



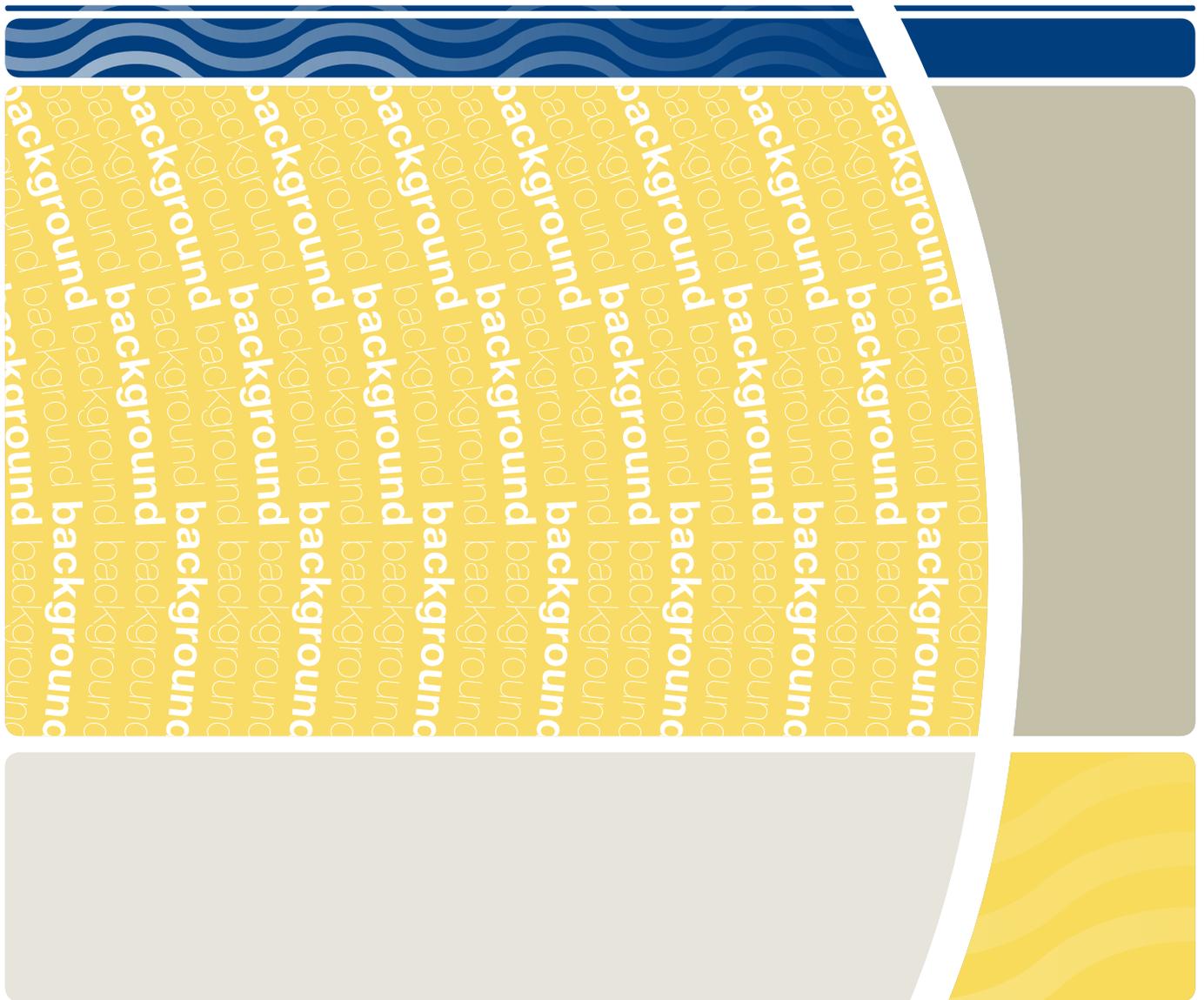
Office  
of Water

# Water Sharing Plan

Murrumbidgee-Wallaga Area

Unregulated and Alluvial Water Sources

## Background document



**Publisher**

NSW Office of Water

Level 17, 227 Elizabeth Street

GPO Box 3889

Sydney NSW 2001

T 02 8281 7777 F 02 8281 7799

information@water.nsw.gov.au

www.water.nsw.gov.au

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*Water Sharing Plan for the Murrumbidgee Area  
Unregulated and Alluvial Water Sources – Background document*

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## Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across New South Wales 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<sup>1</sup> 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 (eg 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 Murrumbidgee Area Unregulated and Alluvial Water Sources 2010 covers 13 water sources that are grouped into one Extraction Management Unit (EMU) (Appendix 1).

Water sharing rules that the water sharing plan focuses on are:

- environmental water rules – the share of the water reserved for the environment
- access rules – which determine when extraction is allowed (for example above a set river flow rate)
- dealing rules – which 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 water sharing plan
- the intended outcomes of the water sharing plan
- a physical description of the Murrumbidgee 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 water sharing plan.

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<sup>1</sup> 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 Murrumbidgee Area 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](http://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 20<sup>th</sup> 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 WMA 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. Water sharing plans provide a legal basis for sharing water between the environment and consumptive purposes.

Water sharing 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 ten years providing all users with greater certainty regarding sharing arrangements<sup>2</sup>.

### 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 water sharing 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. One of the water sources, Dry Creek, covered by the water sharing plan is considered to have a high economic dependence on commercial extraction.

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<sup>2</sup> 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.

### 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.

Ten water sources were identified as having high in-stream values (Table 1). For these water sources, trading into the water source will be limited so that there is no increase in water entitlement, and generally trading rules aim to decrease entitlement in the water sources. 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
Murrumbidgee River	15 threatened species, significant area of National Park
Murrumbidgee Estuary Tributaries	14 threatened species, 2 endangered ecological communities, National Park
Nelson Lagoon Tributaries	14 threatened species, significant area of National Park, 2 endangered ecological communities
Middle Lagoon Tributaries	14 threatened species, large area of National Park, 2 endangered ecological communities
Wapengo Lagoon Tributaries	14 threatened species, 2 endangered ecological communities, small area of National Park
Cuttagee Lake Tributaries	14 threatened species, 2 endangered ecological communities, National Park
Barragoot Lakes Tributaries	13 threatened species, 2 endangered ecological communities, National Park
Bermagui River	14 threatened species, 2 endangered ecological communities, National Park
Wallaga Lake Tributaries	19 threatened species, 2 endangered ecological communities, National Park
Bobundra Creek	19 threatened species, 2 endangered ecological communities, National Park

## Existing rules

Prior to the commencement of the water sharing plan, a number of water sources within the water sharing plan area already had CtP requirements. These arrangements, brokered through the South Coast Water Management Committee, operated in the Dry and Murrumbidgee Rivers and Narira Creek (Table 2). These sharing arrangements provided the basis for water sharing rules written into the Murrumbidgee-Wallaga water sharing plan.

Table 2: Previous water sharing arrangements for water users on Dry River and Narira Creek

Water source	Previous water sharing arrangements
Dry (Murrumbidgee) River	Flow Sharing commences when stream flow at Quaama falls below 2 ML/d, which currently corresponds to the 50 <sup>th</sup> percentile.  CtP when stream flow at Quaama falls below 0.5 ML/d, which currently corresponds to the 75 <sup>th</sup> percentile.
Narira Creek	Flow Sharing commences when stream flow d/s of Cobargo falls below 3 ML/d, which currently corresponds to the 50 <sup>th</sup> percentile.  CtP when stream flow d/s Cobargo falls below 0.5 ML/d, which currently corresponds to the 80 <sup>th</sup> percentile.

## Proposed rules

With the commencement of the water sharing plan, all surface water licences (excluding those licences used for food safety and essential dairy care) are subject to CtP rules. In those water sources where there is no entitlement: Nelson Lagoon Tributaries, Murrumbidgee Estuary Tributaries and Barragoot Lake Tributaries, there is no need to define access rules.

## Alluvial water sources

Only the alluvial aquifers are included in the Murrumbidgee-Wallaga 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

The area covered by the water sharing plan (refer Appendix 1) is comprised of the Murrumbidgee Catchment and the Wallaga Lake Catchment and in total contains 13 water sources covering an approximate area of 784 km<sup>2</sup>. The water sharing plan area is located on the far north coast of NSW and includes the major towns of Cobargo (population 550) and Bermagui (population 1200), with a number of smaller villages and settlements. The catchment is bounded by the Tuross Basin to the north and west, and the Bega-Brogo catchment to the south and west.

The water sharing plan area is bordered to the west by parts of the Great Dividing Range, running approximately north-south and rising to an elevation of over 660 m. The western part of the water sharing plan area consists of rounded granite foothills, while the eastern part of the water sharing plan area consists of lowland sedimentary plains. Mt Gulaga (Dromedary) is the highest peak in the region with an altitude of 797 m, and is located on the northern border of the Bobundra Creek water source. Like most of the South Coast, the Murrumbidgee-Wallaga catchment has a relatively high density of estuaries and coastal lakes (or ICOLLs – Intermittently Closed and Open Lakes and Lagoons). There are nine ecologically significant ICOLLs (including Wallaga Lake, Wapengo Lagoon, and Nelson Lagoon) and one ecologically significant estuary (Bermagui) in the Murrumbidgee-Wallaga catchment. The sensitivity of ICOLLs and estuaries to extractions from surface water and groundwater was considered in preparing the Murrumbidgee-Wallaga Water Sharing Plan, and is discussed later in this report.

## Land use history

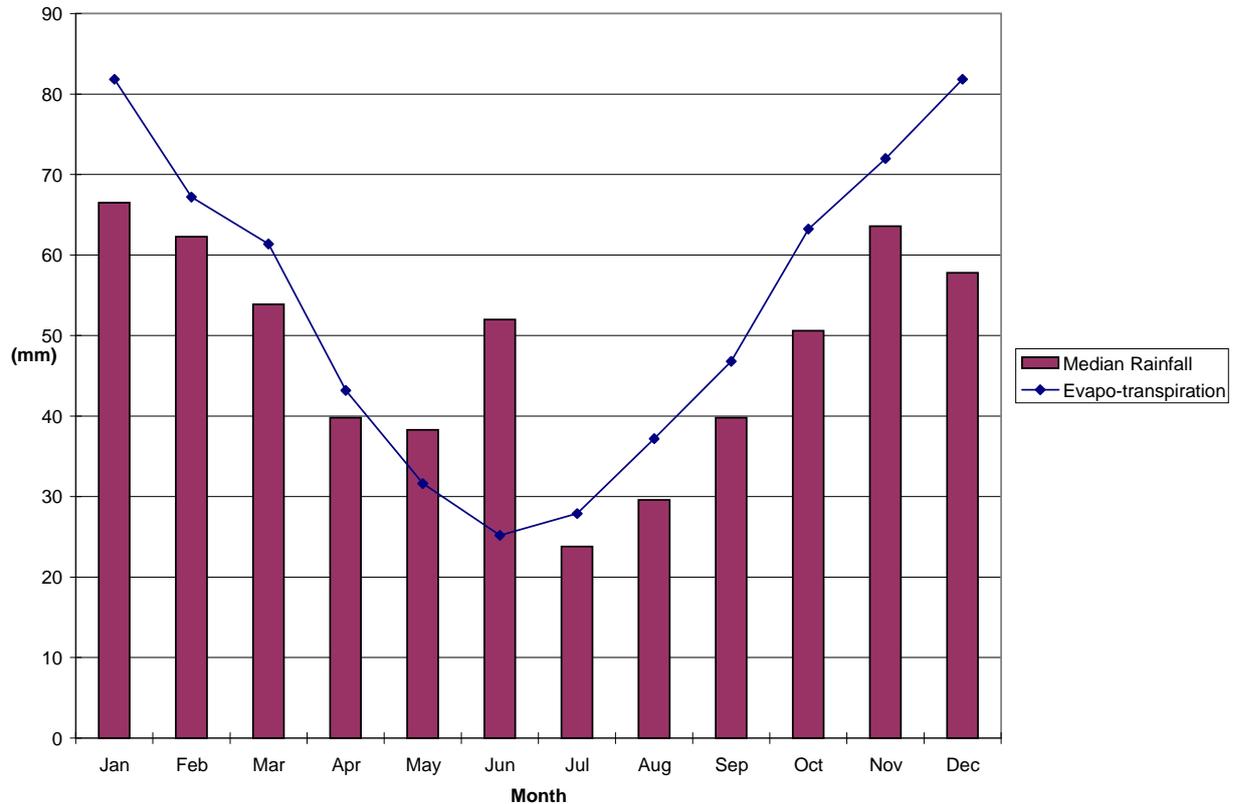
Settlement in the Murrumbidgee / Dry River catchment is concentrated upstream of the town of Quaama, with most of the land downstream of Quaama being State Forest. Land use in the Narira Creek catchment is a similar pattern to the Murrumbidgee / Dry River catchment, in that settlement is concentrated in the upper part of the catchment (upstream of Cobargo) with the lower parts of the catchment predominantly being State Forest. The Dignams Creek catchment, on the southern slopes of Mt Gulaga (Dromedary) shows a different pattern of land use with state-run forestry dominating the upper parts of the catchment and agricultural land use in the lower reaches (DLWC, 1999).

Beef grazing and dairy farming are the main agricultural activities in the Murrumbidgee-Wallaga catchment, comprising about 30 per cent of land use in the water sharing plan area, with the other 70 per cent primarily state forest and National Park. A significant area of land is harvested for timber and paper products by Forests NSW, and there are several commercial oyster leases in the estuaries covered by the water sharing plan area. Tourism is a major contributor to the regional economy.

## 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 1) tends to be greatest during summer (median January rainfall over the period from 1888 to 2009 is 66.5 mm) and lowest in July (median July rainfall over the same period is 23.8 mm).

**Figure 1: Monthly median rainfall (Cobargo Post Office, 1888 to 2008) and evapo-transpiration (Bodalla, 1889 to 2008) for the Murrah-Wallaga catchment**



Sources: Bureau of Meteorology and SILO. Reference evapo-transpiration was calculated using the FAO Penman-Monteith formula, and a crop co-efficient of 0.6 was used for all months.

## Streamflows

Measurements from gauges (Table 3) show generally very low flows in comparison to many other catchments in NSW, but this is the result of the small catchment size and only moderate rainfall. For example, the daily flow in Narira Creek is 3.2 ML or less for 50 per cent of all days, and no stream flow is experienced for at least 10 per cent of all days. This is important in converting the macro risk and value assessment outcome to an actual cease-to-pump flow rate (this is further discussed later). Due to the topography, small catchment areas and the lack of extensive alluvial soils, stream flows tend to increase and decrease quickly in response to rainfall events.

Stream flow is currently measured at two operational stream gauging stations in the water sharing plan area:

- Gauge 219016 Narira Creek near Cobargo; and
- Gauge 219018 Dry River at Quaama.

Records from both the current and discontinued gauging stations provide a history of stream flows throughout the water sharing plan area and have been used in the development of the water sharing plan.

**Table 3: Streamflow percentiles for gauges in Narira Creek and Dry River catchments**

Station name	Station no.	Mean annual flow (ML)	Median annual flow (ML)	Percentile flow (ML/day) of all days				
				95 <sup>th</sup>	90 <sup>th</sup>	80 <sup>th</sup>	50 <sup>th</sup>	30 <sup>th</sup>
Narira Creek near Cobargo	219016	17666	5455	0.0	0.0	0.3	3.2	8.6
Dry River at Quaama	219018	11202	6075	0.0	0.1	0.4	2.8	7.4

## Groundwater

Of the different types of aquifers, only alluvial aquifers are included in the Murrumbidgee Water Sharing Plan as they are often highly connected with surface water bodies. That is alluvial groundwater and surface water in this water sharing 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) then these are subject to salt water ingress, therefore they will be addressed in a separate water sharing plan and have not been included in the surface water macro plans, such as the Murrumbidgee Water Sharing Plan. Both porous rock aquifers and fractured rock aquifers have low to moderate connectivity with surface water, and therefore have not been included in the surface water macro plans. Water usage from these aquifer types will be addressed later in a separate water sharing plan

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, and
- ensures that water is not accounted for twice.

In light of the small number of alluvial bores in this water sharing plan area, alluvial bores have been included in the Murrumbidgee Water Sharing Plan, regardless of whether the bores are located upstream or downstream of the tidal limit. Only two licences in the Murrumbidgee catchment were identified in the highly-connected alluvial aquifers: one in the Bobundra Creek water source, and the other in the Bermagui River water source.

## 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 that 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.

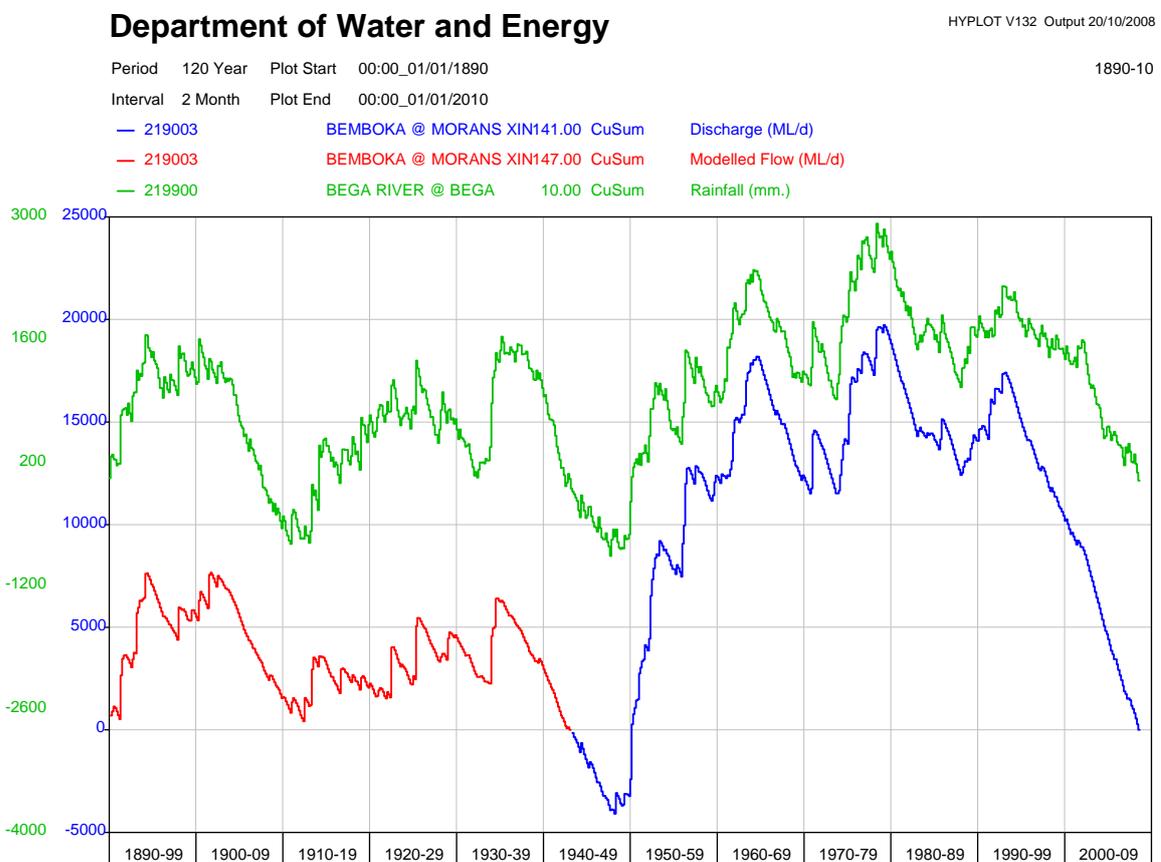
The complex problem of separating variability from change is illustrated in Figure 2. This is a plot of rainfall and runoff at Morans Crossing on the Bemboka River in the neighbouring Bega Valley. The top line illustrates long-term rainfall, while the bottom line represents long-term runoff patterns. 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; and
- 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 Murrumbidgee 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 Murrumbidgee 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 not necessarily indicative of evaporation and rainfall changes, which are more 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 SE 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, and
- 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 Murrumbidgee Water Sharing Plan, the CtP levels set by this 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. 95<sup>th</sup> 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 water sharing 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 water sharing plan.

## Entitlement and use

The greatest volumes of entitlement in the Murrumbidgee catchment are in the Dry River, Bermagui River and Narira Creek Water Sources. There are limited groundwater extractions licensed in the Dry River, Murrumbidgee River and Bermagui River Water Sources, and 50 ML of Town Water Supply (TWS) licence in the Wallage Lake Tributaries Water Source (Table 4).

**Table 4: Total entitlement and number of licences for each water resource**

Water source	Domestic & Stock access licences	Local Water utility access licences	Unregulated river access licences	Aquifer access licences	Total
Murrumbidgee River	12	0	113	5	130
Dry River	123	0	1686	5	1814
Nelson Lagoon Tributaries	0	0	0	0	0
Middle Lagoon Tributaries	13	0	8	0	21
Wapengo Lagoon Tributaries	8	0	144	0	152
Murrumbidgee Estuary Tributaries	9	0	0	0	9
Cuttagee Lake Tributaries	12	0	20	0	32
Barragoot Lake Tributaries	1	0	0	0	1
Bermagui River	41	0	798	5	844
Wallaga Lake Tributaries	9	50	0	0	59
Narira Creek	49	0	1221	5	1275
Dignams Creek	5	0	179	0	184
Bobundra Creek	14	0	330	0	344
<b>Total</b>	<b>296</b>	<b>50</b>	<b>4499</b>	<b>20</b>	<b>4865</b>

Source: NSW Office of Water, Licensing Administrator 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 in the following chapter of this document.

## Local water utility requirements

The Bega Valley Shire Council (BSVC) has a weir on Couria Creek, a tributary of Wallaga Lake. Licensed entitlement is 50 ML/yr to supplement the Brogo-Bermagui water supply system. The intake is a fixed pipe with small screen openings within a concrete chamber with a metal mesh top. Half of the metal mesh top is covered with a metal plate to allow at least 50 per cent of the flow downstream. Water flows from Couria Creek weir under gravity via a 150 mm pipeline to supply Wallaga Lake Koorie Village and Akolele village. A proportion is also used to fill Tilba Dam. Volumes supplied in recent years have been between 5 and 20 ML/year.

There are no significant town water supply infrastructure projects proposed for the Murrumbidgee-Wallaga catchment as most of the town water supply requirements for this area are met by extractions from the Bega Regulated River.

## Agricultural water use

The predominant agricultural industries in the Murrumbidgee-Wallaga catchment are dairy farming and beef farming. There are 14 dairy farms with an estimated 2,500 dairy cows in the catchment. The greatest demand for agricultural water use is for stock watering and irrigating pastures for these cattle. Due to the relative small and highly variable stream flows with a significant proportion of zero flow days in the Murrumbidgee-Wallaga catchment, the opportunities for irrigation are limited without significant storage capacity. However, water extractions for irrigation and stock watering does contribute significantly to the viability of dairy farming and beef farming in the Murrumbidgee-Wallaga catchment.

Rye-grass and kikuyu pastures are irrigated on six or seven farms in the Murrumbidgee catchment, with irrigation water being extracted from streams on four of these farms, and from off-stream dams on the remaining farms. Studies of dairies in the Bega area (Lim-Applegate & McClintock, 1999) found that the average dairy farm is around 280 hectares, with irrigation being used on about 25 per cent of the farm. However, the proportion of farm irrigated in the Murrumbidgee catchment is generally less due to the reduced reliability of flows and smaller volumes of water available in these water sources. Officers from DII estimate that the typical area of irrigated pasture on these farms is 40 hectares or approximately 14 per cent.

Pastures are typically irrigated from December to March, with the peak irrigation demand usually occurring from December to February. (The magnitude of the difference between evapotranspiration and rainfall, as shown in Figure 2, provides a relative indication of the monthly irrigation demand). However, it is not unusual for irrigation to be required during autumn and early spring if conditions are dry and soil moisture is limiting plant growth. The amount of water required for irrigation varies substantially between years depending on rainfall, with the average application rate being around 4 ML/ha/yr. The total average usage for irrigation from either the river or harvestable rights across the Murrumbidgee catchment is therefore estimated to be 1,120 ML/yr (4 ML/ha/yr x 7 farms x 40 ha per farm).

Based on an average of 40 ha of irrigated pasture on each of seven farms, the economic value of irrigation in the Murrumbidgee catchment was estimated. Assuming that irrigation increases the dry matter production by 50 kg/ha/day, and a cost of feed of \$ 300/tonne, then 280 ha of irrigation would contribute \$ 4,200 of extra dry matter per day. Assuming that irrigation occurs over 6 months, the potential total contribution of irrigation in the Murrumbidgee catchment would be \$ 767,000. However, due to the small and unreliable stream flows in this catchment, this potential economic contribution would not be fully realised in all years.

The water usage for dairy wash-down and stock watering is considerably less than the volume potentially used for irrigation, but is arguably more important to the viability of beef and dairy farming in the Murrumbidgee catchment. Assuming an average usage of 10,000 L/day per dairy for wash-down water, a total of 51.1 ML/yr would be required. Assuming a requirement of 50 L/day per cow for drinking water, the total demand for drinking water of dairy cows across the Murrumbidgee catchment would be 46 ML/yr (pers comm John O'Connor, DII).

## Developing the plan

### Scope of the plan

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

The two water resources are:

- the unregulated rivers – these cover all of the water within the rivers, lakes and estuaries within the water sharing plan area, and
- the groundwater in alluvial aquifers.

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, and
- alluvial aquifers, where groundwater is contained in the pore spaces in the unconsolidated floodplain material.

The water sharing plan includes all the alluvial aquifers within the water sharing 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 water sharing 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. The Murrumbidgee Water Sharing Plan contains one EMU.
- Daily access rules apply at the **water source** level. The Murrumbidgee catchment EMU is divided into 13 water sources. The spatial extent is shown in Appendix 1.
- **Management zones**, representing a portion of a water source, may be specified so that more refined implementation of access or trading rules can be applied if required. There are no management zones in the Murrumbidgee Water Sharing Plan area.

## Project groups

### **State Interagency Panel (formerly the Project Control Group)**

The State Interagency Panel (SIP) has overall responsibility for the statewide 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, 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 the 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 Murrumbidgee Water Sharing Plan was prepared by the **South Coast Interagency Regional Panel**, a group consisting of representatives from the 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; and
- 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 water sharing plan provisions.

In preparing the water sharing rules, the IRP considered existing water sharing arrangements, any previous negotiations and agreements under the South Coast Water Management Committee and the practicality of implementing the 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](http://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 5) such as Targets 5 and 6 (see [www.nrc.gov.au](http://www.nrc.gov.au) for details) which is a requirement of the State Plan, Priority E4 (see [www.nsw.gov.au/stateplan](http://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 13 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 5: Contribution of the water sharing plan to the relevant NRC statewide targets**

Relevant statewide 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 at end of water sharing plan period.
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)	- rules developed water sources adjoining 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), facilitated and prepared by the SRCMA). The SRCAP can be found on the SRCMA website [www.southern.cma.nsw.gov.au](http://www.southern.cma.nsw.gov.au).

Similar to the statewide targets on improvement in riverine ecosystems and the ability of aquifers to support groundwater dependent ecosystems, the water sharing 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 water sharing plan.

One of the 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 the SRCAP.

## Previous water planning

The preparation of the Murrumbidgee Water Sharing Plan is the latest step in refining water sharing arrangements amongst water users in the Murrumbidgee catchment. Water sharing arrangements, mostly voluntary, have existed for many years in catchments throughout the South Coast of NSW. With the changes under the *Water Management Act 2000* and the move towards creating a 'water market', it is necessary to formalise water sharing arrangements through the preparation of legislative water sharing plans.

Local water sharing agreements which are not explicitly licence conditions but were brokered through the SCWMC, were operating on the Dry and Murrumbidgee Rivers, and Narira Creek. All water users have long recognised the need for CtP levels and have willingly participated in water sharing agreements.

In 1999 the Minister for Land and Water Conservation established several Water Management Committees across the state with the task of preparing Water Management Plans, and later water sharing plans.

In 2000, the South Coast Water Management Committee negotiated more formal water sharing agreements with water users in the Dry River and Narira Creek catchments. These agreements were based on water sharing practices which occurred informally amongst water users for many years prior to this formal agreement. These water sharing arrangements were taken into consideration during the preparation of the Murrumbidgee Water Sharing Plan.

## 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 through extraction;
- poor water quality;
- reduced numbers of fish and other wildlife; and
- 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 Murrumbidgee catchment, but will certainly be affected

by future water sharing arrangements in the water sharing plan. More recently, members of the IRP held meetings with Aboriginal representatives in the Bega district to discuss the proposed 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 water sharing plan.

Furthermore, opportunities for granting licences for **Aboriginal cultural purposes** throughout the Murrumbidgee catchment will be included in the Murrumbidgee Water Sharing 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.

Ten water sources in the Murrumbidgee catchment were identified as having high in-stream value (Table 1). For these water sources, water trading will be limited so that there is no increase in water entitlement, and generally trading rules 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 Murrumbidgee catchment.

In preparing the Murrumbidgee 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 Murrumbidgee water sharing plan does not include any management rules for specific HCV areas because:

1. A considerable area (> 30 per cent) of the Murrumbidgee catchment is classified as National Park (Biamanga NP, Mimosa Rocks NP, Wadbilliga NP, Kooraban NP and Gulaga NP). 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 boundaries.

Nelson Lagoon, Barragoot Lake and Murrumbidgee Estuary Tributaries water sources have no extraction entitlement and were assessed to have high in-stream values. 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 Murrumbidgee 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 Murrumbidgee 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 Murrumbidgee 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 Murrumbidgee 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.

Two estuaries in the Murrumbidgee catchment were assessed as highly sensitive to **both** low and high inflow variations: Bunga Lagoon (in the Murrumbidgee Estuary water source) and Middle Lagoon. Three estuaries in the water sharing plan area were assessed as being highly sensitive to low inflow variations: Little Lake (in Bobundra Creek water source), Barragoot Lake, and Cuttagee Lake (Table 4). The sensitivity of these estuaries was taken into consideration during the drafting of the water sharing rules.

**Table 6: Inflow sensitivities for the estuaries of the Murrumbidgee catchment**

Name	Groundwater Sensitivity	Low Flow Inflow sensitivity	High Flow Inflow sensitivity
Little Lake	Low	High	Medium
Wallaga Lake	Medium	Medium	Medium
Bermagui River Estuary	Medium	Medium	Medium
Barragoot Lake	Low	High	Medium
Cuttagee Lake	Low	High	Medium
Murrumbidgee Lagoon	Medium	Medium	Medium
Bunga Lagoon	Low	High	High
Wapengo Lagoon	Medium	Low	Low
Middle Lagoon	Medium	High	High
Nelson Lagoon	Low	Medium	Medium

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 fresh despite being affected by daily tidal movements. The streams within this water sharing 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 Murrumbidgee catchment typically because of salinity constraints.

## 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 IRP 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 unforeseen 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 Department. 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 water sharing plan. There are currently no extractions for native title rights. However, these rights may be activated during the water sharing plan's ten year term.

Furthermore, the cease-to-pump 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 Murrumbidgee water sharing plan were estimated using the approach developed by the Water Management Act Implementation Division (WMAIT 2001). These figures represent the current best estimate and will be reviewed once the above-mentioned regulation is completed. Domestic & Stock groundwater licences situated in the highly-connected alluvial aquifers were also identified, and included in the total daily water requirements (Table 7).

**Table 7: Estimated water requirements (ML/d) of holders of domestic and stock rights**

Water source	Estimated rights (ML/d)	Water source	Estimated rights (ML/d)
Murrumbidgee River	0.11	Barragoot Lake Tributaries	0.01
Dry River	0.23	Bermagui River	0.15
Nelson Lagoon Tributaries	0.01	Wallaga Lake Tributaries	0.10
Middle Lagoon Tributaries	0.09	Narira Creek	0.48
Wapengo Lagoon Tributaries	0.06	Dignams Creek	0.13
Murrumbidgee Estuary Tributaries	0.09	Bobundra Creek	0.05
Cuttagee Lake Tributaries	0.01		

An estimate of the Harvestable Rights volume was not explicitly included for the LTAAEL for the Murrah-Wallaga 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 water sharing plan there are currently no extractions for native title rights. However, these rights may be exercised during the water sharing plan's ten 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.

There are no significant water interception activities anticipated for the Murrah-Wallaga catchment within the life of the water sharing plan. There are large areas of the catchment covered by NSW State Forests. The majority of the forests within the catchment are managed with selective logging technique, resulting in minimal change to catchment hydrology.

### **Protecting town water supply access**

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 water sharing 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.

The IRP recommended that the LTAAEL for the 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.

The total volume of licensed entitlement along Narira Creek is 1,275 ML/yr, which represents 7.2 per cent of the mean annual stream flow of 17,666 ML.. The total volume of licensed entitlement along the Dry River and Murrah River is 1,953 ML/yr, which represents 17.4 per cent of the mean annual stream flow of 11,202 ML.. These percentages are low compared to the heavily committed rivers of the Murray-Darling Basin.

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: Report to assist community consultation* which is available on the NSW Office of Water’s website<sup>3</sup>.

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; and
- 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; and
- 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;

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<sup>3</sup> Refer <http://www.water.nsw.gov.au> for the most recent version of the manual

- 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; and
- NSW Fisheries (DII) freshwater and saltwater recreational fishing database.

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 generic classification 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 8.

**Table 8: Refined Classifications based on IRP Knowledge**

Water source	Change to Classification	Justification
Bermagui River	Relative In-stream Value was revised from 'medium' to 'high', and Risk to In-stream Value was revised from 'medium' to 'high'	Need to protect water quality for oyster farms in the Bermagui Estuary.
Wallaga Lake Tributaries	Relative In-stream Value was revised from 'medium' to 'high'	There are a considerable number of threatened species in this water source.
Dignams Creek	Risk to In-stream Values was revised from 'low' to 'medium'	The hydrologic stress and the relative in-stream value are both rated as 'medium'.
Bobundra Creek	Relative Community Dependence was revised from 'low' to 'medium'	The volume of entitlement in this water source is quite considerable, representing 8.2 per cent of entitlement throughout the water sharing plan area.

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

Eleven of the water sources received an indicative cease-to-pump rule of the 95<sup>th</sup> flow percentile based on non-zero flow days (Table 9). All of the water sources in the Murrumbidgee Water Sharing Plan are ungauged, except for Narira Creek and Dry Creek. The IRP initially considered linking the access rules in ungauged water sources to flow readings (95<sup>th</sup> percentile flow) at the Narira Creek and Dry Creek gauges, but later decided that access rules based on visible stream flow in the ungauged streams would be more practicable.

Considering the pattern of flow in these coastal streams, the IRP concluded that visible flow rules will provide a level of environmental protection equivalent to or greater than rules based on gauges in neighbouring catchments. The IRP has therefore recommended visible flow rules for all ungauged water sources where there is existing entitlement (Table 9).

**Table 9: Cease-to-pump rules**

Water Source	Indicative rule	Access rule
Nelson Lagoon Tributaries, Murrumbidgee Estuary Tributaries and Barragoot Lake Tributaries	95 <sup>th</sup> percentile flow	No flow classes (No extraction by access licences permitted)
Murrumbidgee River	Cease-to-pump at visible flow at pump site	<b>Years 1 to 5:</b> Cease-to-pump = 0.5 ML/d, <b>Years 6 to 10:</b> Cease-to-pump = 1 ML/d Measured at Quaama Gauge 219018
Dry River	95 <sup>th</sup> percentile flow	<b>Years 1 to 5:</b> Cease-to-pump = 0.5 ML/d, <b>Years 6 to 10:</b> Cease-to-pump = 1 ML/d Measured at Quaama Gauge 219018
Middle Lagoon Tributaries, Wapengo Lagoon Tributaries, Cuttagee Lake Tributaries, Wallaga Lake Tributaries, Dignams Creek, and Bobundra Creek	95 <sup>th</sup> percentile flow	Visible flow at the pump site
Bermagui River	90 <sup>th</sup> percentile flow	Visible flow at the pump site
Narira Creek	95 <sup>th</sup> percentile flow	<b>Years 1 to 5:</b> Cease-to-pump = 0.5 ML/d <b>Years 6 to 10:</b> Cease-to-pump = 1 ML/d Measured at Cobargo Gauge 219016

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

To achieve environmental flows in the Narira Creek and Dry River water sources, the IRP initially proposed the introduction of a 'Commence to Pump' rule. Following public consultation, and after further consideration, the panel decided to recommend a 12 hour first flush rule in preference to a Commence to Pump level. The rationale for a first flush rule is that it would be easier to implement than a Commence to Pump rule. On the basis of equity, it is proposed that a first flush rule be introduced for all water sources in the Murrumbidgee catchment in which entitlement currently exists.

The first flush rule is that after 30 consecutive days of very low stream flow, licence holders will not be permitted to extract water for the first 12 hours of stream flows being above the cease-to-pump level.

As described earlier in this document, BVSC's weir on Couria Creek is designed and managed to pass at least 50 per cent of stream flows. The Murrumbidgee Water Sharing Plan formalises this existing arrangement.

## Water sharing rules for GDEs

As mentioned earlier, 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 Murrumbidgee 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. However, if an assessment can demonstrate that the impact of a new bore will be within acceptable limits the installation may be permitted closer than the minimum set distances. Existing bores are not affected by the buffer zones and are able to continue operating (i.e. 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 Valley and proposed 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 based on, for example, 0.5 and 1.0 ML/day, would offer little incentive to landholders to undertake the required activities to attain accreditation.

## Total Daily Extraction Limits

The indicative access rules recommended that Total Daily Extraction Limits (TDELs) be considered for three of the water sources: the Dry River, Narira Creek and Bermagui River. The IRP considered TDELs and decided to **not** recommend the inclusion of TDELs in any of the water sources in the Murrumbidgee Water Sharing Plan.

To implement TDELs requires the installation of a gauging station, 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. Whilst implementing some of these activities is being explored in different parts of the State, the costs and benefits of implementing them in each particular water source need to be considered carefully. At this point in time, the costs of most of these activities typically outweigh the benefits in most, if not all, water sources of the NSW South Coast.

More importantly for the Murrumbidgee Water Sharing Plan, there are significant limitations in accurately measuring flows in small streams and therefore implementing the rules effectively. For example, the 70<sup>th</sup> percentile for the Dry River at Quaama is 1.0 ML/day and the 50<sup>th</sup> percentile is 2.0 ML, which is represented by a difference in height of 2.0 cm at the gauge (Hydsys data).

Furthermore, the IRP concluded that the objective of TDEs – to protect environmental flows – could be achieved just as effectively and more simply with the introduction of a first flush rule, as proposed for the Murrumbidgee Water Sharing Plan (refer to section on 'Environmental flow rules').

### **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 this access is limited to very specific licences. Licences with access to very low flows include:

- 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; or
- 6) Cleaning of enclosures used for intensive animal production for the purposes of hygiene.

These licences are listed in Schedule 2 of the water sharing plan. Their allowances are calculated based on a maximum volume of 20,000 litres (0.02 ML) per day for each of the listed licence types held in each water source.

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

### **Mandatory conditions**

The 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 NOW, DECCW and DII.

## 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 Murrumbidgee 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; and
- carry over up to 100 per cent from one water year to the next, and
- provided that the volume of water taken over any three consecutive water years does not exceed 300 per cent of annual entitlement.

## 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 rules for the Murrumbidgee catchment recommended that dealing rules:

- be allowed that will reduce entitlement in 10 water sources,
- prevent a net increase in entitlement in two water sources, and
- allow trading of entitlements up to a defined limit in one water source, Dignams Creek

To consider the issue of trading rules more closely, the IRP considered the level of entitlement already in each water source, relative to a '20 per cent hydrologic stress'<sup>4</sup> indicator, calculated as:

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

The panel determined that all water sources in the Murrumbidgee catchment either have no (or little) current entitlement or levels of entitlement in excess of 20 per cent hydrologic stress. Based on this information, the IRP recommended in the draft water sharing plan that:

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

During public exhibition of the draft water sharing plan, several submissions were received regarding the limited opportunities for trading between water sources. The IRP reconsidered the trade rules and recommended that entitlement may be traded from any other water source in the water sharing plan area into the Dry River or Narira Creek water sources. The IRP recommended that the following conditions be met:

- Any trade of entitlement will be subject to environmental assessment and must meet environmental guidelines for the trade to be approved

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<sup>4</sup> 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 80<sup>th</sup> 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 80<sup>th</sup> percentile (annual flow data) which was considered to equate with 50% of the 80<sup>th</sup> percentile (critical month flow data.)

<sup>5</sup> 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.

- Any trade of entitlement must be into dams (with low flow by-pass) or into a 'high flow access only' licence, which permits extraction only when stream flow is greater than 10ML/day (this condition figure is based on conditions set for existing 'high flow only' licences).

The writing of the Order did not allow for trade to be restricted into dams only. Therefore trade has been allowed into these water sources up to a maximum entitlement of 20 % of the mean annual flow. On assessment of specific applications for trade of entitlement, the Office of Water will be guided by the IRP's recommendation that entitlement traded into Dry River and Narira Creek water sources must be into dams, rather than increasing extractive competition at low stream flows. The maximum total entitlement for Dry River Water Source and Narira Creek Water Source are 2,240 ML and 3,530 ML, respectively.

These recommendations guided the development of trading rules applying to both surface water licences and groundwater licences in the highly-connected alluvial aquifers.

### **Aboriginal community development access licences**

Many rivers in NSW already have a high number of irrigation licences, and are generally judged to be '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<sup>6</sup> (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.

The IRP considered ACDLs for the Murrumbidgee Water Sharing Plan and decided that no new licences would be granted in water sources with high in-stream value or in areas that could not support any high flow conversion licences. On this basis, the IRP decided that ACDLs would also not be appropriate in the Murrumbidgee catchment.

In light of the changes to allow trade of entitlement into Dry River and Narira Creek water sources, an amendment clause has been included in the Order to allow the potential granting of ACDLs in these water sources in the future if required.

### **High flow conversion**

Several streams in the water sharing 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 Murrumbidgee Catchment, and concluded that allowing conversions is not appropriate, based on the following calculations.

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

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<sup>6</sup> 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.

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

In the case of the Murrumbidgee River, Dry River and Narira Creek Water Sources, the High Flow index was defined as the 30<sup>th</sup> percentile.

The 30<sup>th</sup> percentile for the Murrumbidgee River and Dry River Water Sources is 7.4ML/d. The High Flow Conversion limit for the Murrumbidgee River and Dry River Water Sources is therefore:  $0.1 \times 7.4 \times 365 \times 0.3 = 81$  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 32.4 ML, which equates to about 1.7 per cent of the current volume of entitlement in the Murrumbidgee River and Dry River Water Sources (1,944 ML/yr). A lower conversion factor than 2.5 to 1 could be adopted to achieve a higher reduction in low flow stress, but this would result in reduced incentives to convert, making the option for a HFC redundant.

Similarly, the High Flow Conversion limit and maximum potential reduction in low flow stress at a factor of 2.5 to 1 was calculated for Narira Creek Water Source to be 94 ML/year and 4.6 per cent respectively (Table 10).

**Table 10: 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)
Murrumbidgee River and Dry River	1,944	7.4	81	1.7 %
Narira Creek	1,275	8.6	94	2.9 %

The NSW Office of Water recommends that HFCs must offer a significant decrease in low flow stress (25 per cent) for HFCs to be worthwhile. Considering the very low percentage reduction in low flow stress offered by HFCs or the low conversion factor required in the Murrumbidgee River, Dry River and Narira Creek Water Sources, the IRP could not justify HFCs for these water sources.

High-flow figures were estimated for the ungauged streams in the Murrumbidgee-Wallaga Catchment, based on the measured flows in the Murrumbidgee River and Narira Creek. The maximum potential reduction in low flow stress for all water sources proved to be 10 per cent or less at a conversion factor of 2.5.

Therefore the IRP could not warrant the introduction of HFCs for any water sources in the water sharing plan area.

## 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<sup>7</sup>, 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 water sharing plan.

In August 2008, the State Interagency Panel decided 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 Murrumbidgee-Wallaga Water Sharing Plan, the construction of in-stream dams on third order streams would

<sup>7</sup> 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.

be prohibited in the following water sources: Murrumbidgee River, Murrumbidgee Estuary Tributaries, Nelson Lagoon Tributaries, Middle Lagoon Tributaries, Wapengo Lagoon Tributaries, Cuttagee Lake Tributaries, Barragoot Lakes Tributaries, Bermagui River, Wallagee Lake Tributaries, and Bobundra Creek.

## 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 40m of first & 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 40m 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 40m 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; and
- 100 metres from a Department's observation or monitoring bore.

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, and
- there is a process for remediation in the event that any adverse impact occurs in the future, specified as conditions on the access licence.

As a result of public exhibition the IRP recommended that the installation of new bores may be permitted closer than minimum distances if a hydrologic assessment can demonstrate that the impacts of the new bore will be within acceptable limits.

## Consultation

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

While developing the WATER SHARING 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 water sharing 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 Southern Rivers CMA 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 IRP;
- 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 water sharing plan – it is essential that this be given due consideration before the water sharing plan is finalised; and
- specific comments on the Minister's notes included in the draft water sharing 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 11). 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; and
- 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.

**Table 11: Key groups consulted in the water sharing plan area as part of the targeted consultation**

Date	Group	Location
06/12/2005	Licensed water users	Cobargo
06/12/2005	Licensed water users	Quaama
22/03/2006	Bega Valley Shire Council	Bega
23/03/2006	Coastwatchers	Mossy Point
15/06/2006	DPI, SRCMA, Aboriginal stakeholders	Batemans Bay
17/06/2006	South East Conservation Alliance	Bermagui

<sup>8</sup> 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.

<sup>9</sup> 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.

The SRCMA encouraged stakeholders to submit their comments in writing. Submissions were reviewed by the IRP and changes were made to water sharing rules where appropriate.

The IRP reviewed all the submissions and the matters raised at the meetings 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.

Through this process, stakeholder feedback has resulted in the IRP recommending a staged approach to the implementation of more stringent access rules, to limit adverse social and economic impacts. In essence, this proposes that water users be given time to adapt to new rules. Where the existing rules are not consistent with the panel's recommended rules, the degree of immediate change (and hence the affect 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 water sharing plan.

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](http://www.water.nsw.gov.au)

**Table 12: Changes to water sharing rules as a result of targeted consultation and updated data**

Water source	Change to water sharing rules	Justification
Murrumbidgee River, Dry River and Narira Creek	Replace the proposed Commence to Pump rule with a first flush rule	A first flush rule will be easier to implement and will offer similar environmental benefits to a Commence to Pump rule.
Murrumbidgee River, Dry River and Narira Creek	That the introduction of CtP Cease-to-pump rules be staged, with a higher cease-to-pump level for Years 1 to 5 of the water sharing plan.	To give water users time to adjust to the access rules.

## Public exhibition of the draft

Public exhibition of the draft water sharing plan was held during December and November, 2009. A public meeting was held at Cobargo on Monday 19<sup>th</sup> December, 2009. The objectives of this consultation were to:

- provide background to stakeholders as to why the water sharing plan is being developed, how it has been developed to date, what rules are proposed in the various areas and how stakeholders can provide feedback;
- formally consult with a broad range of stakeholders to explain the proposed water sharing rules and how they will be implemented; and
- seek feedback from stakeholders and the general community about the proposed water sharing rules.

A total of sixteen 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 12). 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 water sharing plan.

**Table 13: Changes to water sharing rules as a result of public exhibition**

<b>Water source</b>	<b>Change to water sharing rules</b>	<b>Justification</b>
All	The installation of new bores may be permitted closer than minimum distances if a hydrologic assessment can demonstrate that the impact of the new bores will be within acceptable limits	This is a change being introduced to all water sharing plans across the state.
Narira Creek, and Dry River water sources	<p>Entitlement may be traded from any other water source in the water sharing plan area into either of these water sources.</p> <p>Any trade of entitlement will be subject to environmental assessment, and will be guided by the IRP's recommendation that any additional entitlement either be traded into dams, or be permitted to access higher flows only.</p> <p>The total entitlement for each water source has been set at 20% of the mean annual stream flow. The maximum total entitlement for Dry River Water Source and Narira Creek Water Source are 2,240 ML and 3,530 ML, respectively.</p>	<p>The panel believe that the changes will allow increased trade opportunities for water users in those sub-catchments where there is a significant socio-economic dependence on water extractions, without compromising environmental values.</p> <p>The changes will ensure that there is no increased competition for water from licensed water users in other water sources including Dignams Creek.</p>
All	A 12 hour first flush rules be adopted for catchment in the water sharing plan area.	Stream flows in the sub-catchments of the water sharing plan area are flashier than flows in the Bega-Brogo catchment where a 24 hour first flush rule is proposed.

## 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 water sharing plan that either enables water sharing plan amendment or remaking of a better water sharing plan after ten 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 water sharing plan through amending provisions and establishment of 'limits of change' to the water sharing 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 water sharing 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 water sharing 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 water sharing 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 water sharing plan.

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

- an audit of the water sharing 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 water sharing 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 statewide targets and requirements of the National Water Commission under the National Water Initiative.

There are also some amending provisions that may be triggered as a result of a mid-term review of the water sharing plan itself. This review will consider correlations between flow measurements taken during field verification and data from river gauges at nominated reference points, in order to recommend refinements to the specified flow reference points for each water source.

Between years 5 and 10 of the term of the water sharing plan, the NRC will assess the extent to which the water sharing provisions have contributed to the relevant state wide targets, and natural resource standards and targets in the SRCAP. The NRC will call for public submissions when undertaking its review. The review will consider the environmental merits and likely socio-economic impacts of an adjustment of the water sharing rules. Information from the relevant monitoring and evaluation programs, the review of Implementation Programs and the mid-term review should inform progress against the relevant state wide targets and ultimately the 10-year review of the water sharing plan.

## 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 Office 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 water sharing 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](mailto: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.

**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 Murrumbidgee 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.

	Murrumbidgee River	Dry River	Nelson Lagoon Tributaries	Middle Lagoon Tributaries	Wapengo Lagoon	Murrumbidgee Estuary Tributaries	Cuttagee Lake Tributaries	Barragoot Lake Tributaries	Bermagui River	Wallaga Lake Tributaries	Narira Creek	Dignams Creek	Bobandra Creek
<b>Fish Species</b>													
Australian Grayling	2	1	0	0	0	2	0	0	0	1	0	0	0
<b>Frog Species</b>													
Alpine Tree Frog	1	1	1	1	1	0	1	0	1	1	1	1	1
Giant Burrowing Frog	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
Littlejohn's Tree Frog	2	2	2	2	2	0	2	0	2	1	2	2	2
Southern Bell Frog	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	1
<b>Macroinvertebrate Species</b>													
Giant Dragon Fly	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Birds</b>													
Australasian Bittern	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
Black-Tailed Godwit	2	0	2	2	2	2	2	2	2	2	2	2	2
Comb-Crested Jacana	2	0	2	2	2	2	2	2	2	2	2	2	0
Freckled Duck	0	0	0	0	0	0	0	0	0	2	0	0	2
Great Knot	0	0	0	0	0	0	0	0	0	2	0	0	2
Greater Sand-Plover	0	0	0	0	0	0	0	0	0	2	0	0	2
Lesser-Sand Plover	0	0	0	0	0	0	0	0	0	2	0	0	2
Little Tern	2	0	2	2	2	2	2	2	2	2	2	2	2
Osprey	2	0	2	2	2	2	2	2	2	2	2	2	2
Regent Honeyeater	2	2	2	2	2	2	2	2	2	2	2	2	2
Sanderling	2	0	2	2	2	2	2	2	2	2	2	2	2
Terek Sandpiper	0	0	0	0	0	0	0	0	0	2	0	0	2

	Murrumbidgee River	Dry River	Nelson Lagoon Tributaries	Middle Lagoon Tributaries	Wapengo Lagoon	Murrumbidgee Estuary Tributaries	Cuttagee Lake Tributaries	Barragoot Lake Tributaries	Bermagui River	Wallaga Lake Tributaries	Narira Creek	Dignams Creek	Bobundra Creek
<b>Other Fauna</b>													
Greater Broad-Nosed Bat	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
<b>Wet Flora Species</b>													
Waterwheel Plant	0	0	0	0	0	0	0	0	0	2	0	0	2
<b>Threatened Populations</b>													
Coastal salt marsh	2	0	2	2	2	2	2	2	2	2	2	2	2
Freshwater wetlands on coastal floodplains	2	0	2	2	2	2	2	2	2	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; and
- not known or predicted to occur within a sub-region, the CMU scores a '0'.

### 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
<b>Interagency Regional Panel</b>			
Eddie Harris	NOW	Agency representative (Nov 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); DPI 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 of catchments
Anne Muir	I&I NSW - Agriculture	Agency representative (June 2005 to present)	DPI regional input to water reforms, agriculture, catchment management and land use/strategic planning.
John Patten	DECCW	Agency representative (May 2008 to March 2009)	DECC regional input to water reforms, conservation issues.
<b>Support Staff &amp; Previous Panel Members</b>			
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 (Nov 2006 to May 2008)	Water planning, environmental science, facilitation
Maree Abood	NOW	Panel Co-ordinator (Nov 2006 to May 2008)	Water planning, environmental science
Louise Whiting	NOW	Legal support	Environmental law
Ken Harris & Ashleigh Mayo	NOW	water sharing plan writing	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 & Eva Ciecko	NOW	Spatial Data Analyst	Map preparation
Kimberley Dale, Linden Bird & Danielle Doughty	NOW	Preparation of background document, water sharing plan review	Water planning
Peter Lloyd-Jones	DECCW	Agency representative (2007 to August 2008)	DECC regional input to water reforms, conservation issues.
Dave Winfield	DECCW	Agency representative (2006)	DECC regional input to water reforms, conservation issues.
Matt Rizzuto	DECCW	Agency representative (June 2005 to September 2006)	DECC 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 & floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage ground water for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Murrumbidgee River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Dry River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Nelson Lagoon Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Middle Lagoon Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Wapengo Lagoon Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Murrumbidgee Estuary Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Cuttagee Lake Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH

<b>Water source</b>	<b>Protect pools in dry times</b>	<b>Protect natural low flows</b>	<b>Protect important rises in water levels</b>	<b>Maintain wetland &amp; floodplain inundation</b>	<b>Mimic natural drying in temporary waterways</b>	<b>Maintain natural flow variability</b>	<b>Maintain natural rates of change in water levels</b>	<b>Manage ground water for ecosystems</b>	<b>Minimise effects of weirs and other structures</b>	<b>Minimise effects of dams on water quality</b>	<b>Make water available for unforeseen events</b>	<b>Maintain or rehabilitate estuarine processes and habitats</b>
Barragoot Lake Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Bermagui River	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Wallaga Lake Tributaries	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	HIGH	LOW	N/A	N/A	N/A	HIGH
Narira Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Dignams Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL
Bobundra Creek	HIGH	HIGH	PARTIAL	PARTIAL	N/A	PARTIAL	PARTIAL	LOW	N/A	N/A	N/A	PARTIAL

## Appendix 5: Interagency regional panel reference materials

Australian Bureau of Meteorology web site – [www.bom.gov.au](http://www.bom.gov.au)

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## Appendix 6: Final classification summary

### Value matrix

<b>High In-stream Values</b>	<p><b>a</b></p> <p>Nelson Lagoon Tributaries Cuttagee Lake Tributaries Barragoot Lake Tributaries Middle Lagoon Tributaries</p>	<p><b>b</b></p> <p>Bobundra Creek Wapengo Lagoon Tributaries</p>	<p><b>c</b></p> <p>Murrumbidgee River Bermagui River Murrumbidgee Estuary Tributaries Wallaga Lake Tributaries</p>
<b>Medium In-stream Values</b>	<p><b>d</b></p>	<p><b>e</b></p> <p>Dignams Creek</p>	<p><b>f</b></p> <p>Dry River Narira Creek</p>
<b>Low In-stream Values</b>	<p><b>g</b></p>	<p><b>h</b></p>	<p><b>i</b></p>
	<b>Low hydrologic stress or hydrologic risk</b>	<b>Medium hydrologic stress or hydrologic risk</b>	<b>High hydrologic stress or hydrologic risk</b>

Risk matrix

<b>High Risk to In-stream Values</b>	<b>A</b>	<b>B</b> Narira Creek Bermagui River	<b>C</b> Dry River
<b>Medium Risk to In-stream Values</b>	<b>D</b>	<b>E</b> Wapengo Lagoon Tributaries Dignams Creek Bobundra Creek	<b>F</b>
<b>Low Risk to In-stream Values</b>	<b>G</b> Nelson Lagoon Tributaries Middle Lagoon Tributaries Murrumbidgee Estuary Tributaries Cuttagee Lake Tributaries Barragoot Lake Tributaries Wallaga Lake Tributaries	<b>H</b> Murrumbidgee River	<b>I</b>
	<b>Low dependence on extraction</b>	<b>Medium dependence on extraction</b>	<b>High dependence on extraction</b>

## Appendix 6: Final classification summary

### Value matrix

<b>High In-stream Values</b>	<p><b>a</b></p> <p>Nelson Lagoon Tributaries Cuttagee Lake Tributaries Barragoot Lake Tributaries Middle Lagoon Tributaries</p>	<p><b>b</b></p> <p>Bobundra Creek Wapengo Lagoon Tributaries</p>	<p><b>c</b></p> <p>Murrumbidgee River Bermagui River Murrumbidgee Estuary Tributaries Wallaga Lake Tributaries</p>
<b>Medium In-stream Values</b>	<p><b>d</b></p>	<p><b>e</b></p> <p>Dignams Creek</p>	<p><b>f</b></p> <p>Dry River Narira Creek</p>
<b>Low In-stream Values</b>	<p><b>g</b></p>	<p><b>h</b></p>	<p><b>i</b></p>
	<b>Low hydrologic stress or hydrologic risk</b>	<b>Medium hydrologic stress or hydrologic risk</b>	<b>High hydrologic stress or hydrologic risk</b>

Risk matrix

<b>High Risk to In-stream Values</b>	<b>A</b>	<b>B</b> Narira Creek Bermagui River	<b>C</b> Dry River
<b>Medium Risk to In-stream Values</b>	<b>D</b>	<b>E</b> Wapengo Lagoon Tributaries Dignams Creek Bobundra Creek	<b>F</b>
<b>Low Risk to In-stream Values</b>	<b>G</b> Nelson Lagoon Tributaries Middle Lagoon Tributaries Murrah Estuary Tributaries Cuttagee Lake Tributaries Barragoot Lake Tributaries Wallaga Lake Tributaries	<b>H</b> Murrah River	<b>I</b>
	<b>Low dependence on extraction</b>	<b>Medium dependence on extraction</b>	<b>High dependence on extraction</b>