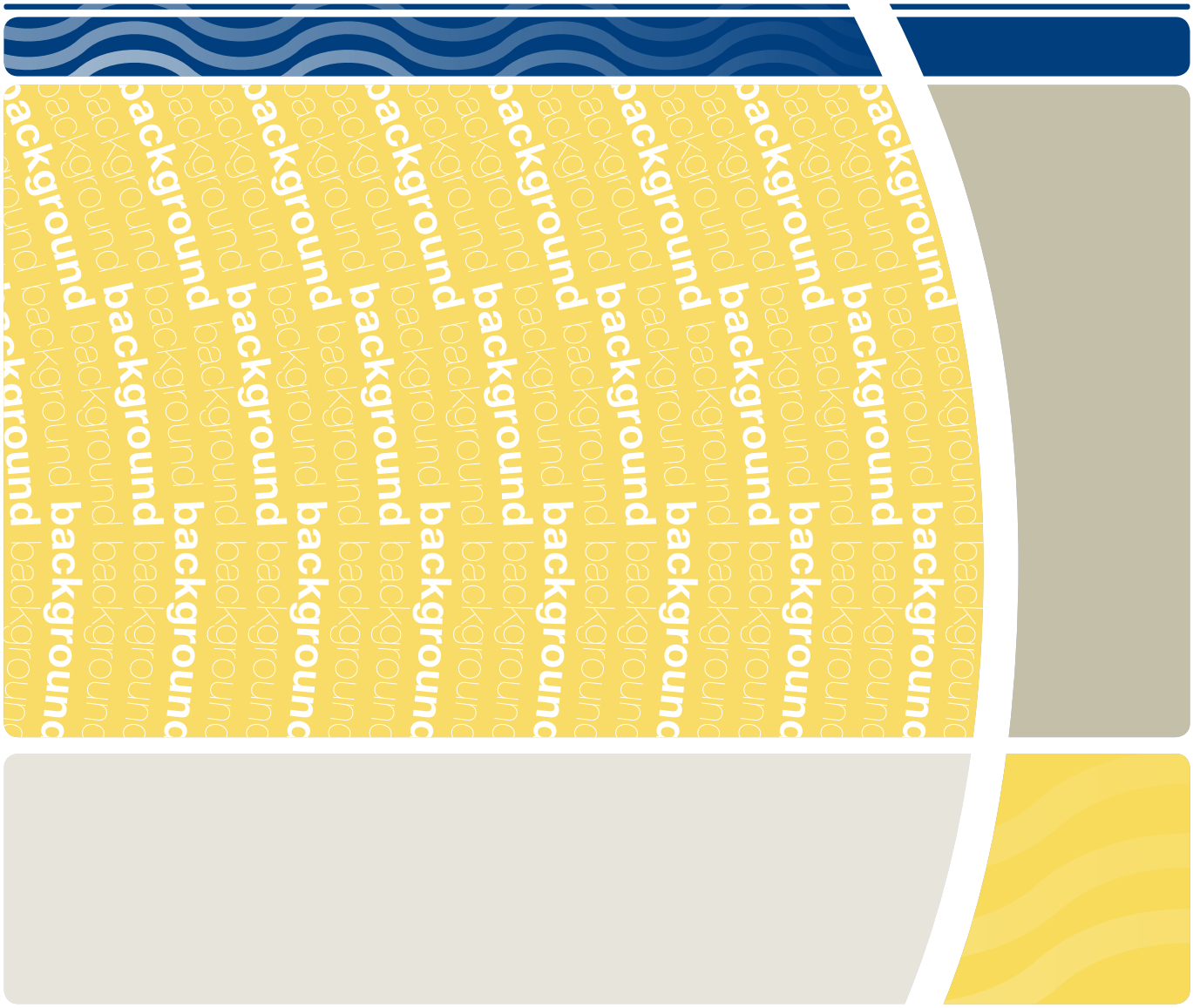
NSW GOVERNMENT | Office of Water

Water Sharing Plan
Towamba River Unregulated and Alluvial Water Sources
Background document



Leading policy and reform in sustainable water management

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The NSW Office of Water is a separate office within the Department of Environment, Climate Change and Water. The Office of Water manages the policy and regulatory frameworks for the State's surface water and groundwater resources to provide a secure and sustainable water supply for all users. The Office of Water also supports water utilities in the provision of water and sewerage services throughout New South Wales.

Water Sharing Plan for the Towamba River
Unregulated and Alluvial Water Sources – Background document

December 2010

ISBN 978 1 74263 115 8

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Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across NSW following the introduction of the *Water Management Act 2000* (*WMA 2000*). These plans protect the health of our rivers and groundwater while also providing water users with perpetual access licences, equitable conditions, and increased opportunities to trade water through separation of land and water.

In recent years, plans for the unregulated[1] rivers and groundwater systems have been completed using a 'macro' or broader-scale river catchment or aquifer system approach. Approximately 90 per cent of the water extracted in NSW is now covered by the *WMA 2000.*

The macro planning process is designed to develop water sharing plans covering most of the remaining water sources across NSW. Each macro plan covers a large river basin rather than a single sub-catchment, or in the case of groundwater systems, cover a particular type of aquifer (e.g. fractured rock). These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water use.

The Water Sharing Plan for the Towamba River Unregulated and Alluvial Water Sources 2010 (water sharing plan or plan) covers 22 water sources that are grouped into three Extraction Management Units (EMU) (Appendix 1).

Water sharing rules the water sharing plan focuses on are:

- environmental water rules – the share of the water reserved for the environment
- access rules – determine when extraction is allowed (for example above a set river flow rate)
- dealing rules – control the trade of water, both the transfer of share components of an access licence and assignment of water allocation between access licences, as well as changing the location for water extraction.

In developing environmental water rules, access rules and dealing rules, other water management rules are considered, including:

- long-term average annual extraction limits – a growth-in-use assessment and management tool
- rules for granting access licences – what types of licences may be granted
- rules for granting works approvals – what types of set-back conditions are required
- system operation rules.

This document provides background to the development of the water sharing plan and includes:

- the purpose of the statutory plan
- the intended outcomes of the plan
- a physical description of the Towamba catchment including land and water use
- the process of plan development including scope, history and basis for decisions
- the use of adaptive management
- the activities associated with implementation, monitoring and review of the plan.

[1] The supply of water in unregulated rivers is typically not controlled by releases of water from dams but rather is dependent solely on rainfall and natural river flows.

The objectives of the water sharing plan are to:

- protect the important water dependent environmental, Aboriginal cultural and heritage values
- protect basic landholder rights
- manage water extraction from the rivers and the closely linked aquifers to ensure equitable sharing between users
- provide opportunities for market based trading of licences and water allocations
- provide flexibility for licensed water users in how they can use their water
- allow for adaptive management, that is, to allow changes to the plan to be made as a result of more information that will become available during the life of the plan.

This document is part of a range of material available specifically on the water sharing plan including:

- the *Water Sharing Plan for the Towamba River Unregulated and Alluvial Water Sources 2010* – a legal instrument written in its required statutory format)
- a guide to the water sharing plan – a plain English version of the plan explaining the key sections and rules
- report cards for each water source – detailing background information on the water sources
- rules summary sheets – summarising the proposed management rules for each water source.

In addition, general information on the macro planning process is available in the Water sharing plans section of the NSW Office of Water website www.water.nsw.gov.au. Information available for download or viewing includes:

- *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation* – a document explaining the method used to classify and set water sharing rules for unregulated streams across the State
- *Guidelines for surface water sharing plan report cards* – a document explaining the information presented in report cards
- *Setting rules for water sharing* – information outlining the key steps for developing the rules.

Purpose of the plan

Why are water sharing plans being prepared?

Expansion of water extraction across NSW in the 20th century has placed most valleys at or close to the limit of sustainable water extraction. This has seen increasing competition between water users (towns, farmers, industries and irrigators) for access to water. This has also placed pressure on the health and biological diversity of our rivers and aquifers.

Under the *Water Management Act 2000*, the sharing of water must protect the water source and its dependent ecosystems and must protect basic landholder rights. Sharing or extraction of water under any other right must not prejudice these. Therefore, sharing water to licensed water users is effectively the next priority for water sharing. Amongst licensed water users, priority is given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and other industries. Plans provide a legal basis for sharing water between the environment and consumptive purposes.

Plans also recognise the economic benefits that commercial users such as irrigation and industry can bring to a region. Upon commencement, access licences held under the *Water Act 1912* are converted to access licences under the *WMA 2000* and land and water rights are separated. This facilitates the trade of access licences and can encourage more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

In conjunction with the *WMA 2000*, plans also set rules so that commercial users can also continue to operate productively. In general, commercial licences under the *WMA 2000* are granted in perpetuity, providing greater commercial security of water access entitlements. Plans also define the access rules for commercial users for 10 years providing all users with greater certainty regarding sharing arrangements[2].

Benefits for water users

With the introduction of the water sharing plan, a number of benefits will flow to water users including:

- greater certainty for water users – the plan sets out the water sharing arrangements for a 10 year period
- clear trading and access rules which will help foster trading
- automatic conversion of licences in the plan area to perpetual water access licences providing greater security for water users – meaning the volumetric water access licences do not have to be renewed, however, approvals for the works used to extract water under these access licences will need to be renewed.

The plan recognises the economic benefits to the region that are generated by commercial users such as irrigators and industry. It sets rules so that commercial users can continue to operate productively. None of the water sources covered by the plan were considered to have a high economic dependence on commercial extraction.

[2] Security versus reliability. These terms are used differently across different jurisdictions, often interchangeably. The National Water Commission encourages the adoption of nationally consistent terminology based on the National Water Initiative. The definitions in the glossary relate to NWI-consistent use of these terms. In summary, security provides better tenure for an entitlement and does not necessarily provide greater reliability as this is determined by seasonal and climatic conditions.

Environmental considerations

Water sharing plans are required to reserve water for the overall health of the river and to protect specific ecosystems that depend on river flows, such as wetlands, lakes, estuaries and floodplains. This share of water reserved for the environment is also intended to sustain the river system's aquatic fauna and flora.

Most of the flows within the area covered by the plan are protected from extraction. Total entitlement within the catchment is just 3,974 ML, compared to an annual mean flow of 22,742 ML for the Pambula River and 146,600 for the Towamba River (the Merrica River gauge information was not included here as there is no current entitlement on the river and no trade permitted in).

Unregulated water sources

Although the total annual volume of water extracted is relatively low compared to average annual flow, most of the demand for water from unregulated systems usually occurs at those times when streamflow is low. Whilst there is only limited research on the importance of protecting very low flows, there is a body of evidence that suggests low flows are essential for maintaining water quality, allowing passage over riffles for fish and other fauna to pools used for drought refuge, and maintaining those parts of aquatic ecosystems that are most productive. For example, the faster flowing riffle areas between pools usually contain the highest abundance and diversity of aquatic fauna. It should also be noted that although many streams will naturally stop flowing in dry times, it is the increased frequency and duration of drying as a result of extraction that has the potential to impact on stream ecosystems.

Accordingly, in order to protect a proportion of these very low flows for the benefit of the environment, the water sharing plan imposes new access restrictions on days when flows are low. This is achieved by establishing 'cease-to-pump' (CtP) rules that describe when water must not be extracted, depending on the amount of flow in the river on any given day.

Twelve unregulated water sources were identified as having high in-stream values (Table 1). For these water sources, trading into the water source will not be permitted. Where the in-stream values are at high risk from extraction, the CtP rule tends to be conservative. Appendix 2 details the threatened species considered when assessing the water source values (note this only included species that are likely to be sensitive to extraction).

Table 1: Water sources with a high in-stream value

Water source	Description of in-stream value
Upper Towamba River	10 threatened species, 50% national park
Wog Wog River	14 threatened species, 2 endangered ecological communities (EECs), 60% national park
Stockyard Creek	10 threatened species, 50% national park
Lower Towamba River	15 threatened species, 2 EECs, 40% national park
Towamba Estuary tributaries	14 threatened species, 2 EECs, mostly state forest
Far South Coast	16 threatened species, 2 EECs, 100% nature reserve
Wonboyn River	17 threatened species, 2 EECs, mostly state forest, some national park
Green Cape	15 threatened species, 2 EECs, 90% national park
Pambula Lake tributaries	16 threatened species, 2 EECs
Sandy Beach Creek	14 threatened species, 2 EECs, 60% national park
Bondi Lake and tributaries	13 threatened species, 2 EECs, 100% national park
Wallagoot Lake and tributaries	14 threatened species, 2 EECs, 60% national park

Existing rules

A number of water sources within the plan area currently have an existing CtP condition. In 2000, the Towamba Water Management Committee, a subcommittee of the Towamba Valley Landcare Group, in conjunction with the Department of Land and Water Conservation (DLWC) drafted water sharing arrangements for the Upper Towamba River (above the Towamba gauging station – 220004) and its tributaries (Myrtle Creek and Mataganah Creek) that have been activated under the *Water Act 1912*. The basis of those arrangements is:

- when stream flow at the Towamba gauge falls below 12 ML/day, water sharing commences and all users are to use water sparingly e.g. no filling of dams
- when stream flow at the Towamba gauge falls below 5 ML/day, all commercial irrigation must stop
- when stream flow at the Towamba gauge falls below 1 ML/day, water usage for all users is restricted, only essential domestic and garden use is permitted.

A display board located in the township of Wyndham indicates the current level of restrictions. These water sharing arrangements have been in place for the last nine years and appear to be working well.

Proposed rules

With the commencement of the plan, all surface water licences (excluding licences used for food safety and essential dairy care) and those water sources with no licensed users or entitlement will be subject to CtP rules.

Alluvial water sources

Only the alluvial aquifers are included in the Towamba water sharing plan as they are often highly connected with surface water bodies. The interagency regional panel (IRP) recommended that alluvial groundwater and surface water be managed as a single resource.

Description of the plan area

This water sharing plan covers the Towamba Basin which includes not only the Towamba River catchment but also several coastal catchments to the north and south of the Towamba River catchment. The Towamba Basin is a coastal basin catchment situated on the South Coast of NSW, and includes 22 coastal sub-catchments (or 'water sources') from Wallagoot Lake to the Victorian border. (Refer to Appendix 1 in the water sharing plan for a map of the plan area.) The towns of Tathra, Merimbula, Pambula, Eden, Towamba and Wyndham are located in the plan area. The Towamba River is bounded by the Bega catchment to the north, the Snowy catchment to the west and the Genoa catchment to the south, and is approximately 2,345 km^2.

The three main catchments in the plan area are the:

- Towamba River catchment
- Wonboyn River catchment
- Pambula Lake catchment.

Like most of the NSW south coast, the Towamba catchment has a relatively high density of estuaries and coastal lakes (or ICOLLs – Intermittently cosed and open lakes and lagoons). There are 10 ecologically significant ICOLLs (including Wallagoot Lake, Merrica Lake, Nadgee Estuary and Nadgee Lake) and two ecologically significant estuaries (Towamba and Wonboyn) in the Towamba catchment. The sensitivity of ICOLLs and estuaries to extractions from surface water and groundwater was considered in preparing the Towamba water sharing plan, and is discussed later in this report.

The majority of the population in the plan area is located within the coastal towns of Tathra, Merimbula, Pambula and Eden. The population of these towns increases several fold during summer holidays, creating a significant demand on town water supplies.

Land use

Beef grazing is the main agricultural activity in the Towamba catchment, comprising about 10 per cent of land use in the plan area. A significant area of land is harvested for timber and paper products by Forests NSW, and there are several commercial oyster leases in the plan area. Tourism is a major contributor to the regional economy. About 40 per cent of the water sharing plan area is national park or nature reserve.

Agricultural water use

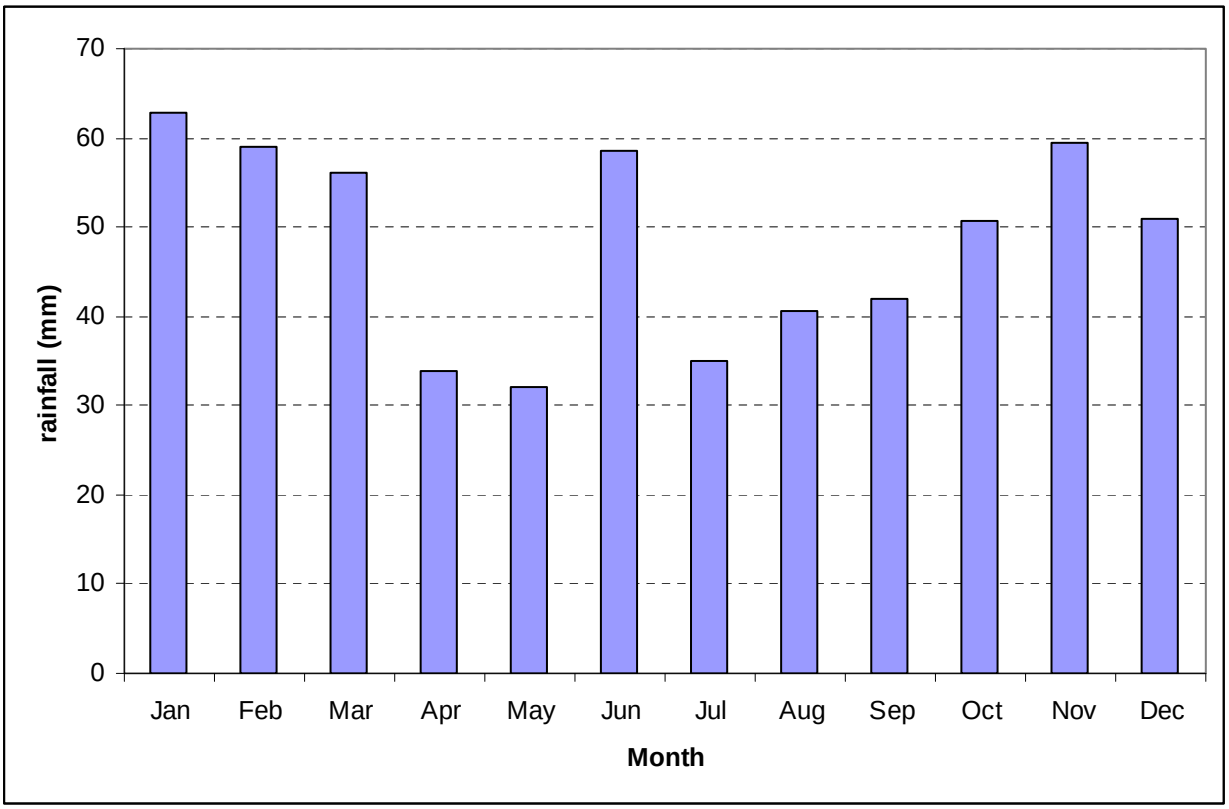
The greatest agricultural demand for water is stock water and small scale irrigation of lucerne. There are also a small number of horticultural properties for which irrigation water is required for fruit and vegetable production, and for orchard maintenance.

Although small-scale, agriculture is the main industry in the Towamba Valley upstream of Kiah, and as such is economically important to the rural communities of Wyndham and Towamba. A significant area of land to the west of Pambula and Eden is grazed for beef cattle production. However, the economic contribution of beef grazing along the coast is small relative to the tourism industry.

Rainfall

The average annual rainfall varies across the water sharing plan area from 900 mm along the coast to 1100 mm in the headwaters of the catchment. Monthly rainfall (Figure 2) tends to be greatest during summer (median January rainfall over the period from 1890 to 2008 is 62.8 mm) and lowest in May (median May rainfall over the same period is 32.1 mm).

Figure 1: Monthly median rainfall (Wyndham Post Office, 1890 to 2008) for the Towamba catchment



Source: Bureau of Meteorology website

Streamflows

There are three operational stream gauging stations in the water sharing plan area:

- Gauge 220003 Pambula River at Lochiel
- Gauge 220004 Towamba River at Towamba
- Gauge 220006 Merrica River.

Measurements from these gauges (Table 1) generally show very low flows in comparison to other coastal catchments in NSW, but this is the result of the small catchment size and only moderate rainfall. The Towamba River experiences the greatest stream flows of all of the streams in the plan area. The daily flow in Towamba River is 50.7 ML or less for 50 per cent of all days. The daily flow in the Pambula River is 5.5 ML or less for 50 per cent of all days. This is important in converting the macro risk and value assessment outcome to an actual CtP flow rate (this is further discussed later).

Table 2: Stream flow percentiles for gauges 220003 (Pambula River at Lochiel), 220004 (Towamba River at Towamba), and 220006 (Merrica River)

	Mean annual flow (ML)	Median annual flow (ML)	Percentile Flow (ML/day) of all days				
			95th	90th	80th	50th	30th
Pambula R	22,742	12,756	0.06	0.3	0.8	5.5	13.5
Towamba R	146,600	62,518	0.5	4.3	13.0	50.7	116.6
Merrica R			0.1	1.8	4.4	11.8	22.1

Source: NSW Office of Water, Hydsys database,
Pambula River data: 1967-2008; Towamba River data: 1971-2008; Merrica River data: 1984-2008

The Merrica River gauge is located in the Far South Coast water source where there is no current entitlement, and no trade permitted. Therefore this gauge was not required to be used in the development of water sharing rules.

Groundwater

Of the different types of aquifers, only alluvial aquifers are included in the Towamba water sharing plan as they are often highly connected with surface water bodies. That is alluvial groundwater and surface water in this plan area is managed as a single resource.

Coastal sand aquifers are usually small in volume and, if pumping exceeds recharge (even over relatively short periods), these are subject to salt water ingress. Therefore, they will be addressed in a separate plan and have not been included in the surface water macro plans, such as the Towamba water sharing plan. Both porous rock aquifers and fractured rock aquifers have low to moderate connectivity with surface water, and therefore they will be addressed in a separate water sharing and have also not been included in the surface water macro plans.

By incorporating groundwater and surface water extractions, the water sharing plan:

- protects highly connected water sources
- strives for equitable water sharing both within and between water user groups
- ensures that water is not accounted for twice.

In light of the small number of alluvial bores in this plan area, alluvial bores have been included in the Towamba water sharing plan, regardless of whether the bores are located upstream or downstream of the tidal limit (Table 3).

Historical droughts

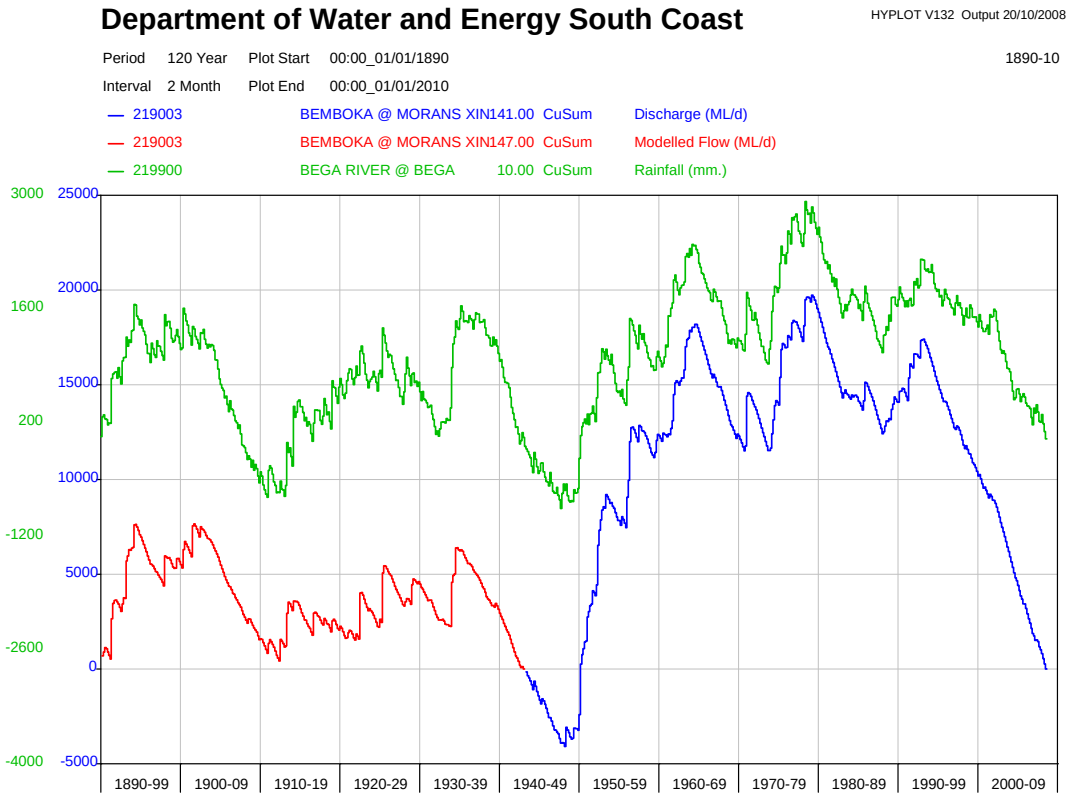
Public and scientific awareness of potentially changing climate is increasing each year. However, separating any potential climate changes from the inherent variability is particularly difficult. The latest science still shows some uncertainty around average changes, but tends to indicate there may be more frequent extreme weather events. Understanding this uncertainty, the potential changes and the related management challenges that will result has become a focus for the management of water resources.

The complex problem of separating variability from change is illustrated in Figure 2. This is a plot of rainfall and runoff at Morans Crossing on the Bemboka River in the neighbouring Bega Valley. The top line illustrates long-term rainfall, while the bottom line represents long-term runoff patterns. The plots are the cumulative sum of rainfall and runoff and their deviation from daily average level. This is a useful indication of ‘wet’ and ‘dry’ conditions and climatic variability. An upward trend in the plot indicates a wetter than average period and a downward trend is a drier period. The gradient points to how different the instantaneous numbers are from the average (ie a steeper line means it is either a lot wetter – upward – or a lot drier – downward – than average). The height of the peak or depth of the trough indicates how much persistence there has been in either a wet or dry period. A number of significant drought periods are highlighted by the plot:

- the Federation drought between 1902 and 1912
- the long drought from the mid-1930s to the late 1940s
- the 1960s and 1980s droughts
- the recent drought starting in the mid 1990s.

There are also wet periods – 1890s, 1950s and the mid-1970s. The period 1910-1930 shows a steady trend, getting neither wetter nor drier.

Figure 2: Residual Mass Curves of Rainfall and Runoff



Climate change and variability

In developing the Towamba water sharing plan, potential climate change was considered in:

- assessing supply and demand for water;
- framing access conditions; and
- determining the long term average annual extraction limit.

The NSW Government's current assessment of the changes to climate in the south east region of NSW (DECC, 2008) indicates that average temperatures in the Towamba catchment are likely to rise over the coming 40 years, however temperature alone is not a good indicator of future water demands. These are also driven by domestic usage in the case of town water supplies and crop water requirements in the case of irrigation. Furthermore, temperature rise alone is also not necessarily indicative of evaporation and rainfall changes, which are also important factors in driving water demands.

Temperature rises are generally correlated with evaporation rises on a daily time-step because hotter temperatures tend to occur on drier days. However, it becomes much more complex when converting rises in average temperatures to rises in average evapotranspiration, with dew point and relative humidity also being factors. This is a new scientific area still being explored, but nonetheless it is still currently assumed that increases in temperature will result in increases in evapotranspiration.

The assessment estimated that summer rainfall for south-east NSW will increase by 20 per cent to 50 per cent on average, and that winter rainfall will decrease by 10 per cent to 50 per cent on average. Changes in autumn and spring rainfall are suggested to be relatively small.

These changes in rainfall and possibly evapotranspiration are expected to alter stream flows with:

- a moderate increase in the magnitude of high flows, and a slight decrease in the frequency of low flows during summer
- a slight increase in the magnitude of high flows, and a slight decrease in the frequency of low flows during autumn
- a moderate decrease in the magnitude of high flows, and a slight increase in the frequency of low flows during winter
- a moderate decrease in the magnitude of high flows, and a moderate increase in the frequency of low flows during spring.

Under clause 48 of the National Water Initiative, water access entitlement holders are to bear the risk of any reduction in the availability of water as a result of climate change unless a different risk-sharing formula is negotiated between water access entitlement holders, environmental stakeholders and the State government. In the Towamba water sharing plan, the CtP levels set by the water sharing plan are based on a specified stream flow (e.g. 2 ML/day) rather than a specified percentile of stream flow (e.g. 95th percentile). Whilst the flow rate is based on the current estimate of a specific percentile using all of the available climatic data, it assumes a static hydrologic sequence. In adopting this approach, the risk of reductions in flows due to climate change is effectively apportioned to extractors rather than the environment because any reduced flows due to climate change that may occur during the life of this water sharing plan would result in statistically reduced opportunities for licence holders to extract. Future plans will need to consider what climatic sequence to adopt in determining the appropriate CtP rules and this is expected to be informed by better science available for the next plan.

Entitlement and use

The volume of entitlement for river access and aquifer access licences in each water source was determined using the NSW Office of Water's Licensing Administration System (LAS) database (Table 2). The greatest volumes of surface water entitlement in the Towamba catchment are along the Towamba River and its tributaries, and in the Pambula Lake tributaries water source.

Table 3: Licensed entitlements (ML/yr) in water sources of the Towamba catchment

Water Source	Domestic and Stock access licences	Local Water Utility access licences	Unregulated river access licences	Aquifer access licences	TOTAL
Upper Towamba River	24	0	359	48	431
Jingo Creek	0	0	38	0	38
Wog Wog River	0	0	180	0	180
Myrtle Creek	24	0	79	6	109
Mataganah Creek	18	0	144	0	162
Pericoe Creek	0	0	0	0	0
Stockyard Creek	0	0	0	0	0
Lower Towamba River	58	1,400	390	70	1,918
Towamba Estuary tributaries	24	0	0	0	24
Far South Coast	0	0	0	0	0
Wonboyn River	0	0	65	0	65
Green Cape	1	0	19	0	20
Nullica River	0	0	0	0	0
Eden tributaries	0	0	0	0	0
Curalo Lake and tributaries	0	0	0	0	0
Pambula Lake tributaries	99	0	769	39	907
Merimbula Lake tributaries	23	0	17	0	40
Merimbula Creek	2	0	93	0	95
Tura Beach	0	0	0	0	0
Sandy Beach Creek	11	0	74	85	170
Bondi Lake and tributaries	0	0	0	0	0
Wallagoot Lake and tributaries	36	0	0	9	45
TOTAL	**320**	**1,400**	**2,227**	**257**	**4,204**

Source: NOW, Licensing Administration System (LAS) database

Water is also extracted from watercourses within the water sharing plan area under basic landholder rights (not requiring a licence), and is discussed later in this document.

Local water utility requirements

Bega Valley Shire Council (BVSC) is the only local water utility covered by the Towamba water sharing plan. BVSC operate the Tantawangalo-Kiah water supply system which supplies water to the towns of Merimbula, Tura Beach, Pambula, Pambula Beach and Eden, the villages of Candelo, Wolumla and South Pambula, small settlements and a number of individual properties with a connection to the trunk main network.

The northern source of water for the system is Tantawangalo Creek, which is covered by the Bega-Brogo water sharing plan. Water extracted from Tantawangalo Creek is used to fill Yellow Pinch Dam, a 3,000 ML off-stream storage for the system. Tantawangalo Creek also supplies water direct to the villages of Candelo and Wolumla and a number of properties with a trunk main connection upstream of Yellow Pinch Dam. Yellow Pinch Dam supplies the towns of Merimbula and Tura Beach and also areas south to Bellbird Hill, although these areas are often supplied instead from the southern source and storage.

The southern source of water for the system is the Kiah Borefield located alongside the Lower Towamba River. Water from the borefield is used to fill Ben Boyd Dam, an 800 ML off-stream storage for the system, as well as to supply Eden and southern areas directly. Extraction from the borefield ranges between 1 and 6 ML/d, depending on river flow and demand.

In recent years, urban water demand by towns and villages served by the Tantawangalo-Kiah scheme has been met by supply of about 1,500 ML per annum from the Tantawangalo weir and 1,400 ML per annum from the Kiah borefield, with the Yellow Pinch Dam and, to a lesser extent, the Ben Boyd Dam being used to supplement supplies at times of low flow in the source streams. The licensed entitlement from the bores for the town water supply is 1,400 ML/year.

In December 2002 the surface water flow in the Towamba River at Kiah ceased. Continued extraction of groundwater from the borefield resulted in an observed drop in groundwater levels in the borefield, adjacent monitoring bores and pools in the river.

In 2003, BVSC commissioned Parsons Brinkerhoff (2004) to review and evaluate the groundwater in the alluvial aquifer associated with the Towamba River. Their geophysical investigation concluded that the aquifer at the borefield is a single layer aquifer deriving most of its recharge from the river. Further, the study concluded that the safe yield from rainfall recharge (0.9 to 0.6ML/day) and groundwater throughflow (0.336 to 1.08 ML/day) was inadequate to supply the bores at full or normal production.

Developing the plan

Scope of the plan

The water sharing plan covers what is known as the South Coast Water Management Area. Incorporating unregulated and alluvial water resources into the one plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these resources.

For the purposes of water planning, aquifer types have been grouped into four basic categories:

- porous rock aquifers found in rock formations such as sandstone or limestone. Groundwater occurs within the pore space in the rock matrix
- fractured rock aquifers found in rock formations such as granite or basalt. Groundwater in these rocks occurs mainly within the fractures and joints
- coastal sand aquifers, where groundwater is contained in the pore spaces in the unconsolidated sand sediments
- alluvial aquifers, where groundwater is contained in the pore spaces in the unconsolidated floodplain material.

The plan includes all the alluvial aquifers within the plan area. Due to the nature of the connectivity between the alluvial aquifers and the rivers system, the surface water and groundwater associated with the alluvial aquifers will be managed as a single resource. This approach is consistent with the national framework for managing the impacts of groundwater and surface water interaction. This also

prevents ‘double – counting’, in other words, that water is not accounted for twice. For example proposed increases in high flow extraction should not remove water already accounted for in assessments of likely inflows to the regulated river.

When developing the plan, the level of connectivity, the relative level of impact and the timing of connection between the surface water and alluvial aquifers have been considered.

Water management units

Water sharing plans can include the following hydrological planning units.

Where appropriate, an extraction management unit (EMU), consisting of one or several water sources, is specified for the purpose of establishing a geographic area over which the long-term average annual extraction limit (LTAAEL) applies. An available water determination (AWD) is made for each licence category within the EMU and any growth in extraction above the LTAAEL is managed across the EMU, not at an individual water source level.

This water sharing plan contains three EMUs:

- Towamba River EMU
- Pambula River EMU
- Wonboyn-Merrica EMU.

Where an EMU is not specified the LTAAEL applies to the water source and any growth in extraction above the LTAAEL is then managed at that level.

Regardless of whether an EMU is specified or not, daily access rules apply at the water source level. The Towamba River EMU is divided into nine water sources, the Pambula River EMU has 10 water sources, and the Wonboyn-Merrica EMU divided into three water sources. Their spatial extent is shown in Appendix 1.

The downstream boundary of water sources varies depending on whether streams flow into open estuaries or ICOLLs. The plan area extends downstream to:

- the mangrove limits in those water sources that flow into open estuaries
- ‘the mouth of the river or lake with the ocean’ in those water sources which flow into ICOLLs.

The Towamba water sharing plan includes the following ICOLLs: Wallagoot Lake, Bondi Lake, Bournda Lagoon, Back Lake, Curalo Lake, Nullica River Estuary, Fisheries Creek Estuary, Merrica Lake, Nadgee River Estuary and Nadgee Lake.

A management zone representing a portion of a water source, may then be specified so that more refined implementation of access or trading rules can be applied, if required. No water sources have been split into management zones in the Towamba plan.

Project groups

State Interagency Panel (formerly the Project Control Group)

The State Interagency Panel (SIP) has overall responsibility for the state-wide strategic direction of water sharing planning, to make certain that adequate resources are available from each agency and to ensure that the varying policy and statutory requirements of the relevant NSW Government agencies are met. The SIP also has the role of making water sharing decisions in cases where the interagency regional panel (IRP), see below, cannot reach agreement or where the issue has statewide significance.

The SIP is chaired by the NSW Office of Water. The group has representatives from NSW Office of Water, the Department of Environment, Climate Change and Water (DECCW), and the Industry and Investment NSW (I&I NSW). There are also three Catchment Management Authority (CMA) representatives. The NSW Office of Water is responsible for the overall delivery of water sharing plans.

Interagency regional panel

The Towamba water sharing plan was prepared by the South Coast interagency regional panel, a group consisting of representatives from NSW Office of Water, DECCW and I&I NSW. The Southern Rivers Catchment Management Authority (SRCMA) is an observer on the interagency regional panel (IRP).

Appendix 1 lists the names of the South Coast IRP representatives and support staff, including their areas of expertise. The key roles of the panel and support staff are to:

- establish the hydrological units or water sources
- assign economic, social and environmental values and undertake risk and value assessment to classify each water source
- review the suitability of existing licence conditions under the *Water Act 1912*
- review the suitability of any sharing arrangements proposed by the South Coast Water Management Committee
- make recommendations on the water access and trading rules for each water source;
- assist SRCMA with the public consultation on the proposed rules
- review submissions from targeted consultation and public exhibition and make changes, where necessary to the water sharing rules.

An independent facilitator was engaged to chair the meetings and guide the decision-making process. The IRP used a consensus decision-making approach. Where agencies had concerns relating to particular issues, those issues have been highlighted for the public consultation period for specific attention. The independent facilitator was not involved in the later IRP meetings which were focused on reviewing feedback from the public consultation and other additional information as part of the clarification and finalisation of the plan provisions.

In preparing the water sharing rules, the IRP considered existing water sharing arrangements, any previous negotiations and agreements reached by the South Coast Water Management Committee and the practicality of implementing the proposed water sharing rules.

Policy context

There are a number of national and state policies that impact on and direct the development of plans.

National Water Initiative

The NSW Government is a partner to the National Water Initiative (NWI) which was signed by the Council of Australian Governments (CoAG) in June 2004. The NWI recognises the continuing imperative to increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction.

The NWI has a number of relevant requirements for water planning in Clauses 23, 25, 35 to 40, 52, 78, 79 and Schedule E (refer to the National Water Commission website www.nwc.gov.au in the

Water Reform section for details). This intergovernmental agreement contains provisions on water planning including:

- settling the trade-offs between the competing uses must be based on the best available science and socio-economic analysis, as well as consultation with the community
- ensuring that environmental and other public-benefit outcomes are provided for through planned and adaptive environmental water on a statutory basis and achieved, including actions to sustain high-conservation value rivers, reaches, and groundwater areas
- providing for water trading to enhance water markets
- recognising and addressing surface and groundwater connectivity
- managing local impacts in groundwater areas as well as protecting groundwater dependent ecosystems (GDEs)
- providing for indigenous consultation and aboriginal cultural and commercial entitlements,
- assessing and addressing interception
- monitoring and reporting on implementation.

The Intergovernmental Agreement on a NWI sets out outcomes and guidelines and timelines for water plans and planning processes. The National Water Commission (NWC) is an independent statutory body responsible for providing advice to CoAG on the implementation of the NWI and national water issues and undertakes a biennial assessment of each States' progress with implementing the NWI for this purpose.

Natural Resources Commission

The macro plans also comply with the NSW Natural Resources Commission (NRC) statewide standards and contribute to the relevant statewide targets (Table 4) such as Targets 5 and 6 (see www.nrc.gov.au for details) which is a requirement of the State Plan, Priority E4 (see www.nsw.gov.au/stateplan for details). The NRC was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this it has developed and recommended a Standard for Quality Natural Resource Management and thirteen statewide targets for natural resource management in NSW, which have been embedded in the NSW State Plan. As with the National Water Initiative, the components of the State Standard focus on the use of the best available knowledge, use of appropriate information management systems, delivery of integrated outcomes, engagement of the community and regular monitoring, measuring, evaluation and reporting to specify how delivery of the targets is progressing. The NRC reviews plans against this Standard and its associated targets.

Table 4: Contribution of the water sharing plan to the relevant NRC state-wide targets

Relevant state-wide target	Plan's contribution
By 2015 there is an increase in the recovery of threatened species populations and ecological communities (Target 3)	– some access and trading rules developed to protect water dependent threatened species where these were identified and the risk to these from extraction is high
By 2015 there is an improvement in the condition of riverine ecosystems (Target 5)	– sets a defined share of water for riverine ecosystems – protection of very low flows – trading rules to maintain or reduce entitlement in high value streams – adaptive management, giving the ability to adjust rules once information becomes available or at the end of plan period

Relevant state-wide target	Plan's contribution
By 2015 there is an improvement in the ability of groundwater systems to support their groundwater dependent ecosystems and designated beneficial uses (Target 6)	– sets distance rules to GDEs for new bores -– extractions from alluvial aquifers managed using connected surface water rules – trading rules designed to protect groundwater resources – local area impact management rules
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained (Target 8)	– trading rules to maintain or reduce entitlement in high conservation value coastal water sources – protection of very low flows
By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems (Target 9)	– trading and access rules developed for water sources that adjoin tidal areas with recognition of estuarine sensitivity and based on the environmental requirements of estuaries
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being (Target 12)	– plans provide a defined share to water and defined certainty of access – separation of land and water enhances trading and value of licences – establishment of perpetual and compensable water access licences provides security for business investment – water markets encourage movement of water licences to high value uses – rules developed which consider community dependence on water extraction.

Catchment action plan

This water sharing plan is consistent with and contributes to the Southern Rivers Catchment Action Plan (SRCAP). The SRCAP can be found on the SRCMA website www.southern.cma.nsw.gov.au.

Similar to the state-wide targets on improvement in riverine ecosystems and the ability of aquifers to support groundwater dependent ecosystems, the plan will contribute to achieving the Water Catchment Target by:

- setting a defined share of water for riverine ecosystems
- protecting very low flows
- implementing trading rules to maintain or reduce entitlement in high conservation value streams
- adopting an adaptive management approach, giving the Minister the ability to adjust rules once information becomes available, or upon remake of the next plan.

One of SRCMA's responsibilities, as observer, is to provide the IRP with advice on the alignment of the proposed classification and extraction limits and rules with the priorities in their SRCAP.

Other considerations

There are a number of policies and water related issues that require consideration with the development of this water sharing plan and the associated water sharing rules.

Protecting Aboriginal values

Aboriginal cultural values may be affected by water extraction from aquifers and surface waters. One of the water sharing plan's objectives is to protect, preserve, maintain or enhance the Aboriginal cultural and heritage values of these water sources.

Most information about water-related Aboriginal values resides in indigenous communities. As part of its inquiry into the Bega River System, the HRC consulted with several representatives of the Bega Aboriginal Land Council, who expressed concerns about the following water sharing issues:

- loss of water from the river
- poor water quality
- reduced numbers of fish and other wildlife
- loss or degradation of wetlands.

The IRP concluded that whilst these concerns are important, not all were entirely the result of existing water sharing/extraction arrangements in the Towamba catchment, but will certainly be affected by future water sharing arrangements in the plan. More recently, members of the interagency regional panel held meetings with Aboriginal representatives in the Bega district to discuss the water sharing plan and to target specific areas for protection of Aboriginal cultural values. Aboriginal representatives indicated that water sharing rules should protect natural in-stream values. Whilst Aboriginal groups acknowledge the rights of commercial water users, they believe that this should not be at the expense of the environment. In their view, the priority for water sharing plans should be to provide for natural flowing rivers with healthy aquatic biodiversity. This is consistent with the provisions of the plan.

Furthermore, opportunities for granting licences for Aboriginal cultural purposes throughout the Towamba catchment will be included in the Towamba plan. These can be used for purposes such as manufacturing traditional artefacts, hunting, fishing, gathering, recreation and ceremonial purposes.

Protecting environmental values

Plans are required to reserve water for the overall health of the river and aquifers and to protect specific ecosystems that depend on river flows, such as wetlands, lakes, estuaries and floodplains and groundwater dependent ecosystems. This share of water reserved for the environment, is also intended to sustain the river and groundwater system's aquatic fauna and flora.

Key environmental assets

A major objective of water sharing plans is to protect the environmental values of water resources. In preparing water sharing rules, the in-stream value of each water source was assessed. In-stream value is the value of retaining water in a river, and has been defined to include three different types of values: ecological (intrinsic), economic (for non-extractive uses such as tourism and recreation) and place (cultural) values.

Twelve water sources in the Towamba catchment were identified as having high in-stream value. For these water sources, water trading will be limited so that there is no increase in water entitlement, and trading rules generally aim to decrease entitlement in the water sources. Where the environmental values are at risk from extraction, the CtP rule tends to be conservative. See Appendix 2 for more information on which threatened species were identified in the Towamba catchment.

In preparing the Towamba water sharing plan, the assessment of in-stream value was used to help identify high conservation areas, and to assess the risk that extractions pose to in-stream values.

High conservation value areas

Clause 25(x) of the Intergovernmental Agreement on a National Water Initiative requires water sharing plans to identify and acknowledge surface and groundwater systems of high conservation value (HCV).

The Towamba water sharing plan does not include any management rules for specific HCV areas because:

1. A considerable area (> 30 per cent) of the Towamba catchment is classified as National Park and nature reserve (Bournda NP, Ben Boyd NP, South East Forest NP, Mount Imlay NP and Nadgee Nature Reserve). Any proposal to extract water in National Park areas would need to meet the requirements of the *National Parks and Wildlife Act 1974*.
2. No areas of HCV were identified outside National Park or nature reserve boundaries.

Several water sources (Pericoe Creek, Stockyard Creek, Towamba Estuary tributaries, Far South Coast, Nullica River, Eden tributaries, Curalo Lake and tributaries, Tura Beach and Bondi Lake and tributaries) have no extraction entitlement. These water sources are protected by a 'no trades in' rule.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are ecosystems which have their species composition and natural ecological processes determined to some extent by the availability of groundwater.

The Towamba water sharing plan includes water sharing rules for extracting from the highly connected alluvial aquifers. An initial assessment has been undertaken to determine whether there are any significant GDEs reliant on the alluvial groundwater. Possible GDEs in alluvial groundwater include cave ecosystems, wetlands, and endangered ecological communities.

Cave ecosystems are below the ground surface and at groundwater discharge areas and as such tend to be totally dependent on groundwater. Groundwater dependent cave ecosystems are typically associated with limestone and support an abundant variety of fauna such as crustacea and macro-invertebrates. Entire families of creatures are known to exist in these systems, some of which have been extinct from the surface for millennia. These caves are rich in biodiversity and it is important to ensure that groundwater extraction doesn't impact on that biodiversity. The initial assessment found no caves in the Towamba catchment that are considered to be highly dependent on groundwater.

Groundwater dependent wetland ecosystems are typically areas where the water table is at the surface, or periodically at the surface. While the degree of groundwater dependency is variable, groundwater plays a critical role in wetlands found on alluvial floodplains. Many wetlands are extremely species rich with a mixture of plants and animals and are often considered to have high conservation value. The initial assessment found no groundwater dependent wetlands on the alluvial floodplains in the Towamba catchment.

An endangered ecological community (EEC) is an assembly of species occupying a particular area (plant or animal communities) that is in danger of becoming extinct. These EECs are listed in schedules of the Threatened Species Conservation Act (1995). In the case of plant communities, where these forests/woodlands occur on alluvial floodplains, it is possible that the vegetation relies to some extent on groundwater to sustain transpiration and growth. Groundwater extraction can effectively lower the water table, having a negative impact on the vegetation community. The initial assessment found no groundwater dependent EECs in the Towamba catchment.

Protecting estuary health

Stream flow and groundwater discharge influence many ecological components of an estuary, and play a significant role in the health of these systems. Therefore, water extraction from surface water or groundwater sources may impact the ecological health of estuaries. Some estuaries are highly sensitive to freshwater inflows, whilst others are more resilient to changed inflows. The size and shape of estuaries vary and this, combined with the amount of freshwater inputs and extractions, determines the estuary's overall sensitivity to freshwater extraction. Where possible, extractions will be limited in catchments found to be highly sensitive to freshwater inflows.

An analysis was undertaken by a group of estuary specialists from the NSW Office of Water to determine how sensitive each of the state's estuaries is to changes to freshwater inflows (DWE, 2008).

The method was checked by staff from I&I NSW (Fisheries) and DECCW. It ranks the sensitivity of estuaries based on their physical attributes – size, shape and the ratio of catchment size to the surface area of the estuary. Small estuaries, such as coastal lagoons, tend to be highly sensitive to inflow variations, with most being only intermittently connected to the ocean. Barrier estuaries are generally less sensitive to inflow variations. As they mature and infill with sediment they tend to be long and narrow 'river' estuaries. The NSW Office of Water is finalising a technical paper that details the method of assessing estuary sensitivity.

Six estuaries in the Towamba catchment were assessed as highly sensitive to both low and high inflow variations: Wallagoot Lake, Back Lake (in Merimbula Creek water source), Nullica River Estuary, Merrica Lake, Nadgee River Estuary and Nadgee Lake. Two estuaries in the plan area were assessed as being highly sensitive to only low inflow variations: Bournda Lagoon (in Sandy Beach Creek water source) and Curalo Lake (Table 4). The sensitivity of these estuaries was taken into consideration during the drafting of the water sharing rules.

Table 5: Inflow sensitivities for the estuaries of the Towamba catchment

Name	Groundwater Sensitivity	Low Flow Inflow sensitivity	High Flow Inflow sensitivity
Wallagoot Lake	Low	High	High
Bournda Lagoon	Low	High	Medium
Back Lake	Low	High	High
Merimbula Lake	Medium	Low	Low
Pambula Lake	Medium	Medium	Medium
Curalo Lake	Low	High	Medium
Twofold Bay	Medium	Low	Low
Nullica River Estuary	Low	High	High
Towamba River Estuary	Medium	Medium	Medium
Fisheries Creek Estuary	Low	Medium	Medium
Wonboyn River Estuary	Medium	Medium	Medium
Merrica Lake	Low	High	High
Nadgee River Estuary	Low	High	High
Nadgee Lake	Low	High	High

Source: DWE (2008) Determining freshwater requirements of estuaries for the macro water sharing plans

Tidal pools are the upper parts of estuaries that are essentially freshwater despite being affected by daily tidal movements. The streams within this plan area have relatively small catchments, and therefore do not have any distinguishable freshwater tidal pools. Therefore, water sharing rules have been developed on the assumption that there is no water extraction from any estuaries in the Towamba catchment typically because of salinity constraints.

The Towamba River Estuary is consider to have high environmental values because of its high Oz Estuaries score (www.ozcoasts.org.au), it is largely unmodified, received a high score for fish community integrity, is an important for commercial and recreational fishing, and scored high for threatened species importance. It was classified as medium sensitivity to reductions in low and high flows because unlike the more sensitive permanent tidal pools the Towamba rivers tidal pool disappears during extended periods of low flow. Due to the high level of extraction at low flow it was categorised as having high risk to estuary values. It is recommended as one of nine out of the 150 estuaries in NSW that required more detailed monitoring and analysis over the life of the plan. It is

recommended that estuary monitoring be undertaken as there is currently no salinity or water level monitoring of the Towamba River Estuary.

Maintaining ecosystem functions

To maintain basic ecological functions in river catchments, the NSW government has recommended a range of River Flow Objectives (RFOs) to help guide river management plans and actions. There are 12 coastal RFOs which the Regional Panel used to guide the development of the draft water management rules (see also Appendix 3):

- RFO 1: Protect pools in dry times;
- RFO 2: Protect natural low flows;
- RFO 3: Protect important rises in water levels;
- RFO 4: Maintain wetland and floodplain inundation;
- RFO 5: Mimic natural drying in temporary waterways;
- RFO 6: Maintain natural flow variability;
- RFO 7: Maintain natural rates of change in water levels;
- RFO 8: Maintain groundwater for ecosystems;
- RFO 9: Minimise effects of weirs and other structures;
- RFO 10: Minimise effects of dams on water quality;
- RFO 11: Make water available for unforseen events; and
- RFO 12: Maintain or rehabilitate estuarine processes and habitats.

Source: http://www.environment.nsw.gov.au/ieo/Bega/report-04.htm

In their assessment of flow objectives, the HRC considered the main emphasis should be on preserving the first flush after a low flow period. Medium flushes are important for river ecology and the estuary as they have a role in triggering life cycle stages in biota such as affects on migration, spawning success, advection of eggs and larvae, species competition and distribution, general productivity, food supply and water quality (Pierson *et al* 2002). Protecting the first flush also provides equity both between and within systems by allowing the flows to recharge groundwater and reach the end of system and thus assist with servicing downstream requirements.

Protecting basic landholder rights

Under the *WMA 2000*, extraction of water for basic landholder rights (BLR) does not require a licence, although in the case of accessing groundwater under BLR the bore must still be approved by the NSW Office of Water. BLR include water for domestic and stock extracted from a water source fronting a landholder's property or from any aquifer underlying the land, and for native title rights.

The principles of the *WMA 2000* also require that water sharing must protect BLR. The water sharing plan does this by including an estimate of the water requirements for BLR at the start of the plan. There are currently no extractions for native title rights. However, these rights may be activated during the plan's 10 year term.

Furthermore, the CtP rules apply to licensed water users but not to extractions for BLR. This in effect affords these BLR users some additional protection.

Domestic and stock rights can be restricted by the Minister to protect the environment or public health, or to preserve existing basic landholder rights. These restrictions are outside the framework of the water sharing plan. The NSW Office of Water is developing a regulation which will limit extractions under domestic and stock rights to a reasonable volume where they are metered and more clearly define what is considered to be reasonable purposes, which is important where they are not metered.

The water requirements for domestic and stock rights at the start of the Towamba water sharing plan were estimated using the approach developed by the Water Management Act Implementation Division. These figures represent the current best estimate and will be reviewed once the above-mentioned regulation is completed. Domestic and Stock groundwater licences situated in the highly-connected alluvial aquifers were also identified, and included in the total daily water requirements (Table 6).

Table 6: Estimated water requirements (ML/d) of holders of domestic and stock rights

Water source	Estimated rights (ML/d)	Water source	Estimated rights (ML/d)
Upper Towamba River	0.31	Green Cape	0.01
Jingo Creek	0.16	Nullica River	0.06
Wog Wog River	0.33	Eden tributaries	0.06
Myrtle Creek	0.23	Curalo Lake and tributaries	0.11
Mataganah Creek	0.42	Pambula Lake tributaries	0.59
Pericoe Creek	0.10	Merimbula Lake tributaries	0.08
Stockyard Creek	0.15	Merimbula Creek	0.10
Lower Towamba River	0.88	Tura Beach	0.02
Towamba Estuary tributaries	0.04	Sandy Beach Creek	0.04
Far South Coast	0.01	Bondi Lake and tributaries	0.03
Wonboyn River	0.09	Wallagoot Lake and tributaries	0.10

An estimate of the Harvestable Rights volume was not explicitly included for the LTAAEL for the Towamba water sharing plan as the estimate using the approach outlined above is likely to slightly over-estimate the actual BLR extractions under domestic and stock rights and there are also very few farm dams in the area. Furthermore, setting the LTAAEL at the sum of entitlements is also likely to over-estimate actual extractions. Therefore making a further allowance in the LTAAEL for this small amount of extractions was not necessary.

At the start of the plan there are currently no extractions for native title rights. However, these rights may be exercised during the plan's 10 year term.

Water interception activities

Changed land-use activities can intercept significant quantities of water. Examples of this are an increased farm dam capacity in a catchment and significant areas of new forestry plantations. Under the National Water Initiative, significant interception activities will require a water access licence.

During public exhibition of the plan, concerns about the impact of plantation and logging operations on stream hydrology in the Towamba catchment were raised. This issue is relevant to many water sharing plans across the state, including those catchments within the Murray-Darling Basin. A clause has been included to allow the Towamba water sharing plan to be amended in the future to provide for the interception of runoff by plantations.

Protecting town water supply access

Towns have a higher priority for access to water than commercial licences. Water sharing plans recognise this priority by ensuring that a full share of water is allocated for annual town water supplies except where exceptional drought conditions prevent this. The annual share for every town water

supply will be specified on the town's licence. Towns may be able to sell part of their annual account water to other towns but, unlike commercial users, will not be able to sell the licence outright.

In unregulated surface water and groundwater sources, towns will not need to change their existing water access arrangements unless their current infrastructure is unable to meet their water needs and requires upgrading. In this case, when a major augmentation of the works occurs, town water utilities will need to meet conditions specified in the plan to ensure that there is enough water flowing to protect the environment and consider any potential impacts on other consumptive users.

Defining water extraction limits

The water sharing plan adopts a 'long-term planning approach' to sustainable water use by setting a Long Term Average Annual Extraction Limit (LTAAEL), monitoring the benefits and impacts of the water management rules, and reviewing the LTAAEL and management rules if required. In preparing the Towamba water sharing plan, the interagency regional panel calculated LTAAELs for each of the three EMUs.

In setting LTAAELs, the current level of entitlement (and thus potential extraction) needs to be considered. The Pambula Lake tributaries water source is the most heavily committed water source in the Towamba water sharing plan; the total volume of licensed entitlement is 907 ML/yr, which represents 7.0 per cent of the mean annual stream flow of 12,756 ML. The water sources in the Towamba EMU are the next most committed. The total volume of licensed entitlement in the Towamba EMU is 2,862 ML/yr, which represents 4.6 per cent of the mean annual stream flow of 62,518 ML. These percentages are low compared to the heavily committed rivers of the Murray-Darling Basin.

Considering the relatively low level of entitlement, the interagency regional panel recommended that the LTAAEL for the Towamba water sharing plan be calculated based on the current level of entitlement rather than a rules-based approach that would restrict water users to a proportion of their entitlement. This is common practice in NSW coastal systems, with relatively low levels of competition between environmental and consumptive water users.

More specifically, LTAAELs are calculated as the average amount of water that can be extracted each water year from the unregulated streams and alluvial aquifers, based on the current level of entitlement, plus an estimate of the current basic landholder rights usage, plus an allowance for 'acceptable growth'. 'Acceptable growth' includes increases in the LTAAEL through the granting of new Aboriginal Cultural or Community Development Licences, increased entitlements through high flow conversions, and the roll-out of tidal pool licences to reflect history of use.

The water sharing plan establishes a monitoring, evaluation and review process which will enable the LTAAELs established by this water sharing plan to be amended in future water sharing plans if the water sharing arrangements encapsulated by this water sharing plan are not maintaining or improving the health of riverine and groundwater dependent ecosystems. Such assessments will require consideration of water sharing externalities such as climatic variability and dry sequences. This adaptive management process is discussed later in this document.

Water sharing rules

Classification method

The classification of water sources was the first step in developing water sharing rules. The IRP classified each water source as high, medium or low on the basis of its instream and economic values, and the risks to these values. Two matrices were developed – the first being the 'value matrix' which

rated a water source's instream value against its hydrologic stress. The second was the 'risk matrix' which rated the risk to in-stream values against community dependence. For full details about the classification method, see the document *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation* which is available on the NSW Office of Water's website[3].

This classification method took into account:

- the amount of water licensed for extraction
- the potential impact of extraction on rivers and estuaries
- the associated uses from this extraction
- the social and economic impacts of restricting extraction.

Specifically the classification process involved assessment of factors, including:

- in-stream values; for example, threatened fish that are likely to be affected by extraction
- the risk to in-stream values posed by the existing or increased extraction
- the hydrologic stress, which is determined based on a comparison of the demands associated with the amount of water licensed for extraction relative to river flow
- the extraction value, which is a qualitative assessment of the economic value of the water licensed for extraction
- the economic dependence of the local community on activities dependent on licensed water extraction
- the sensitivity of estuaries to the removal of freshwater inflows
- current best estimate of the amount of water extracted under basic landholder rights and for town water supplies
- whether the existing water sharing rules are adequate to manage the risk of extraction to in-stream values and basic landholder rights
- NSW Government policy.

A large range of reference material was used in addition to the general knowledge of interagency regional panel members and technical support staff within agencies. This reference material included:

- Licensing Administration System (LAS): a NSW Office of Water state-wide database holding the licence details including volume of entitlement, location details and stream orders
- Hydsys: a NSW Office of Water state-wide database that holds all flow record data. Flow records are available for many water sources on the South Coast
- Volumetric Conversion (VOLCON) Database: used to help determine the Peak Daily Demand (PDD) for each water source
- Regional Geographic Information Systems: NSW Office of Water land use and topographic information
- National Parks and Wildlife (DECCW) state-wide atlas: State-wide flora and fauna database
- NSW Fisheries (DII) modelled data sets: Fish Community Index, Fish Community Vulnerability
- NSW Fisheries (DII) freshwater and saltwater recreational fishing database.

[3] Refer http://www.water.nsw.gov.au for the most recent version of the manual

The classification assisted in determining the optimal balance between extraction and protection of water instream for each water source. These broad-scale relative assessments showed where water sharing rules needed to strongly protect valuable natural assets by limiting extraction or to provide for extraction by water users where there is significant community dependence on extraction.

Generic indicative rules were developed for each classification for each matrix to expedite the development of the water sharing plans by the panels.

Exceptions to the generic rule approach

It is important to note that the matrix approach was used as an 'indicative tool' to develop initial classifications. While these classifications guided the water sharing rules, a major role of the IRP was to use the local knowledge of panel members to assess whether these classifications were realistic. Amendments to both the classifications and the management rules were based on local and technical knowledge of the water sources. In addition, the classification approach did not include some information (e.g. extraction for town water supplies, estuary sensitivity) which was considered later by the IRP. Refinements of classifications for specific water sources are listed in Table 6.

Table 7: Refined classifications based on IRP knowledge

Water source	Change to classification	Justification
Upper Towamba River	Hydrologic stress was revised from 'low' to 'medium.	Significant entitlement in water source including cumulative hydrologic stress from Myrtle and Mataganah Creeks. Potential for increased area of irrigation.
Wog Wog River	Instream values were revised from 'medium' to 'high'.	About 60 % of water source is national park
Eden tributaries	Instream values were revised from 'low' to 'medium'.	Estuary classification.
Curalo Lake and tributaries	Instream values were revised from 'high' to 'medium'.	Mostly state forest, some urban development
Merimbula Lake tributaries	Instream values were revised from 'high' to 'medium'.	Urban development
Merimbula Creek	Dependence on extraction was revised from 'high' to 'medium'	Low stream flows mean usage is limited.
Sandy Beach Creek	Instream values were revised from 'low' to 'high', and risk to in-stream values was revised from 'low' to 'medium'.	Estuary classification, about 60 % of water source is national park or nature reserve
Bondi Lake and tributaries	Instream values were revised from 'low' to 'high', and hydrologic stress was revised from 'high' to 'low'.	100% of water source is in national park. There is no entitlement in this water source.
Wallagoot Lake and tributaries	Instream values were revised from 'medium' to 'high'.	Estuary classification. About 60% of water source is national park and nature reserve. SEPP 14 wetlands

The final classification of all water sources were mapped on the value matrix and risk matrix (Appendix 6). Refer to the Community Manual for an explanation of these matrices. The value matrix was used to develop indicative trading rules and the risk matrix used to develop indicative water access rules.

Access rules

The IRP used local knowledge and expertise in developing the water sharing rules. For example:

- existing local water sharing rules were examined to determine whether they achieved the required level of environmental protection and provided for basic rights
- local studies or information from regional staff in areas such as irrigation (I&I NSW) or aquatic ecology (the NSW Office of Water) were included
- extraction patterns by local water and major utilities were examined
- consideration was given to see if the estuary at the end of the system necessitated additional catchment-wide protection.

In some instances, indicative rules were further refined if site specific information was available.

The water sources where there is the greatest volume of entitlement (Towamba EMU and Pambula Lake tributaries water source) are serviced by stream gauges. Therefore access rules based on stream readings were proposed for these water sources.

The six remaining water sources, in which there is entitlement, do not have gauging stations. The IRP initially considered linking the access rules in ungauged water sources to flow readings at gauges in neighbouring catchments, but later decided that access rules based on visible stream flow in the ungauged streams would be more practical, and would more than meet the requirement of the indicative access rule generated by the macro process. For five of the ungauged water sources the indicative access rule is 'cease-to-pump to maintain a flow of 95th percentile', and for the remaining water source the indicative access rule is 'cease-to-pump to maintain a visible flow' (Table 7). For most of the smaller streams on the south coast of NSW, visible flow occurs less than 95th of all days. (The 95th percentile flow for the Pambula River, which is relatively large compared with many of the other water sources is 0.06 ML/day.)

Table 8: Cease-to-pump rules

Water source	Indicative rule	Access rule
Pericoe Creek, Stockyard Creek	Cease-to-pump at visible flow at pump site	No flow classes (No extraction by access licences permitted)
Far South Coast, Nullica River, Eden tributaries, Curalo Lake and tributaries, Tura Beach and Bondi Lake and tributaries	95th percentile flow	No flow classes (No extraction by access licences permitted)
Lower Towamba, Jingo Creek, Wog Wog River, Upper Towamba River, Myrtle Creek, Mataganah Creek	Cease-to-pump at visible flow at pump site	Cease-to-pump for unregulated river access licences: 5 ML/day at Towamba Gauge 220004
Merimbula Creek	Cease-to-pump at visible flow at pump site	Cease-to-pump at visible flow at pump site
Wonboyn River, Green Cape, Towamba Estuary, Merimbula Lake tributaries, Sandy Beach Creek, Wallagoot Lake and tributaries	95th percentile flow	Cease-to-pump at visible flow at pump site
Pambula Lake tributaries	90th percentile flow	Cease-to-pump at visible flow at pump site

In water sources where the existing access rule was more stringent than the indicative rule, the existing access rule was adopted, given that there should be no adverse social or economic impact as there would be no change to current operations. In these circumstances the IRP acknowledged that many of the rules had been negotiated by water users, had been in place for a period of time and seemed to be adequately protecting environmental values.

Environmental flow rules

The IRP recommended a Commence to Pump rule of 15 ML/day for water users in the Towamba EMU on the basis of enabling fish passage. Environmental flow rules for other water sources were discussed during public exhibition and as a result a 12 hour first flush rule is established in the remaining water sources not in the Towamba EMU. This was considered to be consistent with the neighbouring Bega-Brogo water sharing plan. The rule for the Bega-Brogo plan is that after 30 consecutive days of very low stream flow, licence holders will not be permitted to extract water for the first 24 hours of stream flows being above the CtP level.

Water sharing rules for groundwater dependent ecosystems

A recent assessment found no groundwater-dependent caves, wetlands or endangered ecological communities. However, GDE identification and assessment is an ongoing process. In the event that High Value GDEs are identified in the Towamba catchment, consideration will be given to adding these during the life of the water sharing plan. In this event, new or replacement bores will not be permitted within specified buffer zones around the GDE unless it can be demonstrated through a hydrological assessment that the impacts are within acceptable limits, in which case the bore may be permitted at a smaller distance. Existing bores are not affected by the buffer zones and are able to continue operating (ie within the existing conditions of their access licences).

Dual cease-to-pump

The IRP considered the possibility of introducing an accreditation scheme (similar to that in the Williams River in the Hunter and for the Bega-Brogo water sharing plan) that would offer accredited landholders a higher CtP level than those landholders who are not accredited. To attain accreditation, landholders would need to meet certain land and water management criteria.

The IRP concluded that a dual cease-to-pump system applied to the smaller streams of the South Coast would offer little incentive to landholders to undertake the required activities to attain accreditation.

Total daily extraction limits

Although the indicative access rules produced from the macro risk and value assessment process did not specifically recommend the establishment of Total Daily Extraction Limits (TDELs) for any of the water sources in the Towamba water sharing plan, the IRP have recommended TDELs for water sources in the Towamba EMU as a means of sharing water amongst water users upstream and downstream of the Towamba gauge, including Bega Valley Shire Council (Table 10). The TDELs have been developed to best reflect current water sharing arrangement amongst water users.

Table 9: Total daily extraction limits for water users in the Towamba EMU

Stream flow	TDEL to be shared among all upstream users	TDEL to be shared among all downstream users*	TDEL, BVSC
> 34 ML/day	No TDEL	No TDEL	12 ML/day
15 – 34 ML/day	6.5 ML/day	4.5 ML/day	6 ML/day
5 – 15 ML/day	2.7 ML/day	1.8 ML/day	3 ML/day**
0.5 – 5.0 ML/day	No access (excluding Domestic andStock)	No access (excluding Domestic andStock)	1 ML/day
< 0.5 ML/day	No access for stock purposes from Year 1 No access for domestic purposes from Year 4		1 ML/day

* All downstream users excluding Bega Valley Shire Council, who have their own TDEL as defined in the last column.

** Conditional on there being visible flow in the river adjacent Kiah bore field.

The TDELs in Table 10 are based on the proportion of current entitlement in water sources upstream and downstream of Gauge 220004 (Towamba River at Towamba).

TDELs require considerable resources to establish and implement, and therefore have not been considered for water sources outside the Towamba EMU. To implement TDELs requires at least 10 years of stream gauge readings to establish flow percentiles, telemetry of gauges, the establishment of a system to broadcast flow readings, rostering / administration arrangements and real-time metering and compliance activities. The ongoing cost of managing to TDELs can be considerable. Except for where there is intense competition between local water utilities, irrigation and the environment, sufficient protection for environmental values can be provided by other means such as first flush rules. The Towamba water sharing plan provides for TDELs to be introduced in other water sources at a later date should they be required.

Access to very low flows

Access to very low stream flows is permitted for those activities that are considered to be ‘critical human needs’ or ‘animal health requirements’. Although the level of extraction is small relative to entitlement it is in direct competition with environmental water requirements at its most critical time, therefore access to very low stream flows is limited to specific purposes, including:

1) domestic supply
2) town water supply
3) fruit washing
4) cleaning of dairy plant, processing and equipment for the purpose of hygiene
5) poultry washing and misting
6) cleaning of enclosures used for intensive animal production for the purposes of hygiene.

Licences that may use a percentage of their entitlement to access very low flows for the above purposes are listed in Schedule 2 of the water sharing plan. The volume of water that may be taken will be restricted to the minimum required to satisfy each specific purpose up to a maximum of 20,000 litres/day (0.02 ML/day) per purpose per licence.

The plan provides an estimate of the water requirements of domestic and stock rights within each of the water sources. Activation of domestic and stock rights may increase during the life of the plan. The

plan cannot limit or restrict these rights, but the *WMA 2000* itself provides for restrictions on domestic and stock Basic Landholders' Rights.

As a result of public exhibition the Wyndham Community Water Users Incorporated (WCWUI) has been permitted access to water during periods of very low flow. This is due to the water supply system providing water for uses which are fundamentally the same as council operated town water supply systems (domestic, community hall, school, cemetery, tennis courts and fire hydrants)

Mandatory conditions

The Towamba water sharing plan sets out a number of standard conditions that will be applied to water access licences and water supply work approvals. These mandatory conditions are designed to protect the rights of all users in the water source and the environmental water rules of the plan. They cannot be removed or altered unless the plan itself is amended.

Currently, surface water licence holders and basic rights users have been digging sumps in the sandy bed of some streams to access water. There is a legal requirement under the *Water Management Act 2000* for such activities to obtain a work approval prior to construction. It is proposed that work approvals will also be created, separate to the issued water access licences, when the water sharing plan commences and the *Water Act 1912* licences are transferred across to the *Water Management Act 2000*.

For licensed users, the water sharing plan proposes that mandatory conditions be applied to all works where limits and rules will apply to the use of sumps, particularly to the size of works. Works that do not meet the mandatory conditions will require a new approval or an amendment which will require an assessment to demonstrate the minimal harm requirement to the vicinity of the water source. This is likely to include works such as spear points or permanent structures.

Basic landholder rights users will need to comply with Ministerial guidelines which are currently being developed by NSW Office of Water, DECCW and I&I NSWI.

Carryover and water accounts

A water allocation account will be established for each water access licence. Water is credited to the account when an available water determination is made, and debited when water is extracted. There is enormous variation in the annual flow volumes between years. The Towamba water sharing plan will allow unregulated river licences (subject to compliance with daily access rules) to:

- withdraw up to 200 per cent of entitlement in any one year
- carry over up to 100 per cent from one water year to the next
- provided that the volume of water taken over any three consecutive water years does not exceed 300 per cent of annual entitlement.

In some years the level of extraction might exceed the LTAAEL because these carryover provisions allow water extraction in some years to exceed the entitlement volume because of the utilisation of available water from previous years that was not used at the time.

Access rules for the Bega Valley Shire Council

The IRP negotiated the TWS access rules with officers from BVSC and representatives of the Kiah River Care Group (Table 9). It was decided that BVSC be allowed to extract 1 ML/day after the river drops below the CtP of 5ML/day. As discussed earlier, Parsons Brinkerhoff estimated groundwater throughflow to be about 1 ML/day. Therefore, the level of extraction should not significantly lower groundwater levels, and should allow sufficient replenishment of the Ben Boyd Dam over winter months to provide for the following summer's demand.

Table 10: Access rules for town water supply from the Kiah Borefield

Stream flow	TDELs	Current extractions
> 34 ML/day	12 ML/day	5 ML/day
15 – 34 ML/day	6 ML/day	5 ML/day
5 – 15 ML/day	3 ML/day (conditional on visible flow)	5 ML/day
< 5 ML/day	1 ML/day	1.5 – 2.5 ML/day

As a result of public exhibition the A class TDEL of 3 ML/day is conditional on a visible flow in the Towamba River adjacent to the Kiah borefield. That is, there must be at least 5 ML/day flow at the Towamba gauge and there must be visible flow in the Towamba River adjacent to the borefield in order for Council to pump 3 ML/day. If there is no visible flow adjacent the borefield, then Council's very low flow TDEL of 1 ML/day applies.

Provisions have been written into the Towamba water sharing plan to allow for extreme drought conditions. These take effect when water total storage in Ben Boyd and Yellow Pinch drop below 50 per cent capacity. Under such circumstances BVSC are permitted to extract up to 2.5 ML/day during periods of very low flow (stream flow is less than 5 ML/day).

Dealing rules

The water market can offer an effective and user driven way to reallocate water between users. The NWI sets out guidelines for water trading. Trading can occur either on a permanent or temporary basis. Trading of water entitlement needs to be addressed in the water sharing plan within a framework that maximises the flexibility for users to be able to use water to its highest value but does not adversely impact on water sources or existing users.

The indicative trading rules generated from the macro process are listed in the report cards for each of the water sources. In reviewing the indicative trading rules, the IRP determined the level of entitlement already in each water source, relative to a '20 per cent hydrologic stress[4]' indicator, calculated as:

$$0.2 \times 80^{th} \text{ percentile daily flow} \times 120^{5}.$$

The panel determined that:

- all water sources in the Towamba River EMU either have no current entitlement or already have in excess of 20 per cent hydrologic stress
- all water sources in the Pambula River EMU, except Wallagoot Lake and tributaries water source, either have no current entitlement or already have in excess of 20 per cent hydrologic stress
- Wallagoot Lake water source has high in-stream values
- all water sources in the Wonboyn-Merrica EMU have high in-stream values, and low levels of entitlement.

[4] The approach taken for the South Coast plans was slightly different to other areas of the state. Considering the relative extremes and daily variability in stream flow on the South Coast, the Interagency Regional Panel adopted a low flow index of 80th percentile flow based on annual flow data, rather than critical month flow data which was used elsewhere in the state. The Interagency Regional Panel adopted a trade limit of 20% of the 80th percentile (annual flow data) which was considered to equate with 50 % of the 80th percentile (critical month flow data.)

[5] The daily flow is multiplied by 120 to convert it to a limiting volume based on the assumption that irrigation water will be utilised over a third of the year, which is 120 days.

Based on the above criteria, the IRP recommended that:

- trade of licences be permitted within all water sources where there is current entitlement
- trade of licences not be permitted between the water sources of the Towamba Catchment.

The latter recommendation is explicitly intended to ensure that the level of stress in any water source cannot increase as a result of trading water into that water source. These recommendations guided the development of trading rules applying to both surface water licences and groundwater licences in the highly-connected alluvial aquifers.

Aboriginal cultural and community development licences

Many rivers in NSW already have a high number of irrigation licences, and are generally judged to be hydrologically stressed, particularly during dry times when river flows are low. This effectively prevents the issuing of any new water licences on these stressed rivers. However in some coastal rivers, higher and more reliable flows are common and provide an opportunity for licences to be granted for Aboriginal community development activities, provided this additional extraction would not negatively impact on ecological values that are dependent on high flows. In these coastal catchments, Aboriginal community development licences[6] (ACDLs) may be granted which allow water to be pumped from rivers during higher flows and stored in farm dams or tanks, to be used as needed. It is important to note that higher flows are not just peak or flood flows but also include flows that are exceeded 50 per cent of the time.

Since granting ACDLs would mean less water remains in the river at these higher flows to meet environmental needs, it will be necessary to limit the total volume that can be extracted for Aboriginal commercial purposes. The limit would be a proportion of the river flow, and would never exceed 500 ML/yr per water source. The water sharing plan does not propose to limit the volume assigned to each individual ACDL, only the total volume per water source.

The IRP recommended that ACDLs would be permitted in those water sources assessed as being capable of supporting high flow licences. On this basis, the IRP recommended that ACDLs be permitted in all water sources in the Towamba EMU excluding those water sources where there is no current entitlement. Licences are only allowed providing they do not cause the combined total of all Aboriginal Commercial Access Licences to exceed 310 ML/yr.

High flow conversion

Several streams in the plan area have the potential to be placed under hydrologic stress during times of low flow. Therefore, there is merit in considering incentives that encourage licence holders to move extraction out of low flows and into higher flows.

The IRP considered the conversion of low to high flow licences for water sources in the Towamba Catchment, and recommended that conversions be permitted for all water sources in the Towamba EMU excluding the Towamba Estuary and tributaries water source.

The IRP based their considerations on a high flow conversion (HFC) limit of:

> *10 per cent of the High Flow index (ML/d) x 365 x percentage of time that stream flow exceeds the High Flow index*

[6] The *Water Management Act 2000* currently makes provision for Aboriginal 'commercial' licences. The NSW Government intends to amend the Water Management Regulation 2004 in order to delete the Aboriginal Commercial sub-category and create a new sub-category of unregulated river and aquifer access licences called 'Aboriginal community development.' This new category of licences is not fully commercial. While they may be temporarily traded, they cannot be subject to permanent trade and as such will remain in the Aboriginal community for the life of the licence. Aboriginal communities, enterprises and individuals are encouraged to seek financial assistance from funding bodies such as the Aboriginal Water Trust to purchase fully commercial licences.

In the case of the Towamba EMU, the high flow index was defined as 34 ML/day (based on doubling the Peak Daily Demand (PDD) of entitlement in the Towamba EMU. The logic here being that the same amount of water is set aside for environmental flows before allowing further extractions are permitted.) The High flow conversion limit for the Towamba EMU is therefore: 0.1 x 34 x 365 x 0.5 = 620 ML/year. Allowing a 2.5 to 1 conversion factor from low flow to high flow, the potential maximum reduction in low flow stress would be 248 ML, which equates to about 17 per cent of the current volume of entitlement in the Towamba EMU of 1,462 ML/yr (Table 7).

The Pambula Lake tributaries water source is about half the size of the Towamba River catchment, and receives less rainfall due to its lower altitude. Consequently stream flows are a lot smaller. The mean annual flows for the Pambula River and the Towamba River are 22,742 ML and 146,600 ML respectively (Table 1). Therefore, the IRP decided that the High Flow Index in the Pambula Lake tributaries water source would be better represented by the 30th percentile (13.5 ML/day). The high flow conversion limit for the Pambula Lake tributaries water source is therefore: 0.1 x 13.5 x 365 x 0.3 = 148 ML/year. Allowing a 2.5 to 1 conversion factor from low flow to high flow, the potential maximum reduction in low flow stress would be 59 ML, which equates to about 7 per cent of the current volume of entitlement in the Pambula Lake tributaries water source of 907 ML/yr (Table 8).

Table 11: High flow caps and potential reduction in low flow hydrologic stress

Water Source	Entitlement (ML/yr)	HF index (ML/d)	HF limit (ML/yr)	Max potential reduction in LF stress (% of entitlement)
Towamba EMU	1,462	34	620.5	17 %
Pambula Lake tributaries	907	13.5	148	7 %

The NSW Office of Water recommends that HFCs must offer a significant decrease in low flow stress (25 per cent), and that streams flows must be of a certain size (50th percentile of 20 ML/day) for the implementation of HFCs to be justifiable.

Prior to public exhibition, the calculations for the Towamba EMU were based on a HF index of 50 ML/day. The revision of this figure to 34 ML/day has reduced the maximum potential reduction in LF stress. However, the panel thought that HFCs still offered significant potential reductions in LF stress and therefore recommended that:

- HFCs be permitted throughout the Towamba EMU, excluding those water sources where there is no current entitlement
- HFCs not be permitted in the Pambula Lake tributaries water source.

Considering that the majority of entitlement in the water sharing plan is contained with the Towamba EMU and the Pambula Lake tributaries water source (88 per cent, excluding TWS entitlement), conversion of licences to high flow only was not considered for the remaining water sources.

The IRP recommended that the HFC limit of 620 ML/year for the Towamba EMU (calculated above) be shared amongst water sources in the Towamba EMU on the basis of relative area: Lower Towamba: 119 ML/yr; Upper Towamba: 167 ML/yr, Wog Wog River: 105 ML/yr, Jingo Creek: 31 ML/yr, Myrtle Creek: 44 ML/yr and Mataganah Creek: 65 ML/yr. (The sum of these figures does not equal 620 ML as there are two water sources, Stockyard Creek and Pericoe Creek which contribute flows to the Towamba River but do not have any licensed extractions.)

Rules regarding work approvals

Construction of dams

Capture and storage of rainwater run-off in a farm dam does not require a licence if the dam is within the maximum harvestable right dam capacity[7], and the dam is not spring-fed. Extraction of water in excess of a property's harvestable right requires a category of access licence established by regulation under section 57 (k) of the *Water Management Act 2000*. The provisions relating to harvestable rights are unaffected by any of the rules identified in the Towamba water sharing plan.

In August 2008, the SIP agreed that the construction of new in-stream dams be prohibited in those water sources where high in-stream values have been identified. Therefore, for the Towamba water sharing plan, the construction of in-stream dams on third order streams or higher would be prohibited in the following water sources: Upper Towamba River, Wog Wog River, Stockyard Creek, Lower Towamba River, Towamba Estuary tributaries, Far South Coast, Wonboyn River, Green Cape, Pambula Lake tributaries, Sandy Beach Creek, Bondi Lake and tributaries, and Wallagoot Lake and tributaries.

Construction of bores in alluvial aquifers

The IRP adopted the following state-wide recommendations regarding the construction of new groundwater bores:

- prohibit new bores within 40 metres of first and second order streams, except for bores as a result of a conversion of an unregulated river access licence, unless they are drilled into the underlying parent material, and the slotted intervals of the production bore commence deeper than 30 metres, and the applicant can demonstrate that the bore will have minimal impact on base flows in the stream
- prohibit new bores within 40 metres of a third order or higher stream except for bores as a result of a conversion of an unregulated river access licence
- allow new bores within 40 metres of an unregulated river (but only as a result of the conversion of an unregulated river licence) in which case the surface water daily access rules will apply immediately
- apply the standard local impact rules for alluvial groundwater and the standard provisions for newly identified GDEs.

In relation to distances from other bores, the IRP recommended that approval for the construction of new groundwater bores not be granted within:

- 200 metres of an approved water supply bore nominated by another access licence
- 200 metres of an approved water supply bore from which basic landholder rights water is being extracted
- 50 metres from the property boundary
- 500 metres from an approved water supply bore from local water utility/major utility
- 400 metres from an NSW Office of Water's observation or monitoring bore.

[7] The maximum harvestable right dam capacity is calculated based on providing the ability to harvest 10 % of the mean annual runoff from the landholder's property. It is determined using a calculator provided on the NSW Office of Water's website, with input parameters being property location and property size.

Where these distance restrictions cannot be met, the Minister may grant a water supply work approval provided:

- a hydrogeological study undertaken by the applicant, and assessed as adequate by the Minister; demonstrates minimal potential for adverse impacts on existing authorised extractions
- all potentially affected access licences or approval holders have been notified by the applicant
- there is a process for remediation in the event that any adverse impact occurs in the future, specified as conditions on the access licence.

Consultation

The classifications and the IRP's recommended rules underwent targeted consultation with water users and specific interest groups [8] before the water sharing plan was drafted. Formal public exhibition[9] of the plan ensured wider public consultation.

While developing the plan, the participating agencies (NSW Office of Water, DECCW,I&I NSW and SRCMA) have identified areas where better data is needed for making future water planning decisions. Similarly, the community might suggest areas where further analysis or data gathering is required. This local input is essential in the finalisation of the draft plan.

SRCMA assisted the NSW Office of Water to undertake the consultation process, ensuring that all stakeholders and interested parties had an opportunity to examine and comment on the proposed water sharing rules. In particular, the SRCMA requested stakeholders to provide:

- local knowledge and expertise – for example, there may be other natural or socio-economic values that have not yet been considered by the interagency regional panel
- feedback on the practical elements of the proposed water sharing rules – to make certain they are easily implemented by the licence holders
- confirmation that there are no unintended outcomes from the plan – it is essential that this be given due consideration before the plan is finalised
- specific comments on the Minister's notes included in the draft plan.

Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the draft water sharing plan began in late 2005 and finished in early 2006 (Table 7). The objectives of this consultation were:

- to provide background as to why the plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback
- to provide a 'first opportunity' to informally consult with key stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

[8] Targeted consultation refers to informal consultation held with key stakeholders to test the suitability of the proposed water sharing rules and provide feedback on the rules potential impacts.
[9] Public exhibition is the formal exhibition of a draft Plan where the Minister invites submissions on the draft plan and in particular will seek comment on a range of key issues.

Table 12: Key groups consulted in the water sharing plan area as part of targeted consultation

Date	Group	Location
22/03/2006	Bega Valley Shire Council	Bega
23/03/2006	Coastwatchers	Mossy Point
12/04/2006	Licensed water users	Wyndham
15/06/2006	DII, SRCMA, Aboriginal stakeholders	Batemans Bay
17/06/2006	South East Conservation Alliance	Bermagui
18/12/2008	Bega Valley Shire Council and Kiah River Care	Moruya

The proposed water sharing rules were presented to stakeholders for their consideration and feedback. The targeted consultation process proved useful in:

- providing local knowledge and expertise to the decision-making process
- identifying areas where better data was needed for making future water planning decisions
- providing panel members with a greater understanding of the potential social impacts of the proposed water sharing rules
- providing a better understanding of the practicality and workability of proposed water sharing rules and flow reference points.

In response to feedback from water users, the IRP recommended a staged approach to the implementation of more stringent access rules, to limit any potential adverse social and economic impacts. In essence, this proposes that water users be given time to adapt to any new rules. Where the existing rules were not consistent with the IRP's recommended rules, the degree of immediate change (and hence the effect on extractors) was limited to the next higher level of rule in the first instance, unless a higher level of protection could be achieved with minimal socio-economic impact. The IRP then determined a timeframe and the further steps required to achieve the recommended rules during the life of the plan.

The IRP reviewed all the matters raised during targeted consultation and consequently made some changes to the initial water sharing rules. During this review process, if updated flow data and water use data became available, it was incorporated into the assessment process. Table 12 outlines the changes to the proposed rules as a result of this consultative process, or the inclusion of new data.

The IRP also addressed stakeholder feedback regarding specific water sources. This information is contained in the report cards which can be accessed at www.water.nsw.gov.au

Table 13: Changes to water sharing rules as a result of targeted consultation and updated data

Water source	Change to water sharing rules	Justification
Lower Towamba River	The IRP recommended that Bega Valley Shire Council's extractions during periods of very low flow be restricted to 1 ML/day	Based on hydrogeological studies, the estimated groundwater throughflow in the Kiah aquifer is 1 ML/day.
All water sources in the Towamba Extraction Management Unit	Total daily extraction limits were proposed for all water sources with entitlement	During times of low flow, there has been considerable competition for water

Public exhibition of the draft water sharing plan

Public exhibition of the draft water sharing plan was held during December and November, 2009. A public meeting was held at Wyndham on 20th December 2009. The objectives of this consultation were:

- to provide background to stakeholders as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas and how stakeholders could provide feedback
- to formally consult with a broad range of stakeholders to test the suitability of the proposed water sources and management zones, flow reference points and access and trading rules.

A total of 25 submissions were received as a result of the public exhibition. These were reviewed by the IRP.

The IRP reviewed all submissions as well as matters raised at the meetings and as a result made some changes to the rules. Table 13 outlines the changes to the proposed rules as a result of the consultation. The IRP provided a general response to all submissions so that individuals and groups could see the outcomes of the review of submissions in relation to amendments to the plan.

Table 14: Changes to water sharing rules as a result of public exhibition

EMU/water source	Change to water source rules	Justification
Towamba EMU	The Wyndham Community Water Users Incorporated (WCWUI) is permitted access to water during periods of very low flow.	The WCWUI is providing water for purposes usually met by Council-operated town water supplies.
Towamba EMU	The domestic and stock licences in this EMU will have a CtP set at 0.5ML/day (95th percentile)	This revised CtP for domestic and stock licences: • is similar to current water sharing arrangements which are working effectively, and • is stricter than the indicative rule from the Macro process
Towamba River	The definition of 'high flow' for the Towamba River was revised from 50 ML/day to 34 ML/day.	The Peak Daily Demand (PDD) of entitlement in the Towamba EMU, including TWS extractions is 17 ML/day. The same amount of water needs to be set aside for environmental flows before allowing further extractions. Therefore the definition of high flow is twice PDD.
Towamba EMU	The low flow TDEL for town water supply by Bega Valley Shire Council be conditional on there being a visible flow in the river adjacent to the bore field	Environmental flows to the Towamba Estuary need to be protected.
Pambula Lake tributaries water source	Access rules for Pambula Lake tributaries water source are based on visible flow in the stream from which water users are extracting (preferably at a public flow reference point) and not at the Pambula River gauge as previously proposed.	Rainfall and stream flow is quite variable across this water source.
All	A 15 ML/day Commence to Pump rule will be retained in the Towamba EMU. For all other water sources in the plan area, a first flush rule of 12 hours will be adopted.	Water users in the Towamba Valley are familiar with and are already implementing a Commence to Pump rule. Elsewhere, a 12 hour first flush rule has been proposed which is consistent with water sources in the Murrah-Wallaga catchment which are of similar size and experience similar hydrologic events.

Adaptive management

Adaptive management is an important part of a water sharing plan. Adaptive management refers to the process of ongoing data collection monitoring, evaluation and review during the life of the plan that either enables plan amendment or remaking of a better plan after 10 years. Adaptive management is a requirement of both the *WMA 2000* and the National Water Initiative, and has been allowed for during the life of the plan through amending provisions and establishment of 'limits of change' to the plan.

Where adaptive management is identified further studies may be undertaken within agencies or by external organisations which may assist in informing the review of plan provisions.

Monitoring of plan performance

The NSW Office of Water is also developing a Monitoring, Evaluation and Reporting (MER) Framework. This framework will be developed in collaboration with key stakeholders and will be consistent with the MER needs of the Natural Resources Commission and the National Water Commission. The intention is that the framework can be applied to existing plans and macro plans to enable the development of a specific MER plan.

Performance indicators

The water sharing plan includes a number of performance indicators that will be monitored over the life of the plan.

It is not practicable to monitor all issues in all water sources. The performance indicators identify that monitoring will be undertaken for specific issues in key water sources. The actual procedure for monitoring each indicator may change over the period of the plan as improved methods are developed.

Plan review

Under the *WMA 2000*, the Natural Resources Commission is required to undertake a review of this water sharing plan prior to any decision to extend its term or to make a new plan.

The MER framework developed will consider the statutory requirements for the different types of evaluation:

- an audit of the plan, at intervals of no more than five years, for the purpose of ascertaining whether its provisions have been given effect to. This audit is to be carried out by the State Interagency Panel, which has now been appointed by the Minister (for Water).
- an audit of the plan by the Natural Resources Commission to assess to what extent the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the relevant catchment management area. The Natural Resources Commission will call for public submissions when undertaking its review.
- an annual review of Implementation Programs.
- the application of information from the relevant monitoring and evaluation programs to inform progress against the relevant state-wide targets and requirements of the National Water Commission under the National Water Initiative.

Implementation

Implementation programs

An Implementation Program may be established that sets out the means by which the objectives of this water sharing plan are to be achieved. The process for monitoring of the performance indicators will be outlined in the Implementation Program.

An annual review of the Implementation Program will be conducted to determine whether the Implementation Program is being effective in implementing the water sharing provisions. The results of this review will be included in the NSW Office of Water's Annual Report.

Monitoring water extractions

Each water sharing plan establishes the relevant mandatory conditions for extraction, including that all licences undertake measurement of extraction. The NSW Office of Water will develop a measurement of extractions strategy to meet the objectives of the NSW Water Extraction Monitoring Policy.

Measurement of extractions may be via meters or other forms of monitoring devices fitted to approved works, or via alternate monitoring systems, in order to provide water extraction estimates. Different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the affect that the operation of the work may have on the water source and other water users.

Under the water use monitoring program assessment of water sources is being undertaken across the State to identify priority areas of measurement of extractions and to determine the most suitable measurement options. It is likely that this will be implemented in high priority areas initially, with roll out to all water sources over time, as appropriate.

Note: Decisions regarding the timetable for introduction of measurement of extractions are still under consideration. In the interim, water users are encouraged to use other forms of self-measurement to assist them to extract water in compliance with their licence conditions, which will be developed from the relevant plan provisions. Water users may install flow meters of their own volition. Meters need to meet new national water meter standards and be installed in accordance with the manufacturer's specifications

Compliance

The NSW Office of Water will undertake compliance activities as necessary to enforce each individual's licence conditions, which are developed based on the provisions of the water sharing plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the NSW Office of Water. Reports may be made by calling 1800 633 362 or emailing watercompliance@water.nsw.gov.au (refer to the NSW Office of Water website)

Glossary

Many of the terms in this document are defined in the *WMA 2000* and are therefore not redefined here. However, there are some terms that are not and have therefore been defined below to assist with understanding the water sharing plan.

Account water: The balance in an access licence water allocation account at a particular time. An access licence water allocation account records water allocations accrued under the licence as well as water allocations taken, assigned or re-credited. The operation of the account is also governed by rules for the carrying over of credits from one accounting period to the next and rules for the maximum credit that may be allowed to accumulate in the account as established in a water sharing plan.

Alluvial, alluvium: Sediment deposited by a stream of running water, in particular along river beds or flood plains.

Aquifer: An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be usefully extracted. The volume of water stored in an aquifer, the rate at which water can recharge, the volume of water extracted from it, and the rate at which water can move through the aquifer are all controlled by the geologic nature of the aquifer.

Connectivity: The capacity of in-stream biota to move longitudinally in a river system and not be impeded by barriers (e.g. weirs, dams, culverts). Connectivity is important for in-stream aquatic processes and biota and the conservation of natural riverine systems.

Conversion factor: The adjustment factor that is to be applied to share components when they are cancelled and reissued in a different water source and vice versa, or as a different category. It is designed to allow movement of water from one water source to another or from one licence category to another whilst minimising the impacts on third parties of such movements. These impacts result in that the value of a unit of share component (in terms of the average water allocations) that result from it may vary from one water source to another or from one licence category to another.

Critical habitat: Areas of habitat (land or water) that are crucial to the survival of particular threatened species, populations or communities.

Cumulative impact: The combined impact of all surface water extraction.

Ecological values: The intrinsic or core attributes associated with naturalness, diversity, rarity and special features, but excluding representativeness used to classify water sources for apportioning water management rules.

Endangered ecological communities: Ecological communities listed in Schedule 1 of the *Threatened Species Conservation Act 1995* or Schedule 4 of the *Fisheries Management Act 1994*.

Environmental contingency allowance (ECA): A volume of water held in storage from which releases are made for particular environmental purposes or in response to particular environmental circumstances.

Ephemeral: Temporary or intermittent; for instance, a creek or wetland which dries up periodically.

Extraction of water: Removal of water from a river for off-stream storage or consumptive use.

Extraction management unit (EMU): A group of water sources; defined for the purpose of managing long-term annual average extraction.

Flow classes: The range of daily flow rates in a river which provides the framework for sharing water on a daily basis.

Flow duration curve: A plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest.

Flow gauging station: A device used to measure the height of a river, from which the flow in the river can be calculated.

Flow reference point (FRP): The site from which the flow data is calculated to determine the rates associated with a flow class and then to implement the daily access rules during the life of the plan.

Groundwater: The water beneath the earth's surface that has filtered down to the zone where the earth or rocks are fully saturated.

Groundwater dependent ecosystems (GDEs): Ecosystems that rely on groundwater for their species composition and their natural ecological processes.

Individual daily extraction limit (IDEL): The daily volume limit that may apply for a particular licence holder for each flow class. The IDEL will be specified as part of the extraction component on the access licence. It establishes a share of the TDEL for that flow class.

In-stream refuge habitat: Stream habitat containing pools that retain water for longer periods of time during drought and low flow. In-stream biota will migrate to these more permanent habitats to survive.

Integrated Quantity/Quality Model (IQQM): A numerical hydrologic computer model that simulates a river basin's behaviour on a daily time step, based on inflows to the system, configuration of the major infrastructure, routing and losses of flows through the system and irrigation extractions to meet crop water requirements. It also models the processes of available water determinations, uncontrolled flow and supplementary water announcements and irrigator planting decisions. This model is used to analyse and compare the outcomes of proposed water sharing options or assess potential growth-in-use over long-term climatic sequences (> 100 years).

Long-term average annual extraction limit (LTAAEL): The target for total extractions (under all water access licences plus an estimate of basic landholder rights within an EMU) which is used to assess whether growth-in-use has occurred. The actual annual extractions (metered plus estimated) are averaged over a fixed period of time defined by the water sharing plan when comparing with the LTAAEL. If the fixed period of time is greater than one water year, then in any one water year, extractions can exceed the LTAAEL without triggering a growth-in-use response.

Macro water sharing plans: Plans which apply to a number of water sources across catchments or different types of aquifers. The macro planning process is designed to develop broader-scale plans covering most of the remaining water sources in NSW.

Management zone (MZ): An area within a water source used for defining the location of applicability of water sharing rules, but secondary to the water source. A management zone (MZ) is more likely to be designated where local dealing restrictions are in place or where 'Cease-to-pump' rules for works approvals apply.

Regulated river: A river that is declared by the Ministerial, by order published in the Gazette, to be a regulated river. Typically rivers where state owned storages catch water during wetter periods and the river is used to supply stored water to meet downstream users' orders during dry times are regulated rivers.

Reliability: The frequency with which water allocated under a water access entitlement is able to be supplied in full (referred to in some jurisdictions as 'high security' and 'general security'). Alternately, reliability can also sometimes be measured in terms of long-term average water availability relative to entitlement.

Riparian: Relating to or living or located on the bank of a natural watercourse, such as a river or stream.

Security: The legal status and tenure of a right to access water. This includes the level and assurance that a water access entitlement will provide that which it specifies. Security thus includes the reliability

of supply. The range of water access entitlement characteristics detailed in the NWI contributes to the security of a water access entitlement.

Schedule 2: Refers to those licence holders, as identified in Schedule 2 of the draft plan, that may continue to access water during periods of very low flows for fruit washing, cleaning of dairy plant and equipment for the purposes of hygiene, poultry watering and misting or cleaning of enclosures used for intensive animal production for of hygiene.

Supplementary water event: A continuous period during which the taking of water from uncontrolled flows under supplementary water access licences or as no-debit access under a Regulated River (general security) access licence is permitted in all or part of a River Water source

Sustainable yield: That percentage which is allowed to be extracted from groundwater after considering the aquifer's ability to recharge and the needs of the environment.

Total daily extraction limit (TDEL): The total limit on the daily volume of water that access licence holders in a particular category can take from a flow class. It is the sum of all the IDELs in that flow class.

Uncontrolled flow: is flow, in excess of that needed to meet the environmental provisions of the plan, basic landholder rights and water orders placed by Regulated River (general security) access licences and higher priority access licences in a water source. These flows originate from tributary inflows or dam spills.

Visible flow: The continuous downstream movement of water that is perceptible to the eye.

Water sharing plan (plan): A plan made under the *WMA 2000*, which sets out the rules for sharing water between the environment and water users within whole or part of a water management area or water source.

Water year: The 12 months running from 1 July to 30 June.

Appendix 1: The Towamba Catchment

Appendix 2: Identified threatened species

It is important to note that the macro water sharing plan process is concerned with protecting in stream water values that relate to extraction. Therefore, only threatened species that are likely to be sensitive to extraction have been considered when assessing the water source values.

It should also be noted that some threatened species are highly sensitive to low flow extraction, whilst other threatened species, such as plants that occur in the riparian zone, are less sensitive. Accordingly, threatened species considered to be highly sensitive to low flows are given a highly priority for protection.

The table below shows threatened species that are known (K) or expected (E) to occur in each water source:

	Lower Towamba River	Jingo Creek	Pericoe Creek	Wog Wog River	Upper Towamba River	Myrtle Creek	Mataganah Creek	Stockyard Creek	Far South Coast	Wonboyn River	Green Cape Coastal	Towamba Estuary tributaries	Nullica River	Eden tributaries	Curalo Lake and tributaries	Pambula Lake tributaries	Merimbula Lake tributaries	Merimbula Creek	Tura Beach	Sandy Beach Creek	Bondi Lake and tributaries	Wallagoot Lake and tributaries
Fish species																						
Australian Grayling	2	1	1	1	1	1	1	1	1	2	0	2	0	0	0	2	0	0	0	0	0	0
Frog species																						
Alpine Tree Frog	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1
Giant Burrowing Frog	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Green and Golden Bell Frog	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2
Littlejohn's Tree Frog	2	2	2	2	2	2	2	2	2	2	0	0	2	2	2	2	2	2	2	2	0	2
Southern Bell Frog	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stuttering Barred Frog	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Macroinvertebrate Species																						
Giant Dragonfly	0	0	2	2	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0

	Lower Towamba River	Jingo Creek	Pericoe Creek	Wog Wog River	Upper Towamba River	Myrtle Creek	Mataganah Creek	Stockyard Creek	Far South Coast	Wonboyn River	Green Cape Coastal	Towamba Estuary tributaries	Nullica River	Eden tributaries	Curalo Lake and tributaries	Pambula Lake tributaries	Merimbula Lake tributaries	Merimbula Creek	Tura Beach	Sandy Beach Creek	Bondi Lake and tributaries	Wallagoot Lake and tributaries
Birds																						
Australasian Bittern	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Black Bittern	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Black-tailed Godwit	2	2	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Comb-crested Jacana	2	2	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Little Tern	2	2	2	2	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Osprey	2	2	2	2	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Painted Snipe	0	0	2	2	0	0	0	0	2	2	2	0	0	0	0	0	0	0	-	-	-	-
Regent Honeyeater	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Sanderling	2	2	2	2	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Other fauna																						
Greater Broad-nosed Bat	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Large-footed Myotis	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Threatened populations																						
Coastal salt marsh in the SE Corner Bioregions	2	2	2	2	0	0	0	0	2	2	2	2	2	2	2	2	2	0	2	2	2	2
Freshwater wetlands on coastal floodplains	2	2	2	2	0	0	0	0	2	2	2	2	2	2	2	2	2	0	2	2	2	2

Explanation of scoring

If the species is:

- likely to be sensitive to low flow extraction and is known to occur within a subregion that is located within the catchment management unit (CMU), the CMU scores a '2' for that species value
- likely to be sensitive to low flow extraction and is predicted to occur within a sub-region that is located within the CMU, the CMU scores a '1' for that species value
- not known or predicted to occur within a sub-region, the CMU scores a '0'.

It should also be noted that some threatened species, such as the Eastern Freshwater Cod, are highly sensitive to low flow extraction, whilst other threatened species, such as plants that occur in the riparian zone, are less sensitive. Accordingly, threatened species considered to be highly sensitive to low flows are given a higher priority for protection.

Note: because the macro water sharing plan process focuses on protecting in-stream values relating to extraction, only threatened species that are likely to be sensitive to extraction have been considered in this assessment.

Disclaimer

The Department of Environment Climate Change and Water (DECCW) has provided assessments on the presence of threatened species and their sensitivity to extraction to inform the classification of water sources through the Macro Water Sharing Planning process. The assessments were undertaken for the specific purpose of developing an initial classification of water sources. They were based on the most accurate and relevant data/ information sourced and analysed at the time.

Initial classifications were a first step to inform panel deliberations. Panels considered a range of information and used local knowledge in determining a final classification. The assessments are not absolute – for example the absence of threatened species for an assessment does not necessarily mean the threatened species are not present.

These assessments should not be used for any purpose other than classification of catchment management units as part of the macro water sharing planning process.

Appendix 3: Interagency regional panel and support staff – membership and expertise

Name	Agency	Role	Expertise
interagency regional panel members			
Eddie Harris	NOW	Agency representative (November 2006 to present)	River operations, aquatic ecology and interpretation of the NWI
John O'Connor	SRCMA / I&I NSW	SRCMA observer (June 2008 to March 2009); DII rep (June 2005 to present)	Catchment management, local knowledge of catchments, agricultural issues
Allan Lugg	I&I NSW - Fisheries	Agency representative (June 2005 to present)	Fisheries management and conservations issues, threatened species, local knowledge
Anne Muir	I&I NSW - Agriculture	Agency representative (June 2005 to present)	DII regional input to water reforms, agriculture, catchment management and land use/strategic planning.
John Patten	DECCW	Agency representative (May 2008 to March 2009)	DECCW regional input to water reforms, conservation issues.
Support Staff and previous panel members			
Andrew Craig	NOW	SRCMA observer (2006 to May 2008); Panel Co-ordinator (June 2008 to March 2009)	Water sharing, irrigation management, local knowledge
Jenny Wood	NOW	Panel Co-ordinator (June 2005 to September 2006)	Water planning, water science
Simon Williams	NOW	Agency representative (June 2005 to November 2006)	Aquatic ecology, water sharing, river science
Simon Morton	NOW	Hydrological support	Hydrological modelling
Dave Miller	NOW	Facilitator (November 06 to May 08)	Water planning and facilitation
Maree Abood	OHN	Panel Co-ordinator (November 2006 to May 2008)	Water planning, environmental science
Louise Whiting	NOW	Legal support	Environmental law
Ken Harris, Mark Harris and Ashleigh Mayo	NOW	Plan Writers	Environmental Planning and Management
Wayne Ryan	NOW	Licensing support	Licensing, local knowledge
Bob Britten	NOW	Hydrogeological support	Hydrogeology, local knowledge
Paul Corbett	NOW	Hydrometric support	Hydrometrics, local knowledge
Don McPhee	SRCMA	Agency representative (June 2005 to March 2006)	Facilitation, consultation and local knowledge
Peter Bliss and Eva Ciecko	NOW	Spatial Data Analyst	Map preparation
Danielle Doughty, Kimberley Dale and Linden Bird	NOW	Document preparation	Water resource management
Peter Lloyd-Jones	DECCW	Agency representative (2007 to August 2008)	DECCW regional input to water reforms, conservation issues.
Dave Winfield	DECCW	Agency representative (2006)	DECCW regional input to water reforms, conservation issues.
Matt Rizzuto	DECCW	Agency representative (June 2005 to September 2006)	DECCW regional input to water reforms, conservation issues.

Appendix 4: Contribution to the river flow objectives

Levels of assessed contribution:

- FULL – contributes to objective in full
- HIGH – while not fully contributing to objective is considered a good level of contribution
- PARTIAL – goes some way to contributing to the objective
- LOW – only small degree of contribution to the objective

Note that for some systems while there may be no specific rule for each river flow objective the extent to which the rules, annual extraction limits and the risk to values contributed to the objectives was considered, and a specific rule developed only where necessary.

(*) Note that for the tidal pool water source although rules have not yet been developed the following assessment is based on the intent of the rules. Tidal pool is assessed against the RFOs based on rules intended to maintain natural variability of salinity levels, and protect from significant saltwater intrusion.

Water source	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforseen events	Maintain or rehabilitate estuarine processes and habitats
Upper Towamba River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Jingo Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	PARTIAL
Wog Wog River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Myrtle Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Mataganah Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Pericoe Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	PARTIAL
Stockyard Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	PARTIAL
Lower Towamba River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Towamba Estuary	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL

Water source	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforseen events	Maintain or rehabilitate estuarine processes and habitats
tributaries												
Far South Coast	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Wonboyn River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Green Cape	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Nullica River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Eden tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Curalo Lake and tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Pambula Lake tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	HIGH
Merimbula Lake tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Merimbula Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Tura Beach	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Sandy Beach Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Bondi Lake and tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	PARTIAL
Wallagoot Lake and tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	PARTIAL

Appendix 5: Interagency regional panel reference materials

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Appendix 6: Final classification summary

Value matrix

High in-stream values	**a** Stockyard Creek Wog Wog River Far South Coast Wonboyn River Green Cape Bondi Lake and tributaries Wallagoot Lake and tributaries	**b** Lower Towamba River Towamba Estuary tributaries Upper Towamba River Sandy Beach Creek	**c** Pambula Lake tributaries
Medium in-stream values	**d** Jingo Creek Pericoe Creek Nullica River Eden tributaries Curalo Lake and tributaries Merimbula Lake Tura Beach	**e** Mataganah Creek Myrtle Creek	**f**
Low in-stream values	**g**	**h**	**i** Merimbula Creek
	Low hydrologic stress or hydrologic risk	**Medium hydrologic stress or hydrologic risk**	**High hydrologic stress or hydrologic risk**

Risk matrix

High risk to in-stream values	**a**	**b** Pambula Lake tributaries	**c**
Medium risk to in-stream values	**d**	**e** Lower Towamba River Sandy Beach Creek	**f**
Low risk to in-stream values	**g** Jingo Creek Pericoe Creek Stockyard Creek Wog Wog River Far South Coast Wonboyn River Green Cape Towamba Estuary tributaries Nullica River Eden tributaries Curalo Lake and tributaries Merimbula Lake Tura Beach Bondi Lake and tributaries Wallagoot Lake and tributaries	**h** Upper Towamba River Myrtle Creek Mataganah Creek Merimbula Creek	**i**
	Low dependence on extraction	**Medium dependence on extraction**	**High dependence on extraction**