian river systems except the Macquarie, for which there is major regulation and high water demand. Where there are dams on a river (for example, the Meander Dam), they generally fill and spill on a regular basis, so high flows are intact. Dam impacts on low flows are generally mitigated by releases made while the dam is filling, which attempt to mimic low flows.

Figure 22. Tasmania: water management plan areas (30 June 2010)



Source: Tasmanian Department of Primary Industries, Parks, Water and Environment.

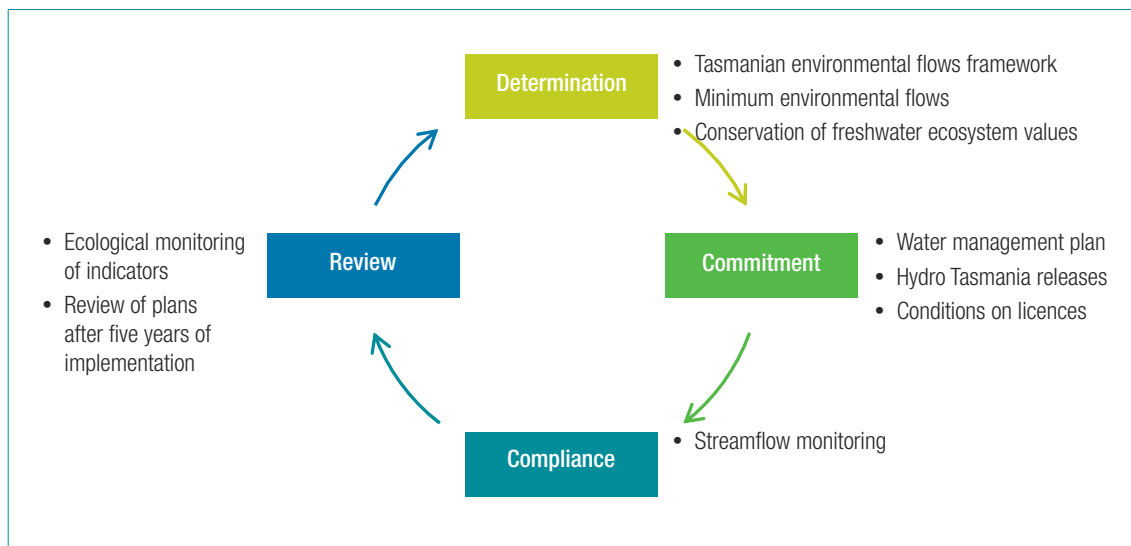
Table 44. Tasmania: water management plans (30 June 2010)

Water management plan	Status	Comments
Great Forester Water Management Plan	Took effect 13 August 2003	Covers the Great Forester River catchment, including the subcatchments of Tuckers Creek, Hurst Creek and Coxs Rivulet.
Mersey Water Management Plan	Took effect 31 August 2005	Covers the Mersey River catchment below Lake Parangana, including all tributaries.
Lakes Sorell and Crescent Water Management Plan	Took effect 30 November 2005	Covers the Lakes Sorrell and Crescent catchment downstream to and including the control structure at Lake Crescent.
River Clyde Water Management Plan	Took effect 30 November 2005	Covers the River Clyde catchment up to the control structure at Lake Crescent and down to the point at which the river enters Lake Meadowbank.
Little Swanport Water Management Plan	Took effect 26 July 2006	Covers the Little Swanport catchment.
Ansons Water Management Plan	In draft at 30 June 2010 (Took effect 7 July 2010)	Covers the Ansons River Catchment, including Big Boggy Creek, Last River, Lower Ansons River and Upper Ansons River.
<i>South Esk Water Management Plan</i>	<i>In draft</i>	<i>Comments on draft closed on 18 December 2009</i>
<i>Sassafras Wesley Vale Water Management Plan</i>	<i>In draft</i>	<i>Comments on draft closed on 19 February 2010</i>

Note: Plans under development at 30 June 2010 are shaded.

The four elements of the environmental water management framework are applied to Tasmania in sections 10.2–10.5 and summarised in Figure 23.

Figure 23. Tasmania: summary environmental water management framework (30 June 2010)



10.2 Determination of environmental water

The determination of environmental water is built into the legislative process in Tasmania. Section 14(2) of the Water Management Act requires a water management plan to include:

- (a) a statement of the objectives of the plan, including the environmental objectives; and
- (b) a description of the water regime that best gives effect to the environmental objectives and other relevant objectives of the plan; and
- (c) an assessment of the ability of that water regime to achieve the environmental objectives and other relevant objectives of the plan; and
- (d) an assessment of likely detrimental effects of the plan on the quality of water.

Identification of freshwater ecosystem values

Since late 2006, important freshwater ecosystem values have been identified through the state Conservation of Freshwater Ecosystems Values project. The project completed a state-wide audit and conservation evaluation of Tasmania's freshwater-dependent values. The overall aim was to map and categorise the rivers, estuaries, wetlands, water bodies, salt marshes and karst across the state according to their condition and conservation value.

The project used existing environmental information to develop datasets, which were used to identify ecosystem biophysical types, identify where special aquatic values exist (such as threatened flora and fauna) and assess the condition of each ecosystem area. This information was used to identify the conservation value of each area—a combination of distinctiveness and condition, in which the most natural example of each biophysical class was accorded the highest priority, and taking into account any special values existing in the area.

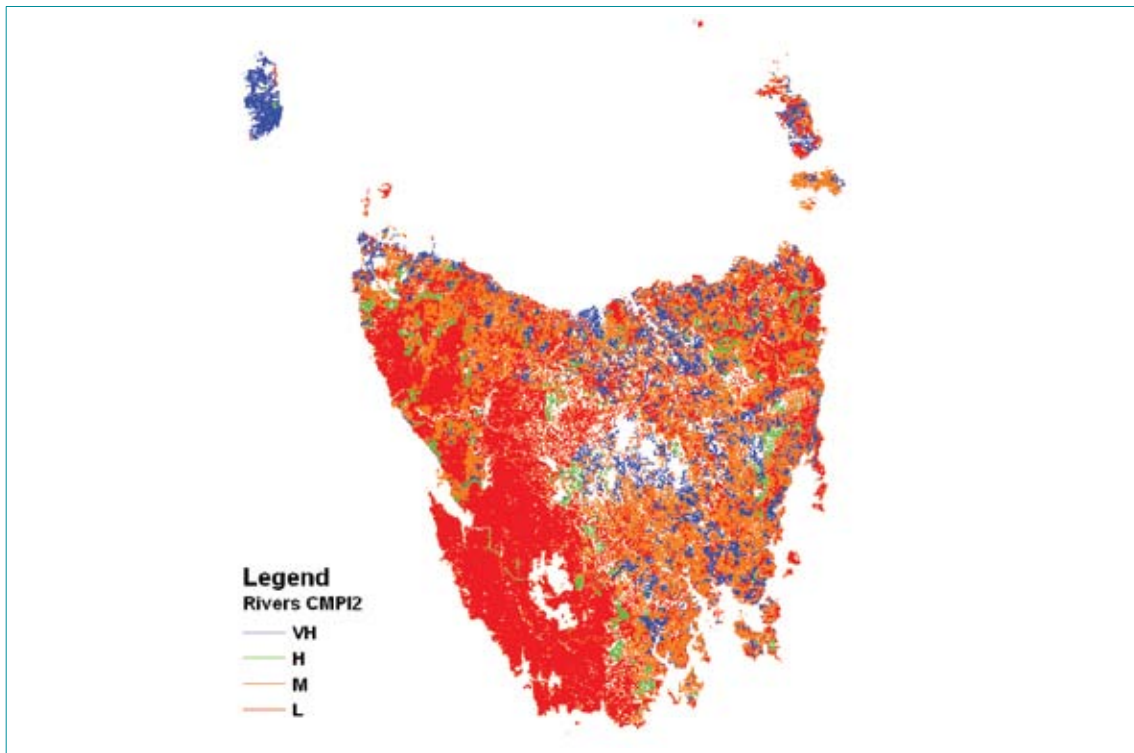
The Conservation of Freshwater Ecosystem Values project also includes a ranking (from 'very high' to 'lower') of freshwater ecosystems that reflects their priority, so as to improve conservation management (Figure 24). The ranking is based on the site's conservation value, coupled with an assessment of the current level of management protection. A surrogate measure for the level of management protection was assessed as:

- + the condition (a high condition score reflects good management)
- + land tenure security (with a high level of security having formal, regulated restrictions in place to ensure that the land is managed to conserve or protect the landscape, such as national parks).

Where an area of high conservation values lies in an area of high land tenure security, the priority for short-term management is lower (that is, the values are secure under current management). A 'high' or 'very high' rating identifies ecosystems requiring immediate improvement of management actions to ensure the protection of the conservation values. An additional ranking assessing the priority of 'maintaining' the present conservation focus in the face of changing land-use development provides for 'high' or 'very high' ratings where future development or changes in management are possible within the catchment.

The project information is used extensively in environmental flow assessments, and is used in assessing dam proposals, licences and allocations. Assessments of dam proposals involve checking that the proposed site and areas immediately downstream are clear of conservation values or important biophysical classes that may be affected by the proposed dam.

Figure 24. Tasmania: improving conservation management priority map



Source: Tasmanian Department of Primary Industries, Parks, Water and Environment, Conservation of Freshwater Ecosystem Values project.

Framework for defining environmental flows

Until 2006, minimum environmental flows for many Tasmanian rivers (such as the Great Forester River in 1999 and the Blyth River in 2001) had been defined mainly on the basis of habitat-based assessments using instream flow incremental methodology. The assessments were primarily based on the requirements of fish, macro-invertebrates and platypuses. The method incorporated the hydraulic, hydrological and biological requirements of habitat for a number of key species, to determine the usable area of stream for different ecosystem components at different flows. A flow that provided a proportion of the usable area, which was assessed as providing a low risk to the ecosystem components, was then selected as the recommended minimum flow. This method has been used to define environmental flows for a number of rivers around the state.¹⁰³ Other assessments have been based on desktop extrapolations of data collected in other nearby rivers (for example, Ansons River in 2000 and Boobyalla River in 2001). These assessments focused only on providing low flows, as the higher flows are intact for most assessed systems due to the lack of regulation.

Tasmania is moving towards defining flow components of the flow regime so that rivers can be managed to maintain or approximate the regime required for priority ecosystems. The Tasmanian Environmental Flows project (TEFlow) aims to investigate the influence of flow change on the physical and biological structure of freshwater-dependent ecosystems, including wetlands and estuaries. It has built on the known flow requirements of freshwater-dependent biota and processes by investigating links between flow variability and river ecology. The framework is currently being tested on the Ringarooma, Macquarie and Little Swanport rivers, and preliminary reports are available for each of those systems on the department's website. Reports on environmental flow assessments for more than 30 rivers in Tasmania are publicly available.¹⁰⁴

Groundwater use registers have not yet been established, and there is currently no licensing system established for the taking of groundwater in Tasmania. Groundwater environmental requirements have not yet been determined in Tasmania.

¹⁰³ Reports are available at the Tasmanian Department of Primary Industries, Parks, Water and Environment website, for example: *Ecological flow requirements for the Great Forester River*, report series WRA 99/15, DPIPWE, November 1999: <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/WWEB-62P2WJ?open>

¹⁰⁴ Available at the Tasmanian Department of Primary Industries, Parks, Water and Environment website: <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/JMUJ-5F93LC?open>

10.3 Commitment of environmental water

Under the Water Management Act, water for the environment can be provided as an entitlement or through a rules-based system. At 30 June 2010, no water access entitlements had been allocated specifically for the environment. The approach taken in Tasmania is to apply a rules-based approach that ensures the provision of environmental water through water management planning or specific licence conditions.

Water management plans

The Act provides for the development of water management plans, which are initiated at the discretion of the Minister for Primary Industries and Water. Environmental water outcomes and objectives are set out in water management plans, and rules are specifically set to provide water for the environment. The rules cover:

- + cease-to-take provisions (flows below which extractions are limited) to protect base flows
- + allocation limits (annual maximum volumes available for extraction) that ensure that key higher flow components are maintained to provide environmental outcomes.

The Department of Primary Industries, Parks, Water and Environment is in charge of creating and implementing water management plans, all of which are publicly available.¹⁰⁵ Summary details of water licences and dam permits are also available on the department's website, although conditions on the licences and permits are not.¹⁰⁶

At 30 June 2010, there were six water management plans in operation and an additional three plans in draft form (see Table 44). There are also a number of potential future plans in regions that are likely to be developed by the Tasmanian Government. The department expects to create a total of approximately 15 water management plans in Tasmania. None of the plans specifies an environmental entitlement or volume, and water for the environment is provided by restricting the levels of diversions (see Table 45).

Hydro Tasmania

Hydro Tasmania operates the state's hydropower system, which includes 29 hydropower stations and more than 50 large dams in central Tasmania across the South Esk–Great Lake, Derwent, Mersey Forth, Gordon–Pedder, Pieman–Anthony, King and Yolande catchments. The hydropower system affects more than 1200 kilometres of Tasmania's waterways, with impacts on environmental flows, fish migration and other aspects of stream health.

Under the Water Management Act, Hydro Tasmania holds a special licence that grants it the right to all water resources in the relevant catchments, with the exception of some small volumes of water provided to other licensees. Therefore, water allocations for other purposes or licensees are subject to agreement from Hydro Tasmania to transfer water.

Since 1999, Hydro Tasmania has undertaken voluntary releases of environmental flows. Those flows have been included in water management plan preparation and are overseen by the Department of Primary Industries, Parks, Water and Environment to ensure that they are instigated within the context of the water management of the area.

Groundwater

There is limited understanding of the role of groundwater in Tasmania. A database of groundwater bores and wells is maintained by the Department of Infrastructure, Energy and Resources, but since 2006 the Department of Primary Industries, Parks, Water and Environment has been responsible for groundwater management in Tasmania.

An owner or occupier of land may take groundwater from the land for any purpose without a water licence unless one is required under a water management plan or the taking would cause material or serious environmental harm (either directly or indirectly). Only one water management plan (Great Forester) requires groundwater users to obtain a licence, and none contains specific restrictions on groundwater use (see Table 45).

Groundwater use registers have not yet been established, and there is currently no licensing system established for the taking of groundwater in Tasmania.

105 Available at the Tasmanian Department of Primary Industries, Parks, Water and Environment website (Water Management Plans): <http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/RPIO-4YH8EZ?open>

106 Available at the Tasmanian Department of Primary Industries, Parks, Water and Environment website (Licensing, Allocation and Works Permits): <http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/SSKA-4Y38HT?open>

Table 45. Tasmania: environmental water commitment in existing water management plans (30 June 2010)

Water management plan	Groundwater	Surface water
Great Forester Water Management Plan	No specific limits linked to GDEs set in plan. All groundwater use (other than stock and domestic) requires a licence.	Restriction management related to maintaining a minimum flow level.
Mersey Water Management Plan	No specific limits linked to GDEs set in plan. A groundwater licensing system may be implemented within the plan area.	Restriction management, including cease-to-take protocols. Specified environmental flow release requirements below Lake Parangana.
Lakes Sorell and Crescent Water Management Plan	No specific limits linked to GDEs set in plan.	Operating guidelines associated with lake levels and drawdown rates to maintain wetlands and <i>Galaxias auratus</i> .
River Clyde Water Management Plan	No specific limits linked to GDEs set in plan.	Restriction management, including cease-to-take protocols. Water taken into storage not to affect environmental flood flow provisions.
Little Swanport Water Management Plan	No specific limits linked to GDEs set in plan.	Surface water allocation limits down to a subcatchment level. Restriction management, including cease-to-take protocols. Flood harvesting restrictions.
Ansons Water Management Plan	No specific limits linked to GDEs set in plan. Plan notes that groundwater usage is negligible and that there are no records of bores installed within the catchment.	Surface water allocation limits down to a subcatchment level. Restriction management, including cease-to-take protocols.

10.4 Compliance with environmental water delivery

Monitoring of compliance is specified in all existing water management plans. Plans include a range of monitoring requirements, mainly focused on river levels and stream flow (Table 46).

Table 46. Tasmania: environmental water compliance in existing water management plans (30 June 2010)

Water management plan	Compliance reporting
Great Forester Water Management Plan	A range of compliance monitoring (Table 2 of plan), including stream flow, installation of additional gauges and meters, and reporting.
Mersey Water Management Plan	A range of compliance monitoring (Part 4 of plan), including stream flow, metering of water usage and restriction management.
Lakes Sorell and Crescent Water Management Plan	Hydrological monitoring program (Part 2.7 .1 of plan), including lake levels, flow monitoring and water availability modelling.
River Clyde Water Management Plan	Hydrological monitoring program (Part 2.6 .1 of plan), including river flow and rainfall monitoring.
Little Swanport Water Management Plan	River level and stream flow to be recorded at gauging sites.
Ansons Water Management Plan	River level and stream flow to be recorded at gauging sites.

10.5 Review of environmental water

All plans include extensive monitoring to assist in the review of environmental water provisions. Table 47 shows review processes for the water management plans.

Table 47. Tasmania: environmental water review processes in water management plans (30 June 2010)

Water management plan	Review of environmental water requirements
Great Forester Water Management Plan	River health, fish and water quality monitoring with annual reporting. Additional ongoing studies (such as wetland habitat) that are aimed at building the knowledge base to feed into the review of the plan.
Mersey Water Management Plan	River health, water quality, fish, macro-invertebrate monitoring reported on a five-year basis. Additional Stage 2 monitoring to assess the effectiveness of flow releases for environmental purposes.
Lakes Sorell and Crescent Water Management Plan	Environmental monitoring program, including fish, water quality and wetlands.
River Clyde Water Management Plan	Environmental monitoring program, including fish, water quality and river health, using standard AusRivAS protocols. ¹⁰⁷
Little Swanport Water Management Plan	Environmental monitoring program, including water quality and river health, using standard AusRivAS protocols.
Ansons Water Management Plan	Environmental monitoring program, including water quality and river health, using standard AusRivAS protocols.

In addition to ongoing review of the adequacy of the environmental water provisions, all water management plans are to undergo a formal review in accordance with section 34(1) of the Water Management Act. Table 48 lists the plans, their review dates and the status of the reviews at 30 June 2010.

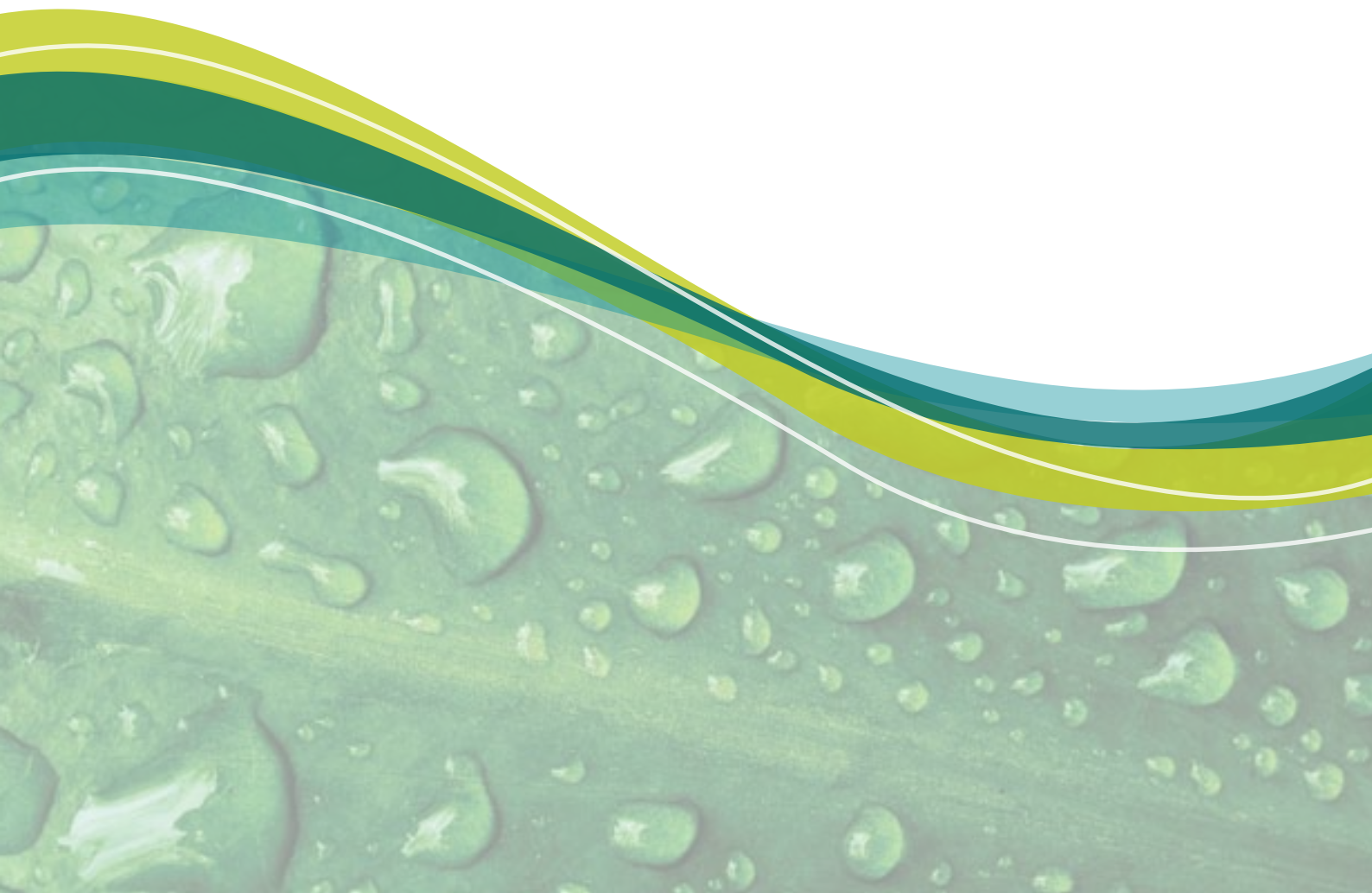
Table 48. Tasmania: review of water management plans (30 June 2010)

Water management plan	Review date	Status of the review
Great Forester Water Management Plan	July 2006	In progress
Mersey Water Management Plan	July 2015	Not applicable
Lakes Sorell and Crescent Water Management Plan	November 2009	In progress
River Clyde Water Management Plan	November 2009	In progress
Little Swanport Water Management Plan	June 2011	Not applicable
Ansons Water Management Plan	July 2020	Not applicable

¹⁰⁷ Further information available at the Australian River Assessment System website: <http://ausrivass.canberra.edu.au/>

11 Victoria

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11 Victoria

11.1 Summary

Overview of the jurisdiction

Victoria is the most densely populated state, with a population of 5 496 400 (at the end of 2009).¹⁰⁸ The population is highly concentrated around Melbourne. Climate varies across the state, ranging from semi-arid in the north-west to temperate along the coast. Average annual precipitation ranges from 200–300 mm in the north-west to more than 1200 mm on the Great Dividing Range in the east of the state.¹⁰⁹

Residential use, agriculture, mining and power generation are some of the key water uses in Victoria. The state's water supplies are mainly from surface water and groundwater; desalinated seawater will be added from the end of 2011.

Water management in Victoria is largely shared among 10 CMAs, 19 water corporations and the Department of Sustainability and Environment.

In Victoria, the statutory instruments that give authority to take surface water or groundwater are a bulk entitlement, environmental entitlement or a licence issued under the *Water Act 1989* (Vic.). The major licensed water resource in Victoria is surface water. At 30 June 2010, there were 43 479 regulated surface water entitlements in the state water register with a total entitlement volume of 3934 GL. There were 10 461 groundwater entitlements amounting to 870 GL, 17 195 entitlements for unregulated waterways, springs or run-off totalling 795 GL.

Overview of environmental water management arrangements

Victoria's water entitlement and allocation framework provides the basis for the management of Victoria's water resources. Environmental water in Victorian systems is held in the Environmental Water Reserve, comprising:

- + environmental entitlements
- + obligations on consumptive entitlements including the passing flows that water corporations or licensed diverters are obliged to provide (out of storage or past a diversion point)
- + above cap water, which includes water that is left over after limits on diversion have been reached and unregulated flows that cannot be kept in storage.

Environmental water in unregulated streams and groundwater systems is delivered through rules-based arrangements, which are specified in the licence conditions. Streamflow management plans will be set out for a limited number of priority rivers as determined by sustainable water strategies. For the balance of rivers, local management rules that document water sharing rules will be developed. At 30 June 2010, six of the intended 21 stream flow management plans had been approved; all are in the Yarra catchment.

The environmental and consumptive bulk entitlement arrangements provide a clear framework for the delivery of environmental water in regulated streams. The FLOWS method and the Victorian Environmental Flows Monitoring and Assessment Program are used to identify environmental water requirements and the ecological response to those requirements in surface water systems. There is no standard method or approach to determining the environmental requirements for GDEs. Extraction rates from unregulated streams and groundwater systems are extensively monitored in Victoria.

Victoria is developing four regional sustainable water strategies (shown in figures ii and iii):

1. Northern Region (the River Murray system and its tributaries- Loddon, Goulburn, Broken, Campaspe, Kiewa and Ovens systems)
2. Central Region (West Gippsland, Port Phillip, Westernport, Western, Central Highlands and Barwon Regions)
3. Western Region (Wimmera, Mallee, Millicent, Portland, Otway, Glenelg, Hopkins and Avoca Basins)
4. Gippsland Region (South Gippsland, Latrobe, Thomson, Mitchell, Tambo, Snowy and East Gippsland Basins).

¹⁰⁸ ABS, 3101—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

¹⁰⁹ Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

Each sustainable water strategy sets out a long-term regional plan to secure water for local growth, while maintaining the balance of the area's water system and safeguarding the future of its rivers and other natural water sources. In each case the sustainable water strategy provides a stock-take of all the water resources available within a region and outlines the planning arrangements for consumptive use and the environment.

At 30 June 2010, final strategies were in place for the Northern and Central regions, while the strategies for Gippsland and Western regions are in draft form and undergoing stakeholder consultation.

Victorian Environmental Water Holder

A major change to the management of environmental water in Victoria was announced in the *Northern Region Sustainable Water Strategy*, released in November 2009.¹¹⁰ The Strategy provides for the establishment of a Victorian Environmental Water Holder as an independent statutory body responsible for holding and managing environmental water entitlements and allocations and making decisions on their best use to achieve the highest environmental value. The Victorian Environmental Water Holder will coordinate the delivery of Victorian and Commonwealth water with the Commonwealth Environmental Water Holder.¹¹¹

In particular, the Victorian Environmental Water Holder will:

- + hold and manage the various environmental entitlements across the regions of the state as a collective available volume
- + determine and publish annual plans describing environmental water distribution priorities
- + buy and sell environmental entitlements and allocations as needed to maximise the environmental benefit
- + consult with CMAs to identify the rivers and wetlands of highest value and their environmental watering objectives
- + have an operational planning process that allocates environmental water to its highest value environmental use each year and provide it via the most efficient delivery mechanism
- + report annually to the Victorian Minister for Environment and Climate Change and Innovation on the use of environmental water
- + work with the Commonwealth Environmental Water Holder.

Under the new structure, the CMAs will continue to be responsible for local planning, operational management, delivery arrangements and community consultation for environmental water. In addition, they will ensure that local environmental water management is integrated with other local management to achieve agreed river and wetlands objectives.

Table 49. Victoria: environmental water statutory framework (30 June 2010)

Legislation	<i>Water Act 1989 (Vic.)</i>
Responsible minister	Minister for Water Minister for Environment and Climate Change and Innovation (Minister for Environment)
Environmental water manager	CMAs Melbourne Water
Other relevant institutions	Department of Sustainability and Environment
Method of securing environmental water	Stream-flow management plans Permissible consumptive volumes Bulk entitlements Environmental entitlements Groundwater management plans

¹¹⁰ Department of Sustainability and Environment, *Northern Region Sustainable Water Strategy*, Victorian Government, Melbourne, 2009.

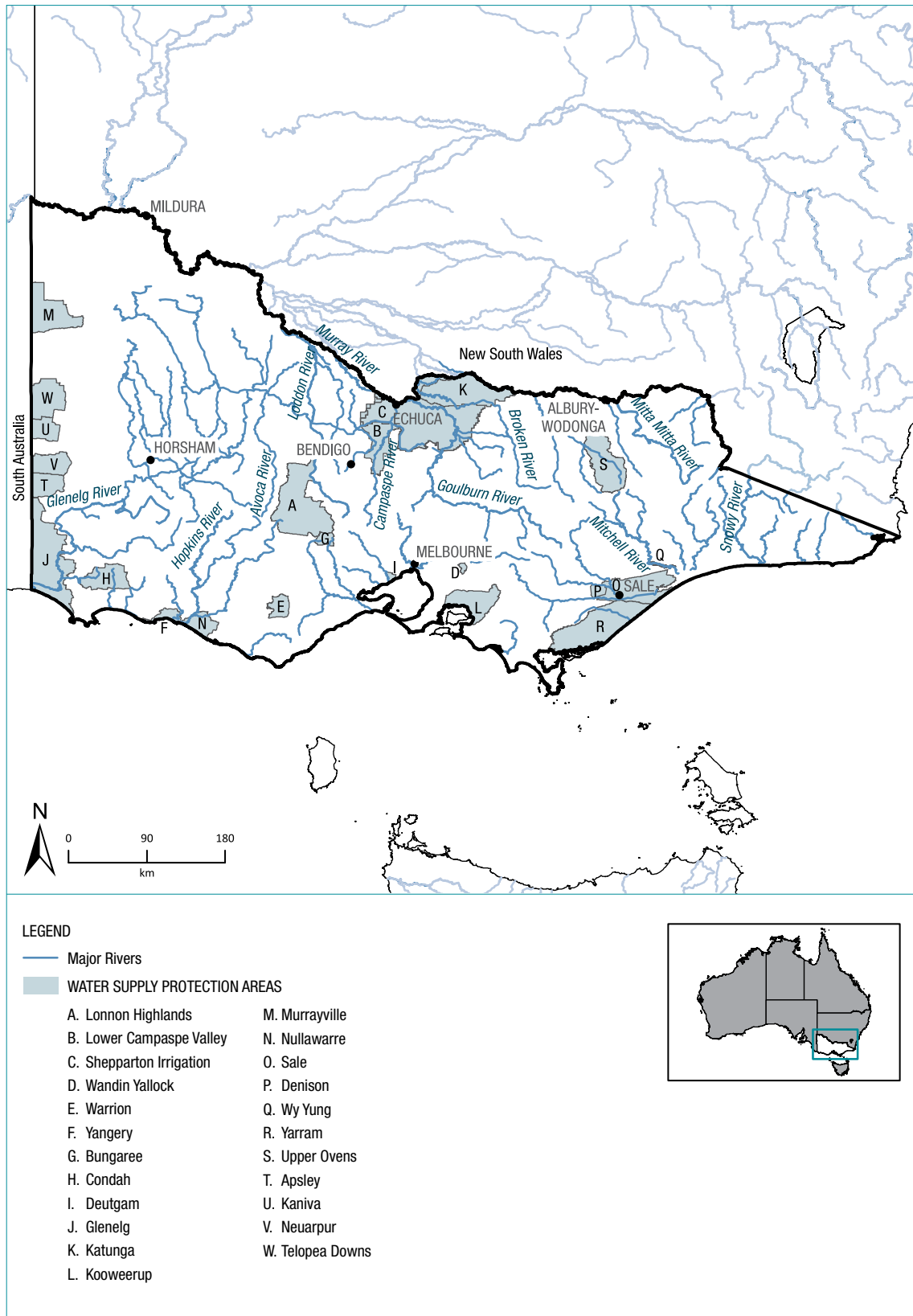
¹¹¹ Legislation to establish the new body was passed by the Victorian Parliament on 13 August 2010. It is intended that the Victorian Environmental Water Holder will start operations from July 2011.

Table 50. Victoria: environmental water and water management terminology (30 June 2010)

Term	Type	Definition
Bulk entitlement	Statutory instrument	Issued to water authorities that divert directly from rivers and setting operating rules for infrastructure (annual diversion volume and rate, and/or passing flow requirements).
Environmental entitlement	Statutory instrument	A right to a portion of the water in a regulated river system that can be allocated to meet specific environmental objectives for a system or site.
Groundwater management unit	Groundwater management area	The principal management unit for groundwater in Victoria. A groundwater management unit can be a water supply protection area, a groundwater management area or an unincorporated area (in decreasing intensity of resource use).
Water supply protection area	Surface water and/or groundwater management area	An area declared under s. 27 of the Act to protect the water resources through the development of a management plan. Twenty-three water supply protection areas have been declared.
Groundwater management area	Groundwater management area	An area in which groundwater has been (or has the potential to be) intensively developed. Thirty-eight groundwater management areas have been declared.
Unincorporated area	Groundwater management area	An area in which limited development or use of groundwater has occurred.
Stream flow management plan	Management tool	A plan to ensure that all surface water in a catchment is managed to provide for environmental and consumptive requirements.
Annual watering plan	Management tool	A plan produced by CMA that outlines the volumes, objectives and conditions for the use of environmental water entitlements.
Permissible consumptive volume	Management tool Allocation limit	The maximum volume of water that can be allocated in a groundwater resource on an annual basis. Also known as 'permissible annual volume'.
Sustainable diversion limit	Management tool Allocation limit	The allowable diversion volume over June to November for unregulated Victorian catchments without stream flow management plans.

Water Supply Protection Areas are areas declared by the Minister for Water under s.27 of the Act for areas where the water supply is under stress. The stress may be due to over-allocation, where environmental values are at risk or where future development is proposed. They can be declared for unregulated rivers, groundwater management units, or both. There are currently twenty-three water supply protection areas declared in Victoria as shown in Figure 25.

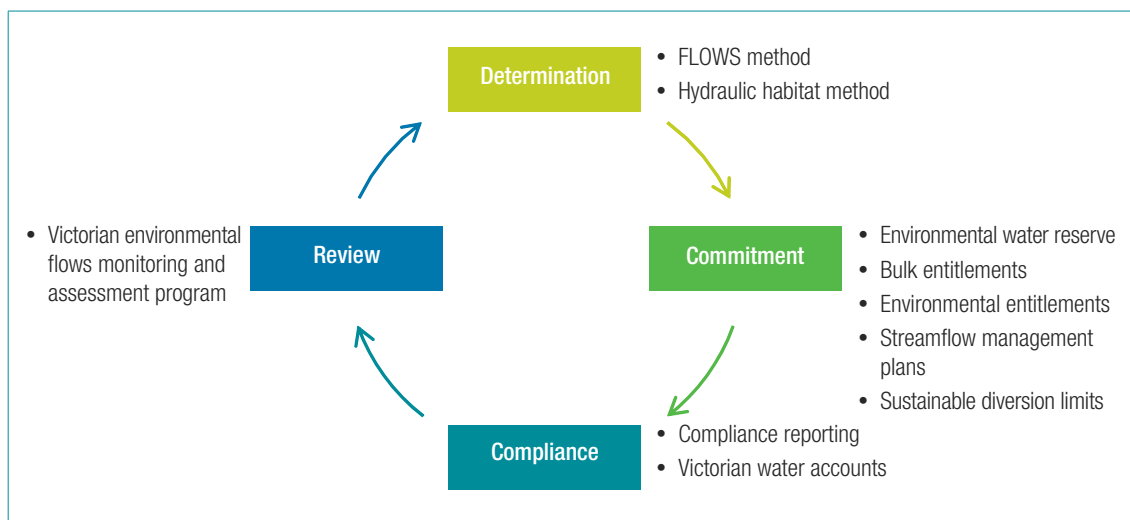
Figure 25. Victoria: water supply protection areas



Source: NWC: Victorian Department of Sustainability and Environment.

The four elements of the environmental water management framework are applied to Victoria in sections 11.2–11.5 and summarised in Figure 26.

Figure 26. Victoria: summary environmental water management framework (30 June 2010)



11.2 Determination of environmental water

Surface water

Determining environmental flows in Victoria is underpinned by the principle that ‘an environmental flow regime should retain and/or reinstate as many of the features of the natural flow regime as possible.’¹¹²

In Victoria, environmental water requirements for surface water are determined using the FLOWS methodology,¹¹³ which uses an expert panel to establish a series of environmental objectives for each river reach as the basis for developing the final environmental flow recommendations. The environmental flow recommendations include specific critical flow components, comprising low flow, low-flow freshes, high flow, high-flow freshes, bank-full flows, overbank flows and cease-to-flow. The panel also determines the recommended volume, timing, duration and frequency for each flow component in the system. The FLOWS method has been used extensively throughout the state as a key input to Victoria’s water allocation program.

Table 51. Victoria: FLOWS assessments in surface water systems (30 June 2010)¹¹⁴

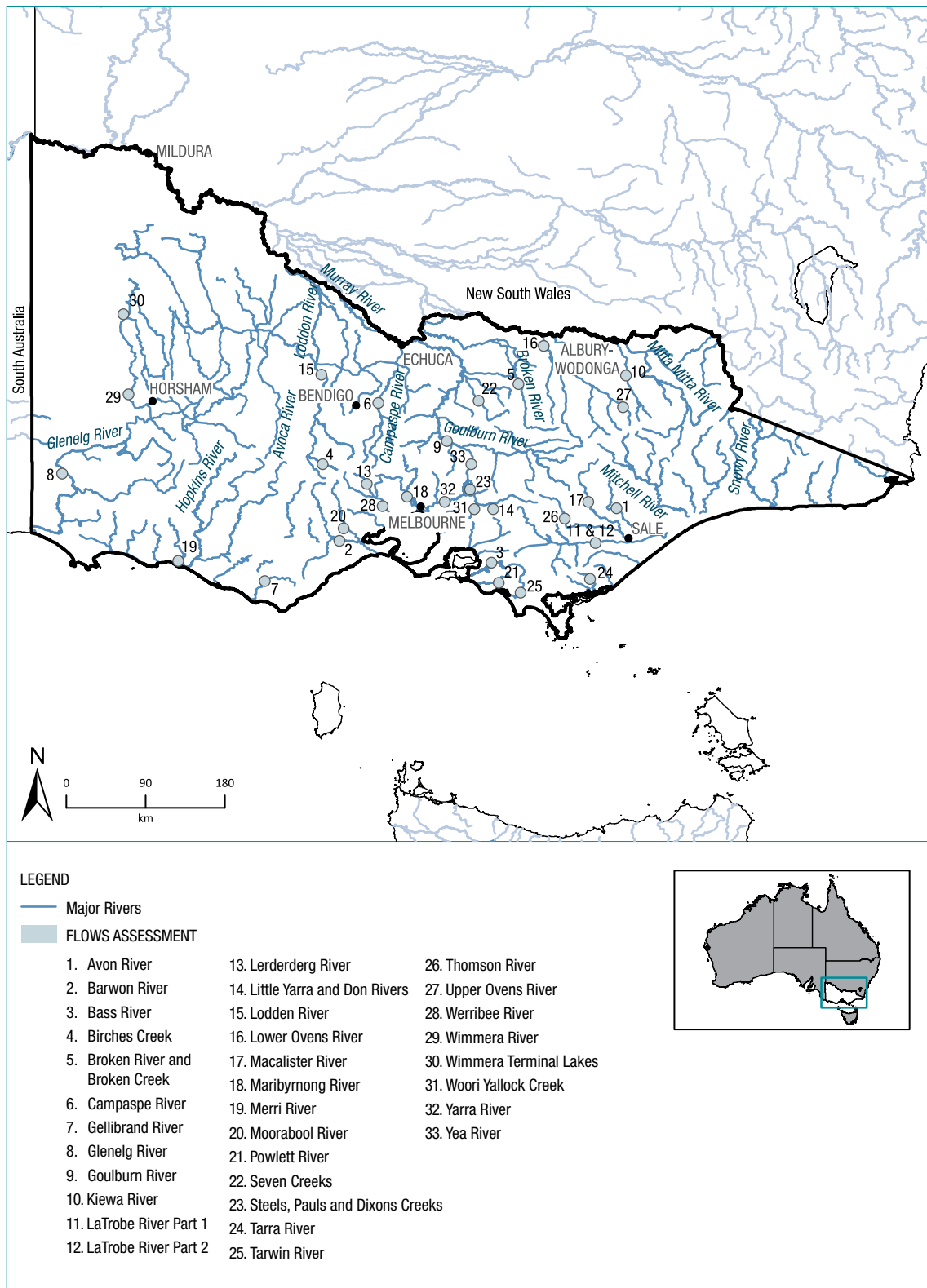
FLOWS assessment		
Avon River	Latrobe River Part 2	Steels, Pauls and Dixons Creeks
Barwon River	Lerderderg River	Tarra River
Bass River	Little Yarra and Don rivers	Tarwin River
Birches Creek	Loddon River	Thomson River
Broken River and Broken Creek	Lower Ovens River	Upper Ovens River
Campaspe River	Macalister River	Werribee River
Gellibrand River	Maribyrnong River	Wimmera River
Glenelg River	Merri River	Wimmera Terminal Lakes
Goulburn River	Moorabool River	Woori Yallock Creek
Kiewa River	Powlett River	Yarra River
Latrobe River Part 1	Seven Creeks	Yea River

¹¹² Victorian Government, *Our water our future*, Victorian Government, 2010, available from Our water, our future website: <http://www.ourwater.vic.gov.au/>

¹¹³ SKM, Cooperative Research Centre for Freshwater Ecology, Freshwater Ecology (NRE) and Lloyd Environmental Consultants, *FLOWS—a method for determining environmental water requirement in Victoria*, Department of Natural Resources and Environment, 2002.

¹¹⁴ Available at the Victorian Department of Sustainability and Environment website: <http://www.ourwater.vic.gov.au/environment/rivers/flows/environmental-flow-studies>.

Figure 27. Victoria: surface water systems with FLOWS assessments (30 June 2010)



Source: Victorian Department of Sustainability and Environment.

Groundwater

The principal management basis for groundwater in Victoria is groundwater management units, the boundaries of which often fall across more than one river basin. A groundwater management unit can be one of three types:

- + *groundwater management areas*, which exist in areas where groundwater has been, or has the potential to be, intensively developed
- + *water supply protection areas*, which are declared under the Water Act and require the development of a management plan to protect the water resource (water supply protection areas also apply to surface water resources)
- + *unincorporated areas*, which exist where groundwater development or use is limited, usually because the groundwater resource is unsuitable.

There is not a consistent method for establishing specific environmental water requirements of groundwater systems across Victoria, although environmental objectives may be specified in the various groundwater management plans.

Limits on access to groundwater resources are imposed to prevent the resource being depleted or causing adverse impacts, such as loss of water supply, reductions in base flows in rivers and streams, or changes to water quality.

A key groundwater management provision under the Water Act is the setting of a cap on extraction. The Minister for Water may make an order declaring the total volume of water that may be taken from the area or water system specified in the order. This is known as the 'permissible consumptive volume'.

11.3 Commitment of environmental water

Surface water

Environmental Water Reserve

The Environmental Water Reserve, which is legislated under the Water Act, contains water set aside for environmental purposes through environmental entitlements, conditions on consumptive bulk entitlements, stream flow management plans, and conditions on other licences and permits. This provides for two kinds of environmental water:

- + water held in storage and actively managed for specific environmental requirements under environmental entitlements
- + water available through rules on consumptive use under conditions of consumptive bulk entitlements, licences and permits, and stream flow management plans; these rules include passing flow requirements (a direct and measurable contribution to environmental water) and limits on daily and annual diversions (indirectly providing unquantifiable environmental water through, for example, spills from weirs).

Bulk entitlements

Bulk entitlements are the main mechanism for managing water in regulated rivers and are held by water authorities and other specified bodies (such as electricity companies). Obligations under the bulk entitlement include the release of flow for environmental purposes, to undertake metering, accounting and reporting, and to restrict the entitlement when water resources are limited. The three main environmental components of consumptive bulk entitlements are:

- + *rights to water in storage*, which provides a volume of water specifically set aside for the environment
- + *a cap on total water use*, which ensures that only a certain volume of water is allocated for consumptive use and that the remaining flow is included in the environmental water reserve
- + *provision of passing flows*, which requires that minimum flows be met at key compliance points along a regulated river, as specified in the conditions on the bulk entitlement.

Environmental entitlements

Environmental entitlements are issued by the Minister for Water and are held by the Minister for Environment. At 30 June 2010, 15 environmental entitlements were held in Victoria, two of which are held in trust for Snowy Recovery and another two of which are held in trust for The Living Murray. A summary of all current environmental entitlements in Victoria is provided in Table 52. Environmental entitlements are obtained through a number of pathways, including water savings projects, buybacks and donations. Within 12 months of the establishment of an environmental entitlement, the water manager and storage operator for the system are required to develop operational arrangements for the delivery of water held under the environmental entitlement, in accordance with the environmental flow and operational requirements set out in the entitlement. Typically, this involves the development of an annual watering plan by the relevant CMA.

Table 52. Victoria: summary of environmental entitlements (30 June 2010)

Entitlement	Amount held
Bulk Entitlement (Loddon River—Environmental Reserve) Conversion Amending Notice 2007	2105 ML (low reliability) made available under amendment.
Bulk Entitlement (River Murray—Flora and Fauna) Conversion Further Amending Order 2009	High reliability: 33 310 ML Low reliability: 101 850 ML Unregulated flow: 34 300 ML
Tarago and Bunyip Rivers Environmental Entitlement 2009	The Minister for Environment is entitled to a storage capacity of 3000 ML in Tarago Reservoir. Minimum environmental flows given as the lesser of a specified flow and the natural flow at the Drouin West gauging station.
Bulk Entitlement (Wimmera and Glenelg Rivers—Flora and Fauna) Conversion Amendment Order 2009	Specified as a share of the total water available for regulated entitlements and a total of 34 739 ML for unregulated entitlements.
Bulk Entitlement (Thomson River—Environment) Order 2005	10 000 ML Seasonal passing flow requirements
Yarra Environmental Entitlement 2006	17 GL in storage plus minimum flows at other harvesting sites.
Bulk Entitlement (Yallourn Energy Ltd for SECV) Conversion Order 1996 <i>Transferred to Minister for Environment in 2002</i>	25 000 ML
Silver & Wallaby Creeks Environmental Entitlement 2006	Passing flow requirements based on storage inflows
Environmental Entitlement (Birch Creek—Bullarook System) 2009	Seasonal passing flow requirements
Environment Entitlement (Goulburn System—Environmental Water Reserve) 2010	One-third of the total volume saved in the Goulburn component of the Goulburn Murray Irrigation District from Stage 1 of the Northern Victoria Irrigation Renewal Project.
Environmental Entitlement (River Murray—Environmental Water Reserve) 2010	One-third of the total volume saved in the Murray component of the Goulburn Murray Irrigation District from Stage 1 of the Northern Victoria Irrigation Renewal Project.
Bulk Entitlement (Goulburn System—Snowy Environmental Reserve) Amendment Order 2009 <i>Held in trust for Snowy Recovery</i>	16 812 ML
Bulk Entitlement (River Murray—Snowy Environmental Reserve) Further Amending Order (2) 2009 <i>Held in trust for Snowy Recovery</i>	High reliability: 29 794 ML
Environmental Entitlement (Campaspe River—Living Murray) Amendment Order 2009 <i>Held in trust for The Living Murray</i>	High reliability: 126 ML Low reliability: 5048 ML
Environmental Entitlement (Goulburn System—Living Murray) Further Amending Order 2009 <i>Held in trust for The Living Murray</i>	High reliability: 39 625 ML Low reliability: 156 980 ML

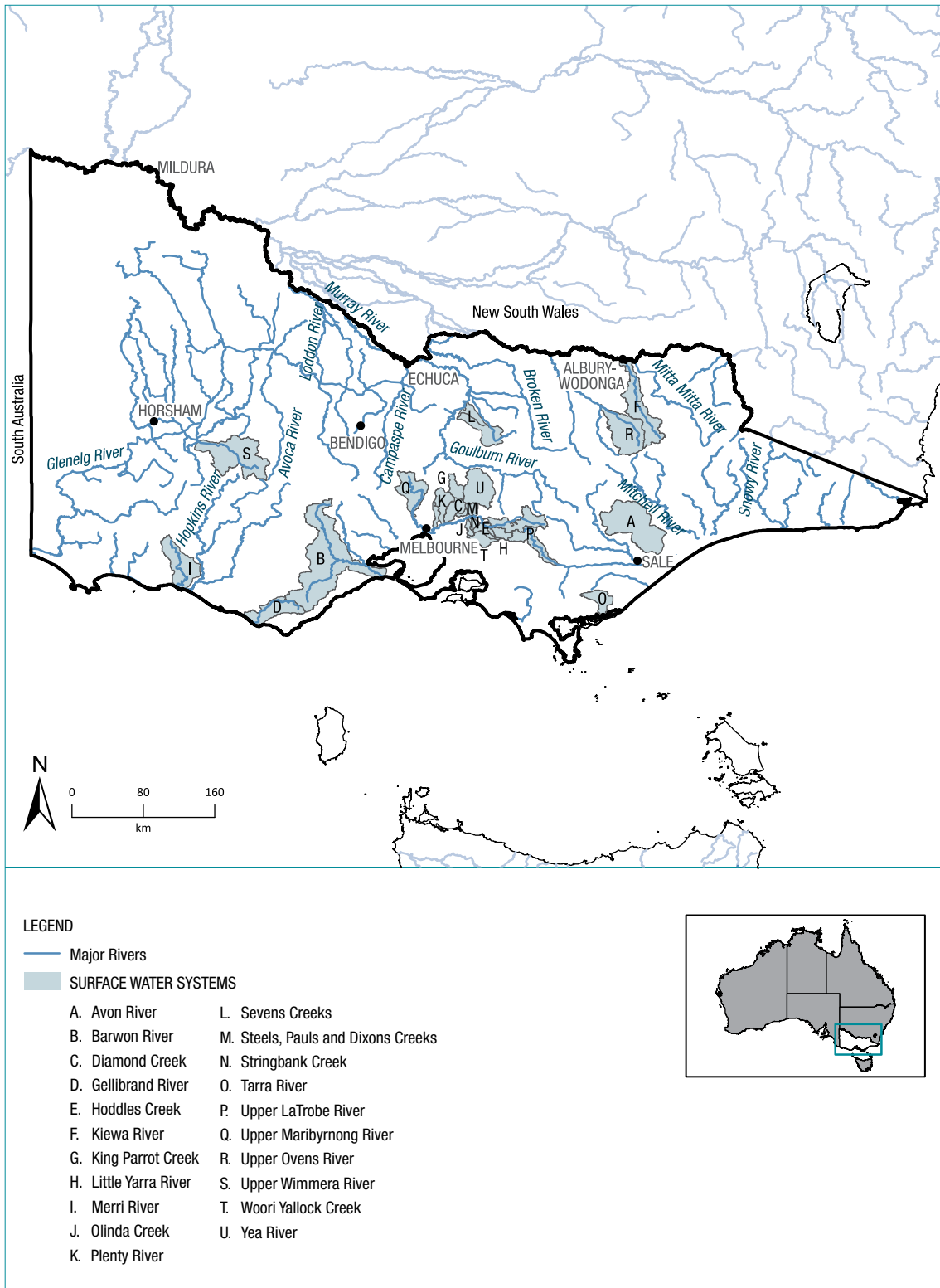
Qualification of entitlements

During extremely dry periods when water supplies are limited, the Minister for Water may declare a water shortage and qualify water entitlement rights. This involves securing water supplies by taking water rights from the environment and redirecting that water to priority needs under the plan, such as critical human needs.

Stream flow management plans

Stream flow management plans define the total amount of water in the area and how it should be shared between the environment and water users. Stream flow management plans apply to priority unregulated rivers as shown in Figure 28.

Figure 28. Victoria: priority, flow stressed, unregulated rivers requiring a stream flow management plan (30 June 2010)



Source: *Our water our future: securing our water future together*, Victorian Government White Paper, 2004.

Six stream flow management plans are currently in operation. Since 2002, environmental flow requirements for stream flow management plans have been defined using the FLOWS method.

Table 53. Victoria: stream flow management plans in surface water systems (30 June 2010)

Surface water system	Status
Avon River	Not commenced
Barwon River	Not commenced
Diamond Creek	Published 2003—under review
Gellibrand River	Not commenced
Hoddles Creek	Published 2003—under review
Kiewa River	Not commenced
King Parrot Creek	Not commenced
Little Yarra and Don Rivers	Started 2009
Merri River	Not commenced
Olinda Creek	Published 2007
Plenty River	Published 2007
Seven Creeks	Not commenced
Steels, Pauls and Dixons Creeks	Published 2007
Stringybark Creek	Published 2007
Tarra River	Not commenced
Upper Latrobe River	Not commenced
Upper Maribyrnong River	Not commenced
Upper Ovens River	Started 2009
Upper Wimmera River	Not commenced
Woori Yallock Creek	Started 2009
Yea River	Not commenced

Source: Melbourne Water website: http://www.melbournewater.com.au/content/rivers_and_creeks/waterway_diverters/stream_flow_management.asp?bhcp=1

The need for stream flow management plans is being reviewed as part of the development of Sustainable Water Strategies.

Stream flow management plans prescribe a permissible annual volume of extraction for unregulated streams, which protects environmental water requirements in the system. The permissible annual volume acts as a cap on the total amount of water that can be allocated in the area; the remaining water is designated for the environment.

Environmental flows are also accounted for in the licence conditions under the stream flow management plan. The conditions specify seasonal flow trigger levels at certain locations in the system. When flows fall below the trigger levels, extraction must cease. Water extraction rosters or restrictions can be imposed when stream flow is low, in order to share the available flow among licence holders or to protect environmental flows in the system.

In unregulated streams for which a stream flow management plan is yet to be implemented, water is managed using rules-based arrangements and winter sustainable diversion limits. The sustainable diversion limit is established by taking into consideration:

- + a winter fill period over which diversions can occur (June to November)
- + a minimum flow threshold, below which diversions should cease
- + a maximum daily extraction rate
- + an annual licensed volume associated with a specified reliability of supply.

Groundwater

Groundwater allocation and sharing are managed through the issuing of licences by rural water corporations. Groundwater extraction is limited by the permissible consumptive volume, which is established by the Minister for Water and is applicable to groundwater management areas and water supply protection areas. Permissible consumptive volumes are intended to protect the groundwater resource from depletion and other potential adverse impacts of water extraction, including loss of water supply, reduced base flows in waterways, reduction in water quality and saline intrusion, by placing a cap on the total volume that can be extracted from the resource.

Permissible consumptive volumes for each groundwater management unit and groundwater management area are published in the Victorian Government Gazette and are provided in the Victorian Government's Groundwater Online database.¹¹⁵ For some permissible consumptive volumes, there is a brief mention of the limit rationale in the public database, but that information is not consistent or specific across all PCVs. Groundwater-dependent ecosystems have not generally been addressed in groundwater management, due to limited understanding of their water requirements. However, there is a Victorian Government proposal to manage GDEs in the Draft Western Sustainable Water Strategy.¹¹⁶

Groundwater management units do not align with surface water basin boundaries. Permissible consumptive volumes have been set for 58 of Victoria's 66 groundwater managements. For units where permissible consumptive volumes have not been set, licensed entitlements are used to set the limit on extractions.

11.4 Compliance with environmental water delivery

Victorian Water Accounts

The Victorian Water Accounts¹¹⁷ provide an annual summary of water availability, allocation and use across the state at bulk supply level. The accounts are a state-wide overview with basin scale information, consolidated from information provided by all Victorian water businesses, CMAs, the Department of Sustainability and Environment, power generators and other major users. The accounts document water availability and provide information on water taken for consumptive use and water set aside for environmental purposes in the context of the Victorian water entitlement and allocation framework. The accounts also contain basin summaries of rainfall, flows and storages; diversion volumes from both surface and groundwater resources; entitlement limits; total licensed entitlements; use and discharge of recycled water; components of the environmental water reserve; delivered environmental water; and passing flow compliance.

Stream flow management plans

Under the stream flow management plans, the relevant water authorities are required to meter held licences and monitor stream flow at the specified sites. They are required to report on this annually. Melbourne Water produces annual reports for the six stream flow management plans in operation in the Yarra catchment.¹¹⁸

Bulk and environmental entitlements

Holders of bulk and environmental entitlements are obligated to undertake a metering program, which monitors the amount of water taken by the holder, the amount of water returned to waterways, storage inflows and volumes in storage, and passing flows. Entitlement holders may be required to report on the metering program annually.¹¹⁹ The annual watering plans include an environmental flow monitoring program.

Resource managers of bulk entitlements report on compliance and noncompliance with their respective entitlement provisions, and that information is published in the relevant authority's annual reports.

115 Available at the Victorian Department of Sustainability and Environment website: <http://groundwater.geomatic.com.au/Main.aspx>.

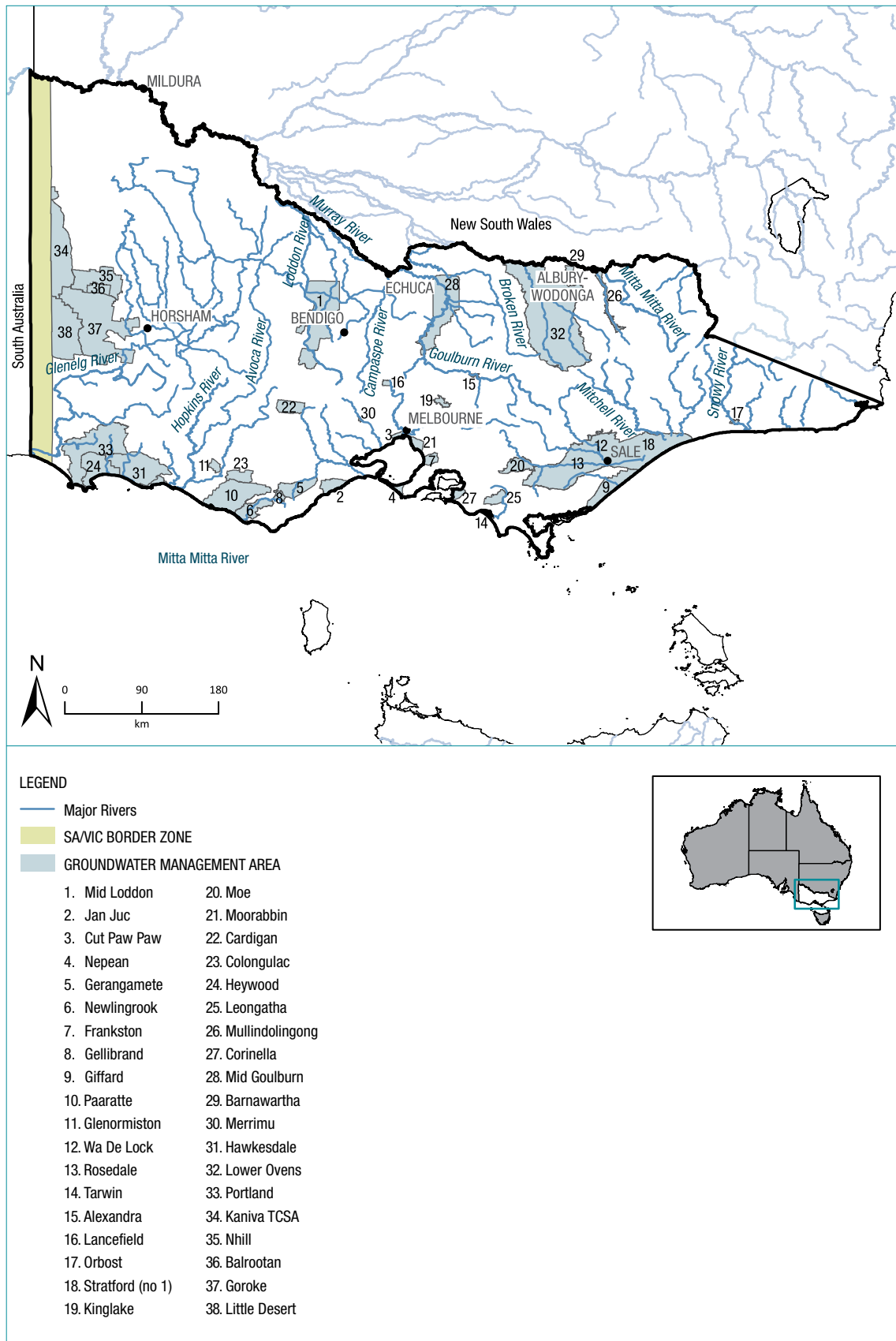
116 Department of Sustainability and Environment, *Draft Western Region Sustainable Water Strategy for community comment*, Victorian Government, 2010.

117 Available at the Victorian Department of Sustainability and Environment website: <http://www.ourwater.vic.gov.au/monitoring/accounts>

118 Available at the Melbourne Water website: http://www.melbournewater.com.au/content/rivers_and_creeks/waterway_diverters/stream_flow_reports.asp?bhcp=1

119 Section 43 of the *Water Act 1989* (Vic.)

Figure 29. Victoria: groundwater management units (30 June 2010)



Source: Department of Sustainability and Environment, <http://www.ourwater.vic.gov.au/environment/groundwater/management/GMUs-map>.

Groundwater

Under the Water Act, holders of a groundwater licence for urban water supply are required to develop a water level monitoring program, a groundwater extraction monitoring program, a groundwater salinity protection program and a surface water and riverine environment protection program. Monitoring results are to be reported to the licensing corporation. All groundwater extraction for s 51 licenses (greater than 20 ML) issued prior to 2004 are metered, and all new licences from 2004 are metered, regardless of volume.

The State Observation Bore Network monitors the movement, availability and quality of groundwater in Victoria using around 2500 monitoring-specific bores across the state. The Department of Sustainability and Environment is responsible for the network. The Groundwater Management System contains historical data gathered from approximately 135 000 bores throughout Victoria. A copy of the data stored in the system is available on request from the department. Groundwater data is also supplied to the Victorian Water Resources Data Warehouse.¹²⁰ Metered use for each of the groundwater management units is reported in Groundwater Online, which is publicly available.¹²¹

11.5 Review of environmental water

The Department of Sustainability and Environment produces an annual report, *Environmental watering in Victoria*¹²², which details the outcomes of environmental watering programs across the state. The programs use environmental water from Victorian water entitlements, The Living Murray program, Commonwealth environmental water holdings and donated water.¹²³ Monitoring for the report is undertaken by the relevant CMAs.

In Victoria, monitoring of environmental flow outcomes for a limited number of rivers is undertaken through a standard approach known as the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP). VEFMAP was initiated by the Department of Sustainability and Environment in 2005 to evaluate ecosystem response to environmental flows in eight major regulated rivers. The program applies a consistent monitoring approach across the river systems so that aggregated data enables more useful comparisons to be drawn from cumulative measured responses.

Annual watering plans typically require monitoring, using VEFMAP, of the ecological responses to environmental flow releases in regulated river systems. Results from the monitoring are used to inform the development of subsequent watering plans. Some CMAs publicly release the results of their VEFMAP assessments (for example, West Gippsland CMA¹²⁴).

In unregulated systems, the relevant water authorities are required to monitor stream health under stream flow management plans. The plans are to be reviewed against their objectives at a frequency of no less than five years.

Groundwater

As a result of the cost and lack of specificity in determining GDEs, ecological health monitoring does not occur. Details on the monitoring of groundwater levels and other resource attributes are included in Section 11.4.

120 Available at the Victorian Government website: <http://www.vicwaterdata.net/vicwaterdata/home.aspx>

121 Available at the Victorian Department of Sustainability and Environment website: <http://groundwater.geomatic.com.au/Main.aspx>

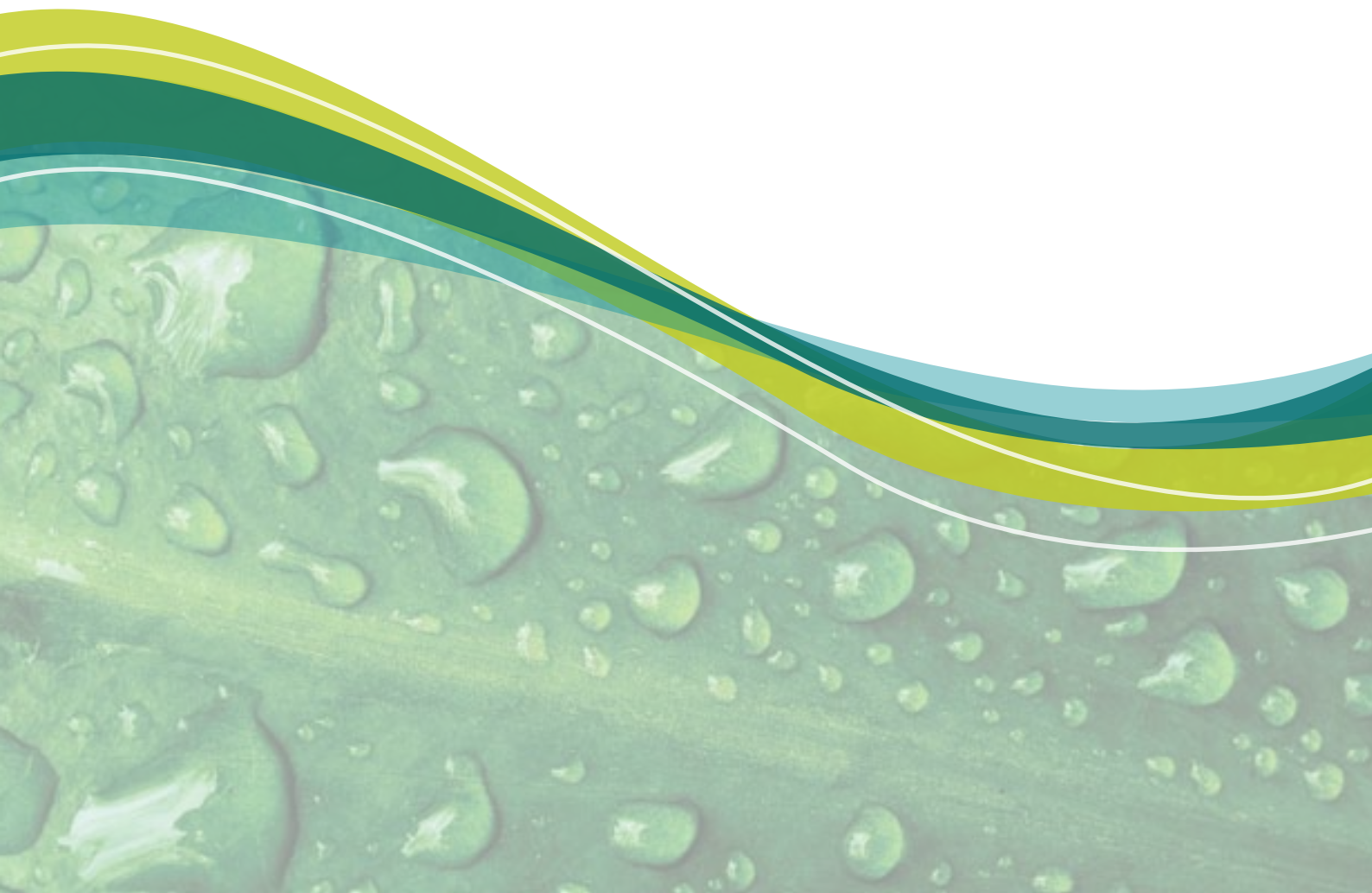
122 Available at the Victorian Department of Sustainability and Environment website: <http://www.ourwater.com.au/environment/rivers/flows>

123 Victorian Department of Sustainability and Environment, *Environmental watering in Victoria 2008–09*, Victorian Government, 2010.

124 Available at the CMA website: <http://www.wgcm.vic.gov.au/programs/multi-region/134-monitoring-flows-in-the-thomson-and-macalister-riversbackground.html>

12 Western Australia

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12 Western Australia

12.1 Summary

Overview of the jurisdiction

Western Australia is the largest state in Australia (252 500 km²), with a population of approximately 2 270 300 (at the end of 2009).¹²⁵ The vast, central area of the state is semi-arid or desert and sparsely inhabited. Three-quarters of the state's population lives in Perth, and there is an additional population concentration in the south-west corner of the state. As a result, most water planning activity is around the Perth and south-west area.

Rainfall varies enormously across the state. The north has high temperatures year round and highly seasonal rainfall. At the Kimberley Research Station there is a mean annual rainfall of 826 mm; February is the wettest month (average of 208 mm) and August the driest (0.4 mm). In the far south, Walpole has a mean annual rainfall of 1316 mm; July is the wettest month (average of 223 mm) and January the driest (26 mm).¹²⁶

Apart from domestic supplies, other major water uses are for agriculture and mining, mostly from groundwater sources.

In Western Australia, the statutory instrument that gives authority to take surface or groundwater is a water extraction licence issued under the *Rights in Water and Irrigation Act 1914* (WA). Western Australia has significant groundwater resources compared to surface water. At 30 June 2010, there were 12 908 groundwater licences across the state with a total entitlement volume of 1491 GL. In comparison 1223 surface water licences amounting to 946 GL were on issue.

Overview of environmental water management arrangements

The Rights in Water and Irrigation Act provides for the identification and management of water for ecosystems. The Act provides for three different spatial levels of management planning—regional, sub-regional and local.

Within each of eight water regions across the state, a regional water management plan is required. The regional water management plan drives the production of water allocation plans, based on sub-regions within the water management plan area. Commitment of environmental water in surface and groundwater systems over most of Western Australia is achieved through the setting of allocation limits in water allocation plans. The allocation limits are set to achieve environmental water provisions that in turn meet all or part of the environmental water requirements.

Eleven water allocation plans have been finalised, most of which relate to groundwater management. Groundwater dependent ecosystems such as wetlands and phreatophytic vegetation (plants that derive their water from groundwater), are identified and managed through the maintenance of groundwater levels. In some cases, the environmental water requirements for these environmental assets have been specifically determined in background assessments that are publicly available.¹²⁷

Generally, Western Australian water plans do not link specific management rules (such as allocation limits) to the protection of specific GDEs. Monitoring of GDEs only occurs in the South West and Gnamptara Groundwater allocation plans, which makes it difficult for the Department of Water to assess whether water provisions are adequate and to make adaptive management adjustments to those provisions in subsequent iterations of the plans. However, monitoring is required as a licence condition for large licence holders across the state.

125 ABS, 3101.0—*Australian demographic statistics, December 2009*, issued 24 June 2010, ABS, Canberra.

126 Data for individual sites available at the Bureau of Meteorology website: <http://www.bom.gov.au/climate/data/>

127 Available at the Western Australia Department of Water website: <http://www.water.wa.gov.au/Managing+our+water/Allocation+planning/default.aspx>

Table 54. Western Australia: environmental water statutory framework (30 June 2010)

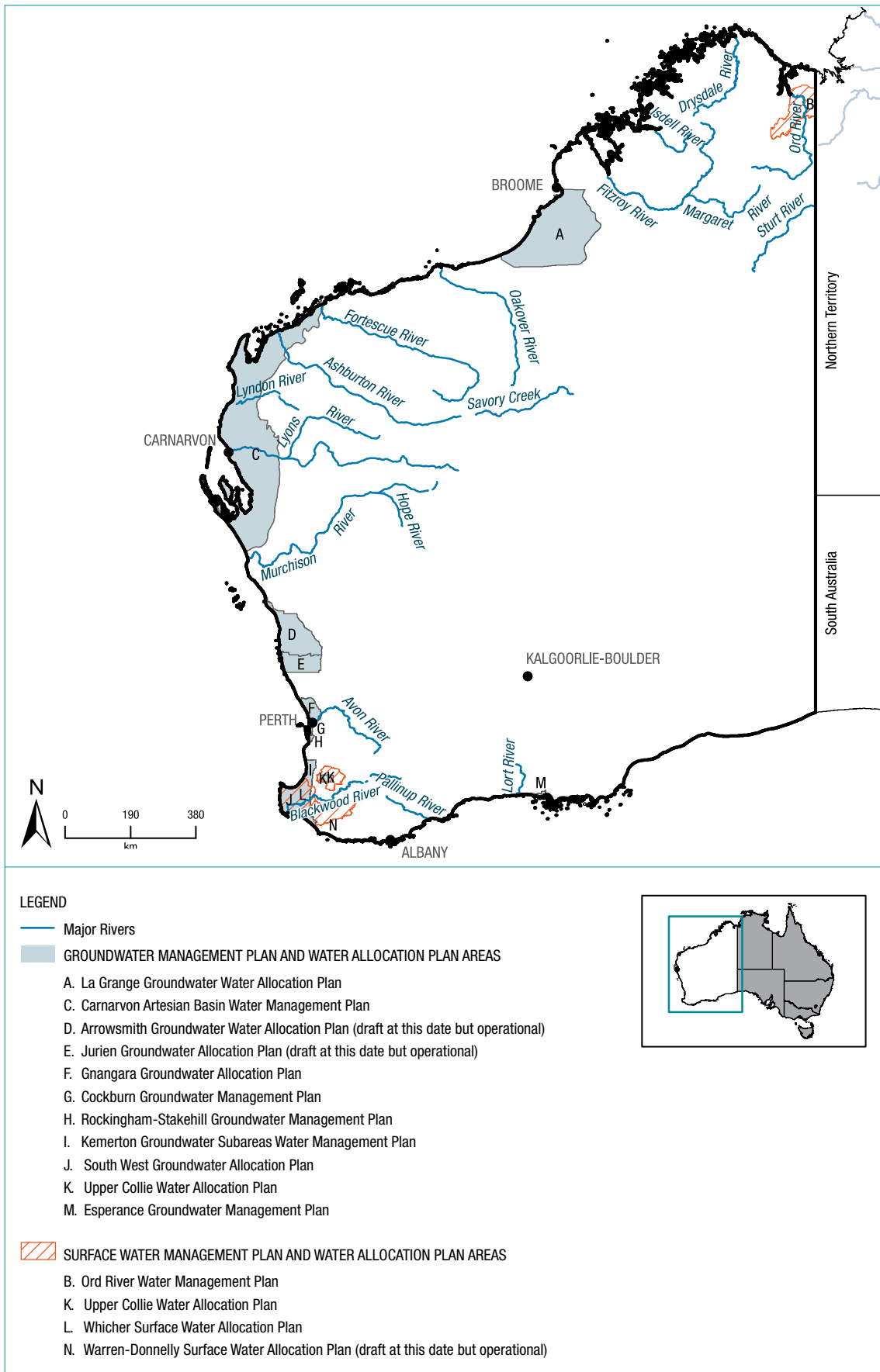
Legislation	<i>Rights in Water and Irrigation Act 1914</i> (WA) Statewide Policy No. 5 Environmental Water Provisions Policy for Western Australia <i>Environmental Protection Act 1986</i> (WA) <i>Waterways Conservation Act 1976</i> (WA)
Responsible minister	Minister for Water Resources
Environmental water manager	Department of Water
Other relevant institutions	Environment Protection Authority Water Corporation
Method of securing environmental water	Planned: mostly groundwater systems that deliver environmental outcomes through the use of allocation limits.

Table 55. Western Australia: environmental water terminology (30 June 2010)

Term	Type	Definition
Surface water management areas and groundwater management areas	Statutory areas	Areas defined for managing water resources. There are 44 surface water management areas and 174 groundwater management areas. The areas are divided among eight water regions.
Proclaimed area	Statutory area	Proclamation is a legal process that allows the Department of Water to manage resources in a particular region (part or all of a surface water management area or groundwater management area). Proclamation results in a requirement for water users to be licensed to use water from the area. Under the Rights in Water and Irrigation Act, it is illegal to take water from a proclaimed watercourse or groundwater aquifer without a licence.
Water licence	Statutory instrument	A water licence is an authority, which is attached to land, to take and use water. Water licences are issued in proclaimed areas, and eligibility for water licences is restricted to entities that own, occupy or have access to land on which water occurs.
Sustainable yield	Management tool	The sustainable yield is the amount of water that can be taken from a water resource system (expressed as an extraction regime) without causing unacceptable impacts on the environment.
Water management plan	Management tool	Water management plans support the strategic planning direction provided by the State Water Plan 2007 and the regional water plans by outlining processes to protect and share water resources and manage land-use changes.
Water allocation plan	Management tool	Water allocation plans determine and license how much groundwater or surface water can be taken from a region for domestic or commercial purposes without adversely affecting ecological, recreational and cultural values.
Ecological water requirements	Management input	Ecological water requirements outline the water regime necessary to maintain the ecological values of water-dependent ecosystems at a low level of risk.
Environmental water provisions	Management output	Environmental water provisions are the water regimes that are provided as a result of the water allocation decision-making process. They may fully or partly meet the ecological water requirements.

Western Australia uses a system of eight macro 'water regions' within which water planning and management services are delivered. The regions and their associated plans are listed in Table 56.

Figure 30. Western Australia: water management plan and water allocation plan areas (30 June 2010)



Source: Western Australia Department of Water, subject to data licence agreement with the National Water Commission.

Water reform

Changes in legislation during 2009–10 will affect the stipulation of environmental water provisions and associated water management plan and water allocation plan licensing arrangements. They include the introduction of the Water Resource Management Bill and amendments to the Rights in Water and Irrigation Act. The Bill, which was drafted during the 2009–10 water year, will incorporate NWI-compliant mechanisms that will result in changes to legislation involving water access entitlements.

Securing water for environmental purposes as a specific release from a dam in Western Australia occurs through licences that spell out conditions for the storage operator. (There are a number of dams from which water is released into the stream below the dam for the benefit of the environment and water users. The releases occur as part of the operating strategy attached to the licence of the public water supply utility. Only one of those releases, in the Canning, has a formal plan.) There is no equivalent statutory security for environmental water where it is deliberately retained in groundwater or surface water systems. The Bill will remedy this by identifying the principle that environmental water should have the same security as consumptive water. This will mean that the new planning framework will address environmental water provisions through rules-based approaches, similarly to the current system, but will also allow water access entitlements to be held for environmental purposes.

In addition to this, the water planning provisions in the Act will be revised to ensure that statutory regulation of water allocations can be incorporated into water management plans and water allocation plans. Defining environmental outcomes in statutory water management plans will enable monitoring and reporting on the effectiveness of the measures that have been implemented to meet environmental outcomes.

Table 56. Western Australia: water management planning (30 June 2010)

Macro region	Water management plans and water allocation plans	Surface / groundwater	Status	Dates and comments
Kimberley	La Grange Groundwater Water Allocation Plan	Ground	Final	February 2010. Covers the groundwater resources of the superficial Broome Sandstone aquifer.
	Ord River Water Management Plan	Surface	Final	December 2006. Covers the surface water resources of the lower Ord River. Currently preparing a supplement based on additional environmental investigations. Intended for release in late 2008
Pilbara	<i>Pilbara Regional Water Plan 2010–2030</i>	<i>Both</i>	<i>No plan</i>	<i>May 2010. The water plan is a macro-planning document under which water allocation plans will be developed</i>
Mid-West Gascoyne	<i>Arrowsmith Groundwater Water Allocation Plan</i>	<i>Ground</i>	<i>Draft</i>	<i>Draft plan released August 2009</i>
	Carnarvon Artesian Basin Water Management Plan	Ground	Final	December 2007. Covers the groundwater resources of the Carnarvon Artesian Basin (Birdrong Aquifer). The Birdrong Aquifer is Western Australia's most geographically extensive artesian aquifer.
	<i>Jurien Groundwater Allocation Plan</i>	<i>Ground</i>	<i>Draft</i>	<i>Comment period closed on 18 December 2009</i>
	<i>Lower Gascoyne River Water Allocation Plan</i>	<i>Both</i>	<i>No plan</i>	<i>Draft plan due for release for public comment in 2010</i>

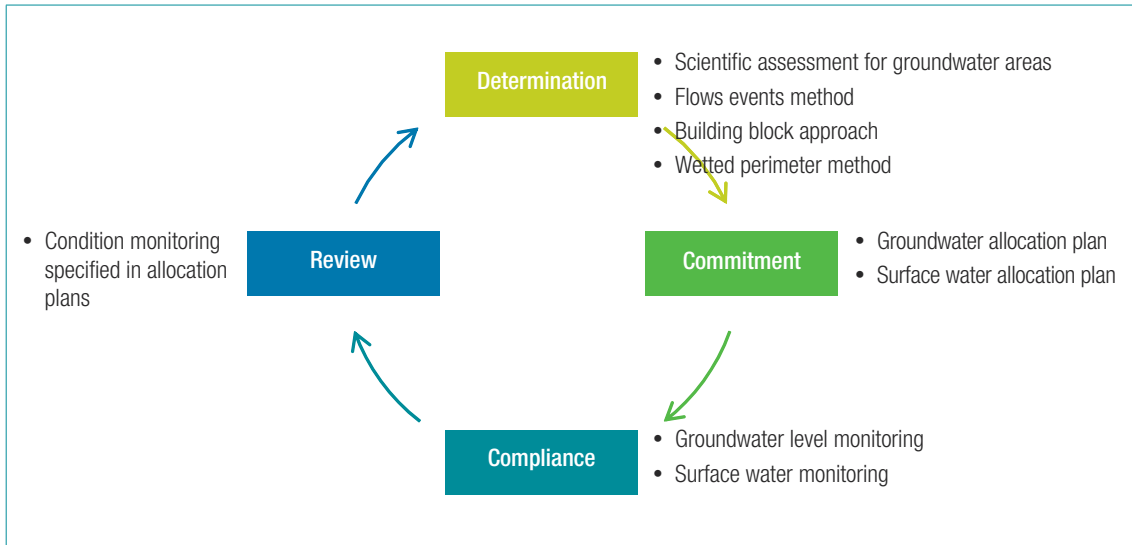
Macro region	Water management plans and water allocation plans	Surface / groundwater	Status	Dates and comments
Swan Avon and Goldfields ¹²⁸	<i>Canning River Surface Water Management Plan</i>	Surface	No plan	<i>Draft plan due in late 2008</i>
	<i>Gingin Groundwater Allocation Plan</i>	Ground	No plan	<i>Draft plan due in 2010</i>
	<i>Gingin Surface Water Allocation Plan</i>	Surface	Draft	<i>Draft September 2009. Final plan due for release in mid-2010</i>
	Gnangara Groundwater Allocation Plan	Ground	Final	November 2009. Covers the groundwater resources of the Gnangara groundwater areas, the largest single source of good quality fresh water in the Perth region.
Kwinana–Peel	Cockburn Groundwater Management Plan	Ground	Final	December 2007. Covers the groundwater resources of the Cockburn Groundwater Area, a coastal strip 30 kilometres south of Perth.
	Rockingham–Stakehill Groundwater Management Plan	Ground	Final	November 2008. Covers the groundwater resources of the Rockingham Groundwater Area and the majority of the Stakehill groundwater sub-areas adjacent to the Cockburn area 30 kilometres south of Perth.
South West	Kemerton Groundwater Subareas Water Management Plan	Ground	Final	December 2007. Covers the groundwater resources of the Kemerton sub-areas in the coastal strip north of Bunbury.
	South West Groundwater Allocation Plan	Ground	Final	May 2009. Covers the groundwater resources in the South West area of approximately 8250 km ² , a coastal zone encompassing the towns of Bunbury and Margaret River.
	Upper Collie Water Allocation Plan	Both	Final	August 2009. Covers the surface water and groundwater resources in the Upper Collie, around 200 kilometres south of Perth.
	Whicher Surface Water Allocation Plan	Surface	Final	September 2009. Covers the surface water resources of the Whicher area, including the Margaret, Blackwood and Lower Blackwood rivers south of Bunbury.
	<i>Warren–Donnelly Surface Water Allocation Plan</i>	Surface	Draft	<i>Released for comment in June 2010. Submissions close 6 September 2010</i>
South Coast	Esperance Groundwater Water Management Plan	Ground	Final	May 2007. Covers the groundwater resources of the Esperance Groundwater Area, a narrow coastal strip some 725 kilometres south-east of Perth.

Note: Plans under development at 30 June 2010 are shaded.

128 The Swan Avon region also covers the Goldfields region for all areas except the Shire of Dundas. There are eight macro regions.

The four elements of the environmental water management framework are applied to Western Australia in sections 12.2–12.5 and summarised in Figure 31.

Figure 31. Western Australia: summary environmental water management framework (30 June 2010)



12.2 Determination of environmental water

The process for determining ecological water requirements and environmental water provisions for surface water and groundwater resources is outlined in Statewide Policy No. 5 Environmental Water Provisions Policy for Western Australia. The policy notes that:

Ecological water requirements are the water regimes needed to maintain ecological values of water dependent ecosystems at a low level of risk. Ecological water requirements are determined on the basis of the best scientific information available and are the primary consideration in the determination of environmental water provisions. Environmental water provisions are the water regimes that are provided as a result of the water allocation decision-making process taking into account ecological, social and economic impacts. They may meet in part or in full the ecological water requirements. The water allocation decision-making process includes assessment of the proposed environmental water provisions under the *Environment Protection Act 1986* (WA) where environmental impacts may be significant.¹²⁹

An adapted version of Western Australian approach is shown in Figure 3 in Section 2.2, as the basis for the environmental water management model that is used throughout the *Australian environmental water management report 2010*.

The determination of an ecological water requirement involves different approaches for surface water and groundwater resources. The common first step in specifying a requirement is the identification of key ecological values, such as vegetation, aquatic fauna or ecological processes. In undisturbed systems, the aim is to establish ecological water requirements to protect existing natural ecological values. In disturbed systems, ecological water requirements are established to:

- + maintain the current ecological values
- + maintain and/or enhance current key ecological values
- + re-establish likely pre-existing natural ecological values
- or
- + a combination of these three aims, with different goals for different ecosystem components.

¹²⁹ Policy available at the Western Australia Department of Water website: <http://www.water.wa.gov.au/PublicationStore/first/11676.pdf>

Surface water requirements are determined using an approach in which all components of the ecosystem are considered (for example, fish, other vertebrates, invertebrates, riparian and floodplain vegetation) and all flow components (base flows, freshes and floods) are included. A number of specific approaches have been used in Western Australia, including:

- + the *flow events* method¹³⁰—which incorporates the investigation of environmental values and objectives, hydraulic survey and modelling, and hydrologic analysis
- + the *building block* method—which is a holistic approach that addresses the health of all components of the system to construct a flow regime for maintaining a river in a predetermined condition
- + the *wetted perimeter* method—which is a simple method that uses the relationship between wetted perimeter and discharge to determine ecological water requirements.

In most studies, ecological objectives are set for different ecosystem components, and the flow components required to achieve the objectives are determined. Using hydraulic criteria (for example, a minimum of 5 cm depth over riffles for adequate macro-invertebrate production), the flows (rate, timing, duration) are established from hydraulic models of representative sites. The ecological water requirement of a water source is the combination of all the flow requirements for individual ecosystem components. Publicly available examples of the process can be found in the ecological water requirement determinations for Cowarumup Brook¹³¹ and the lower Ord River.¹³²

Groundwater systems vary in their dimensions, connectivity, complexity and the value of the ecosystems associated with them. To establish recommended ecological water requirements, the relationships between groundwater levels and ecological and geomorphological responses are modelled for different ecosystem components (wetlands, cave systems, terrestrial vegetation dependent on ground water etc.), and responses to drawdown from groundwater extraction are estimated. A publicly available example of the process can be found in the ecological water requirement determination for Gngangara and Janadakot Mounds.¹³³

Environmental water provisions

Environmental water provisions are the water regimes that are established as a result of the water allocation decision-making process, taking into account ecological, social and economic impacts. They are defined after balancing ecological, social and economic requirements, and therefore may meet the ecological water requirement in part or in full. An environmental water provisions may be less than an ecological water requirement when an ecological impact has been accepted due to a trade-off to accommodate social or economic pressures. Alternatively, all the water might be allocated to the ecological water requirement in areas of high ecological value.

Social water requirements and potential extraction requirements are determined through the identification of the social and economic values of the water resource. They are balanced with the ecological water requirements to define the management objectives for the system, which are outlined in the water allocation plans. Scientific modelling and evaluation are used to identify the best allocation options to meet those objectives. This process outlines the environmental water provisions, as well as quantities of water available for consumptive uses (sustainable yields).

The approach to defining environmental water provisions for groundwater systems depends on the ecological and social values of the area. For example, several internationally important wetlands and a number of nationally and state recognised ecosystems are present in the groundwater system of the South West Region. Given the high social, cultural and economic value of the region's groundwater resources, an extensive process of scientific investigation, regulatory approval through the Environment Protection Authority and community consultation was undertaken to determine the environmental water provisions. Conversely, in the Carnarvon Artesian Basin there are no groundwater-dependent ecosystems of environmental value, so the sustainable development of groundwater resources concentrates on maintaining available water for users, with no water provided for the environmental water provisions.

Environmental water provisions are usually expressed as detailed descriptions of water regimes (which may vary spatially and temporally). For example, environmental water provisions may be stipulated as minimal levels in wetlands in certain months or for certain periods, peak levels in spring, monthly flow rates, depths required over riffles or flow releases for storages.

130 For further information, see M Stewardson, C Gippel, *Incorporating flow variability into environmental flow regimes using the flow events method*, River Research and Applications, Vol 19, Issue 5-6, September 2003. Available at: <http://www.catchment.crc.org.au/archive/pubs/1000173.html>

131 Further information available at the Western Australian Department of Water website: <http://www.water.wa.gov.au/Water+regions/South+West/default.aspx#>

132 Further information available at the Western Australian Department of Water website: <http://www.water.wa.gov.au/Managing+our+water/Allocation+planning/Ord+River+surface+water/default.aspx>

133 Further information available at the Western Australian Department of Water website: <http://www.water.wa.gov.au/Understanding+our+water/Understanding+groundwater/Gngangara+Mound/default.aspx>

Table 57. Western Australia: definition of environmental water requirements in water management plans and water allocation plans (30 June 2010)

Water management plans and water allocation plans	Defining environmental water requirements
La Grange Groundwater Allocation Plan	Recognises that information gaps exist. In the absence of specific information, a risk-based assessment of licences is used to set a conservative allocation limit.
Ord River Water Management Plan	Ecological water requirements defined in the form of minimum monthly flow rates in different reaches.
Carnarvon Artesian Basin Water Management Plan	Not considered to have natural GDEs because of the depth of the aquifer system.
Gnangara Groundwater Allocation Plan	Ecological water requirements determined for GDEs, including permanent and seasonal wetlands, groundwater-dependent terrestrial vegetation, mound springs and caves.
Cockburn Groundwater Management Plan	Wetland water level criteria and maximum water level criteria set for rare flora, phreatophytic vegetation and environmentally sensitive areas.
Rockingham–Stakehill Groundwater Management Plan	GDEs identified, including wetlands and groundwater-dependent terrestrial vegetation, but not their environmental water requirements.
Kemerton Groundwater Subareas Water Management Plan	Ecological water requirements determined for GDEs, including permanent and seasonal wetlands and terrestrial vegetation defined through a broader study of the Perth region. Critical tolerance levels of extended groundwater drawdown for terrestrial vegetation are defined for a range of wetland categories.
South West Groundwater Allocation Plan	Wetlands of high conservation value and areas of terrestrial vegetation were chosen as representative sites. Generic ecological water requirements in the form of maximum drawdown and rate-of-change criteria were established at each reference site.
Upper Collie Water Allocation Plan	Ecological water requirements for surface water in each sub-area have been formally assessed in various studies to estimate ecological sustainable yield. Requirements of GDEs in pools of the Collie River dictate the groundwater environmental water requirements.
Whicher Surface Water Allocation Plan	Ecologically sustainable yield set for Cowarumup Brook. Other areas use sustainable diversion limit calculations. The sustainable diversion limit is defined by a set of rules that specify when and how water can be taken from a river, including a winter fill period over which diversions can occur (15 June to 15 October), a minimum flow threshold below which diversions should cease, a maximum daily rate of extraction, and annual licensed volume associated with a specified reliability of supply.
Esperance Groundwater Water Management Plan	Recognises that information gaps exist. In the absence of specific information, conservative allocation limits have been set to meet the ecological water requirements of GDEs such as the Esperance Lakes.

12.3 Commitment of environmental water

The commitment to provide environmental water is determined through a hierarchical planning process. In each of eight water regions across the state, a regional water plan is required. The regional water plan drives the production of water allocation plans, based on sub-regions within the region. Commitment of environmental water in surface and groundwater systems over most of Western Australia is achieved through the setting of allocation limits in water allocation plans. The allocation limits are set to achieve environmental water provisions that in turn meet all or part of the ecological water requirements. Minimum monthly flow rates have been defined only in the water management plan for the Ord River, where studies of ecological water requirements have been conducted.

Table 58. Western Australia: environmental water commitment in water management plans and water allocation plans (30 June 2010)

Water management plans and water allocation plans	Environmental water commitment
La Grange Groundwater Allocation Plan	Allocation limits based on annual recharge, maintenance of saltwater interface and making allowance for ecological and cultural values by allowing 50% of annual available water for abstraction.
Ord River Water Management Plan	Environmental water provisions defined as minimum monthly flow rates in both the Lower Ord River and the Dunham River. Sustainable diversion limits also set.
Carnarvon Artesian Basin Water Management Plan	Not applicable, due to absence of ecological water requirements.
Gnangara Groundwater Allocation Plan	Annual allocation limits set for sub-areas to protect groundwater-dependent ecosystems (GDEs). Allocation limits are set to achieve the environmental water provisions. The environmental water provisions, based on ecological water requirements, are usually water-level criteria set for representative sites.
Cockburn Groundwater Management Plan	Allocation limits based on the 'sustainable supply', which was calculated as the total supply minus an allowance for the environment. Allocation principles include the protection of Ramsar wetlands and GDEs.
Rockingham–Stakehill Groundwater Management Plan	Allocation limits based on the 'sustainable supply', which was calculated as the total supply minus an allowance for the environment. Allocation principles also include the protection of Ramsar wetlands and GDEs.
Kemerton Groundwater Subareas Water Management Plan	Allocation limits set through use of groundwater modelling that incorporates ecological water requirements, such as critical levels of drawdown.
South West Groundwater Allocation Plan	Annual allocation limits set for sub-areas to protect GDEs.
Upper Collie Water Allocation Plan	Annual allocation limits set for surface water and groundwater. The detailed stream flow requirements in the background study ¹²⁰ have not been included in the plan (winter base flow, fish passage, etc.).
Whicher Surface Water Allocation Plan	Annual allocation limits set for sub-areas to protect ecological values. Ecological water requirements and ecologically sustainable yield have been determined only for the Cowarumup Brook; a precautionary approach based on calculated sustainable diversion limits was adopted.
Esperance Groundwater Water Management Plan	Annual allocation limits set for sub-areas to protect GDEs; specific ecological water requirements are not known.

12.4 Compliance with environmental water delivery

Compliance with groundwater environmental water delivery is generally in the form of groundwater level monitoring through a network of bores. This is mainly focused on groundwater levels and sometimes includes salinity and saltwater interface monitoring in coastal systems. In larger licences there is generally a requirement to install metering, and the Department of Water undertakes compliance audits of some systems. Compliance with surface environmental water delivery varies, from stream-flow monitoring, to regular audits of licences, through to requirements for meters to confirm licence compliance.

Consistent reporting on environmental water compliance will be included in water accounting reports prepared for priority water allocation plan areas. A disclosure note will provide summary-level information on compliance with water access rules and environmental water provisions. A 2009–10 water account for the Gngangara Groundwater Areas was in preparation at 30 June 2010.

Table 59. Western Australia: environmental water compliance in water management plans and water allocation plans (30 June 2010)

Water management plans and water allocation plans	Compliance reporting
La Grange Groundwater Allocation Plan	No regional monitoring network exists. Reporting from licensees is used. Deemed to be at low risk due to low levels of abstraction.
Ord River Water Management Plan	The Water Corporation holds a licence with conditions including maintaining the interim environmental water provision regime in the lower Ord River.
Carnarvon Artesian Basin Water Management Plan	Not applicable, due to absence of ecological water requirements.
Gngangara Groundwater Allocation Plan	Groundwater level data is collected from a large number of monitoring bores. The frequency of monitoring of individual bores ranges between monthly and annually.
Cockburn Groundwater Management Plan	Groundwater level data is collected from a large number of monitoring bores. The frequency of monitoring of individual bores ranges between monthly and biannually. Some salinity monitoring.
Rockingham–Stakehill Groundwater Management Plan	Groundwater level data is collected from a large number of monitoring bores. The frequency of monitoring of individual bores varies. Some salinity monitoring. Bore metering and water-use surveys provide estimates of use.
Kemerton Groundwater Subareas Water Management Plan	Flow meters for all licences of more than 50 ML/year. Licences under 50 ML/year may require flow metering if there are specific risks to ecological water requirement criteria levels and water quality. The department may require the licensee to monitor groundwater levels.
South West Groundwater Allocation Plan	Groundwater level monitoring at a network of more than 450 bores six times per year to capture maximum and minimum water levels. Groundwater level measurement at 39 sites on a monthly basis. Twenty-four sites have had ecological water requirements determined, and some have had continuous time series data collected. Trigger and response framework in place at 10 sites.
Upper Collie Water Allocation Plan	Monitoring program includes groundwater levels and quality; groundwater and surface water interaction; surface water quality; and surface water flow.
Whicher Surface Water Allocation Plan	No specific compliance monitoring linked to sub-area allocation limits. The plan commits the department to conduct compliance audits every 3–5 years for all licensees with entitlements greater than 50 000 kL/year and upon renewal of all other licences.
Esperance Groundwater Water Management Plan	Ongoing groundwater level and water quality monitoring (including saltwater interface monitoring bores) is undertaken by the Water Corporation and reported annually. Specifics are not detailed in the plan.

134 Further information available at the Western Australian Department for Water website:
<http://www.water.wa.gov.au/Managing+our+water/Allocation+planning/Upper+Collie+surface+and+groundwater/default.aspx>

12.5 Review of environmental water

Monitoring of water-dependent environmental values to assess the adequacy of environmental water provisions is undertaken at a number of sites in Western Australia, in particular the Gngangara Mound and Millstream. The South West Groundwater Allocation Plan includes annual vegetation condition assessments at reference sites, which can then be used in conjunction with the compliance monitoring to review ecological water requirements. Some plans in Western Australia include the requirement for the preparation of an annual evaluation statement. As of 30 June 2010, no statements had been prepared.

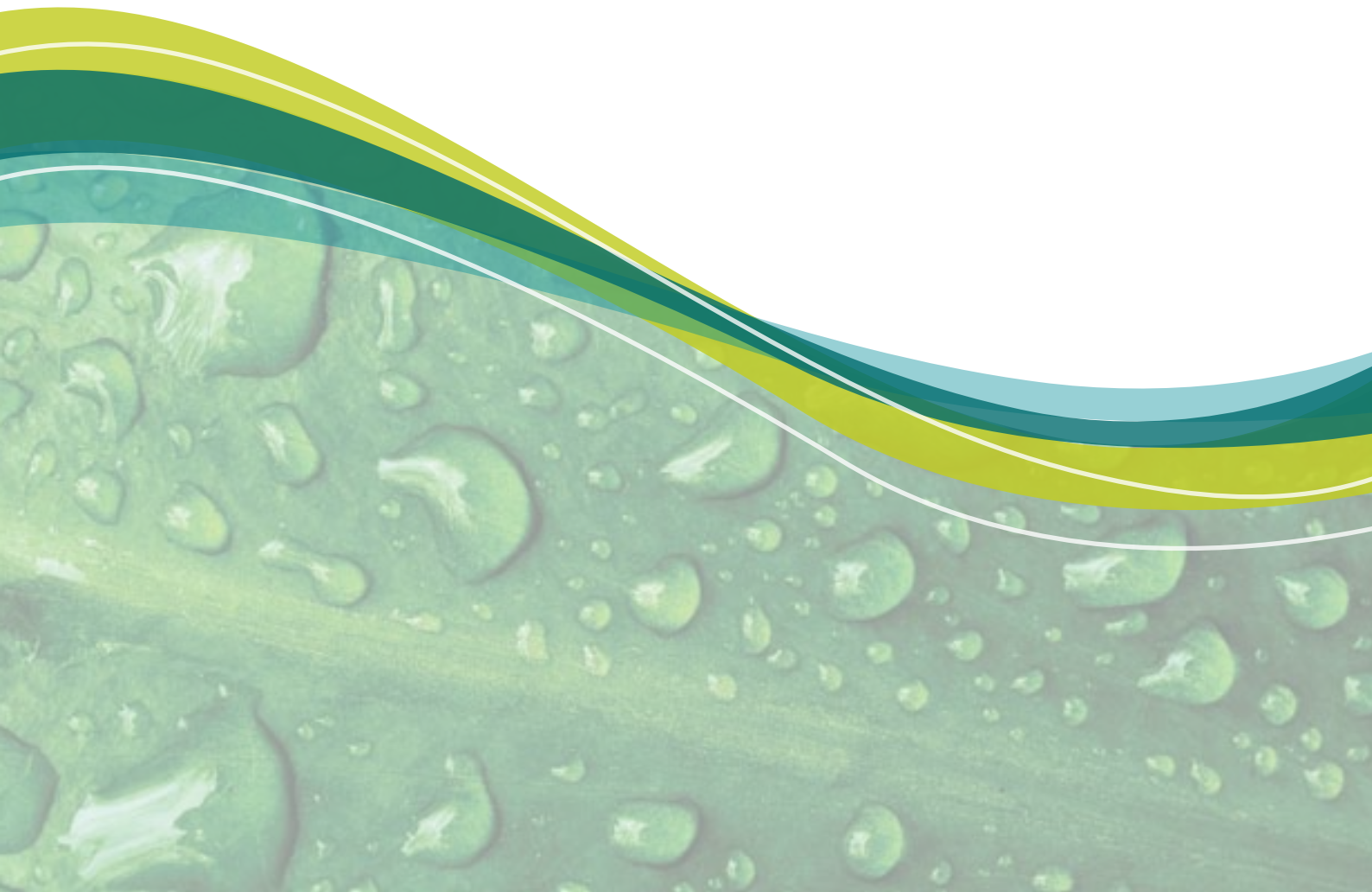
Table 60. Western Australia: environmental water review processes in water management plans and water allocation plans (30 June 2010)

Water management plans and water allocation plans	Review of environmental water requirements
La Grange Groundwater Allocation Plan	None. Evaluation statement released annually includes the status of water use and all actions and performance against the plan's objectives, but not ecological response monitoring. In addition, there is a series of management triggers and associated responses.
Ord River Water Management Plan	Updated hydraulic and hydrologic modelling has enabled a revised ecological water requirement to be drafted. A supplement to the Ord River Water Management Plan (intended for release in late 2008 but not yet available) will incorporate the revised ecological water requirement information.
Carnarvon Artesian Basin Water Management Plan	Not applicable, due to absence of ecological water requirements.
Gngangara Groundwater Allocation Plan	Gngangara condition monitoring is being used as the basis for review of the ecological water requirements for the next Gngangara plan. The number of noncompliances with environmental water provision criteria, the rate of groundwater level decline, ecological condition and end-of-summer water-level predictions are used to manage the abstraction of public water supply on an annual basis. Detailed environmental monitoring program, including water levels, wetland vegetation, water quality and frogs.
Cockburn Groundwater Management Plan	None. Proposed review of interim criteria following the completion of more detailed assessments of the requirements of groundwater-dependent vegetation.
Rockingham–Stakehill Groundwater Management Plan	None. There is an obligation under the plan to include an appropriate monitoring program for GDEs and report on it in the Kwinana–Peel regional monitoring program, but that requirement had not been implemented at 30 June 2010.
Kemerton Groundwater Subareas Water Management Plan	Regional groundwater monitoring program data is used to ensure that the management objectives are being met. Local ecological water requirements will be established for key GDEs by December 2010.
South West Groundwater Allocation Plan	Annual vegetation condition assessments at 39 reference sites. Trigger and response framework (generic and some specific) to guide rapid adaptive management. Annual production and release of a public evaluation statement that discusses the effectiveness of implemented trigger/response management.
Upper Collie Water Allocation Plan	None. Production of an annual public evaluation statement (due August 2010) that includes reporting on groundwater levels and surface water flows in accordance with the monitoring program, but does not review the health of water-dependent values.
Whicher Surface Water Allocation Plan	None. There is a performance indicator ('criteria established through ecological requirement studies that are accepted by the department are met'), but the indicator has not been addressed. To identify whether the management approach is working to achieve its objectives, the Department of Water will release an evaluation statement annually (due in September 2010).
Esperance Groundwater Water Management Plan	Regional groundwater monitoring program data is used to ensure that the management objectives are being met. The monitoring information will be used to reassess the sustainable groundwater yield and allocation limits for the protection of the environment and existing users.

Appendices

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Appendix A

Background on the National Water Accounting Development project

1. Paragraph 80 of the NWI provides:

The Parties agree that the outcome of water resource accounting is to ensure that adequate measurement, monitoring and reporting systems are in place in all jurisdictions, to support public and investor confidence in the amount of water being traded, extracted for consumptive use, and recovered and managed for environmental and other public benefit outcomes.

2. Ministerial Council 40 (24 November 2006) agreed to establish the National Water Accounting Development project (NWADp) to assist in achieving paragraph 80 of the NWI.
3. The Water Accounting Development Committee (WADC), supported by the Water Accounting Development Committee Office (WADCO), was established to oversee the National Water Accounting Development project. A Jurisdictional Reference Panel provided advice to WADC and tested WADC output. The WADC was funded from the National Water Commission's Raising National Water Standards funds from November 2006 until October 2008, by which date it had delivered:
 - a. A developed National Water Accounting Model
 - b. A Vision for Water Accounting in Australia in 2030
 - c. Development of a Water Accounting Conceptual Framework
 - d. User Information Requirements
 - e. A Standard Development Process
 - f. Several pilot projects in the jurisdictions and the Murray–Darling Basin
 - g. Recommendations for ongoing institutional arrangements
 - h. An initial common chart of accounts.

4. The Commission's 2007 biennial assessment stated that:

When adopted, the National Water Accounting Model will provide a sound basis for each jurisdiction to produce state water reports that provide reliable, comparable information across the jurisdiction and allow for aggregation with other states' accounts to produce a national water balance.

It is generally recognised that the scope of the National Water Accounting Model involves a theoretical basis that now goes beyond what was conceived in the development of the NWI.

This has led to an extended timeframe for the development and implementation of water accounting standards.

There is strong national support for this additional rigour, which will mean the standards as implemented by states will have a sound basis. The Commission considers that the additional value that this development work will bring outweighs any potential concerns about an extended timeframe. The piloting and trials of standards will be important to establishing industry and community confidence in water accounting.

The national standards to be developed by the WADC will be essential to the rigour and consistency required. The implementation of the standards will be an important next step in the process to ensure the outcomes of the NWI are achieved. (p. 66)

5. In October 2008 the Water Accounting Standards Board (WASB) was created from the WADC. The Jurisdictional Reference Panel was disbanded, and the WADCO became the Water Accounting Standards Board Office (WASBO). WASBO was relocated to the Bureau of Meteorology and WASB became an independent expert advisory panel to the Bureau. At 30 September 2010 WASB has developed:
 - a. Water Accounting Conceptual Framework for the Preparation and Presentation of General Purpose Water Accounting Reports (published 2009) to guide the development of Australian Water Accounting Standards (AWAS)

- b. Preliminary Australian Water Accounting Standard (published in 2009) to assist the Bureau of Meteorology with their obligation to publish a National Water Account and
 - c. An Exposure Draft for Australian Water Accounting Standard 1: The Presentation and Preparation of General Purpose Water Accounting Reports (published in November 2010).
6. The 2009 Biennial Assessment stated that:

The Commission notes that standards for environmental water accounting are being addressed through the National Water Accounting Development Project. While noting progress in New South Wales, Victoria and the Murray–Darling Basin, the Commission finds that only limited progress has been made in developing the environmental water registers required by the NWI. (Finding 3.4)

The Commission considers it essential that water accounting standards adequately address environmental water accounting. The Commission urges a refocusing of effort to ensure that registers report on environmental water, particularly given the importance of registers in underpinning community confidence in environmental water recovery investments. Such registers need national consistency and public accessibility, and should be properly nested within the national water accounting system as a whole. (Recommendation 3.3)

Appendix B

Extracts from the Water Accounting Conceptual Framework and the exposure draft of the Australian Water Accounting Standard 1

Water accounting definition from the Water Accounting Conceptual Framework (WACF)¹³⁵

'Water accounting' is a systematic process of identifying, recognising, quantifying, reporting, and assuring information about water, the rights or other claims to that water, and the obligations against that water.

Objective of general purpose water accounting reports from the exposure draft of the Australian Water Accounting Standard 1 (ED AWAS 1)

5. *A general purpose water accounting report* shall provide information to users of that report that will be useful in:
- a) making and evaluating decisions about the allocation of resources; and
 - b) understanding and evaluating the accountability of managers, management groups or governing bodies of the water report entity for the water assets and water liabilities of the water report entity.

Water for environmental, social and cultural, and economic benefit

157. Information shall be disclosed in the notes that enables users to understand how water assets and water liabilities of the water report entity have been used during the reporting period in the pursuit of each of the following:

- a) environmental benefit;
- b) social and cultural benefit; and
- c) economic benefit.

Water related to environmental benefit

158. To give effect to the principle in paragraph 157(a), the following information is disclosed in the notes:

- a) details of non-discretionary or rules-based provisions in externally-imposed requirements aimed primarily at environmental benefit. This includes information about the objective, nature and volumes of such provisions;
- b) details of any changes in non-discretionary or rules-based provisions in externally imposed requirements aimed primarily at environmental benefit;
- c) details of holdings of water rights aimed primarily at environmental benefit and discretionary provisions in externally-imposed requirements aimed primarily at environmental benefit. This includes:
 - i) details of who holds or controls such holdings and discretionary provisions;
 - ii) a description of the attributes of the holdings and discretionary provisions including the related environmental objectives;
 - iii) any changes to the holdings, including details of any water entitlement or water allocation trading, and any changes to the discretionary provisions during the reporting period; and
 - iv) the volumes, origins and destinations of water accessed and taken or delivered during the reporting period;
- d) information that allows users to understand compliance by the management of the water report entity with the rules and changes to the rules disclosed in accordance with sub-paragraphs a) and b) above.

¹³⁵ Available at the Bureau of Meteorology website: <http://www.bom.gov.au/water/about/consultation/wacf.shtml>

