



Department of  
Primary Industries  
Water

# Water Sharing Plan for the Richmond River Unregulated, Regulated and Alluvial Water Sources

Background document for amended plan 2016

Published by the NSW Department of Primary Industries, Water

*Water Sharing Plan for the Richmond River Unregulated, Regulated and Alluvial Water Sources - Background document for amended plan 2016*

First published in December 2010

This edition published August 2016

Incorporates amendments to the plan following inclusion of the Coopers Creek Water Source

ISBN 978-1-74256-962-8

More information

Rural Water Planning

[www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)

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## Introduction

Water Sharing Plans are being progressively developed for rivers and groundwater systems across NSW following the introduction of the *Water Management Act 2000*. 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 July 2004, 31 water sharing plans commenced in New South Wales, bringing these water sources and some 80 per cent of water extracted in New South Wales under the management and licensing provisions of the *Water Management Act 2000*.

In recent years, water sharing plans for the unregulated<sup>1</sup> rivers and groundwater systems have been completed using a broad scale ‘macro’ approach based on whole river catchments or aquifer systems. Approximately 95 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.

The *Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010* (the Plan) covers 24 water sources (refer to Appendix 1). The Richmond Regulated system has been included for completeness and ensures equitable management of all water and its extraction within the Richmond River catchment.

Water sharing rules that the 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.

This document provides background to the development of the rules in the Richmond water sharing plan. It includes information on the purpose of the plan and the policy framework that supports it, a description of the Richmond catchment including land and water use, and the process of developing the various water sharing rules in the plan.

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

- the *Water Sharing Plan for the Richmond River Area Unregulated, Regulated and Alluvial Water Sources 2010* (a draft legal instrument written in statutory format)
- a *Guide to the Water Sharing Plan* (a plain English version of the Plan explaining the key sections and rules)
- Report cards summarising the proposed management rules for each water source.

### An amended plan for the Richmond catchment

The *Water Sharing Plan for the Richmond River Unregulated, Regulated and Alluvial Water Sources 2010* (hereafter referred to as the Richmond water sharing plan) commenced in October 2010. Until now, water sharing arrangements for the Coopers Creek Water Source, which is located in the Richmond catchment, were covered by a separate 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.

that commenced in 2004. This plan was one of the first water sharing plans in NSW and was due to expire in 2014.

In 2013 the Minister approved the replacement of all 2004 plans based on reports from the Natural Resources Commission and DPI Water. Proposed changes must be permitted under the WMA 2000 and also need to consider the significant amount of consultation which was undertaken in their initial development.

The merging of the Coopers Creek plan with the more recent Richmond water sharing plan will bring it into line with the current legislative and policy framework for water sharing in NSW. All unregulated water in the Richmond will now be governed by the one plan. Once amended, the plan will set the rules for water sharing arrangements until 30 June 2020 providing certainty to water dependant businesses and the environment.

Changes to the provisions of the Coopers Creek water sharing plan have occurred for a number of reasons including: changes to policy, updates to legislation, updated data, outcomes of audits, and stakeholder requests. As the provisions in this plan area have been operating for over a decade, and the initial plan was developed in close consultation with stakeholder groups, DPI Water has aimed to avoid unnecessary changes and focus on improving provisions based on the information sources mentioned above.

## Purpose of the Plan

### Why are water sharing plans being prepared?

#### To provide certainty for the environment and water users

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

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

With the commencement of water sharing plans, land and water rights are separated, providing enhanced opportunity for a broader water market. In addition, access licences held under the *Water Act 1912* will be converted to access licences under the *Water Management Act 2000* (the Act). In general, commercial licences under the Act are granted in perpetuity, providing greater commercial security of water access entitlements. WSPs also define the access rules for commercial users for ten years providing all users with greater certainty regarding sharing arrangements.

Water sharing plans, in conjunction with the Act, also facilitate the trade of access licences thus encouraging more efficient use of water resources, and the development of new industries with the ability for water to move to its highest value use.

General information on the macro planning process is available in the water sharing plans section of the DPI Water website [www.water.nsw.gov.au](http://www.water.nsw.gov.au). This includes:

- *Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation* – explains the method used to classify and set water sharing rules for unregulated streams across the state
- *Macro water sharing plans – the approach for unregulated rivers. Access and trading rules for pools* – explains the method used to set access and trading rules for pools in unregulated water sources across the state
- *Macro water sharing plans – the approach for groundwater. A report to assist community consultation* – explains the method used to classify and set water sharing rules for groundwater across the state

### Intended outcomes of the Plan

The objectives of the 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 water sharing plan to be made as a result of more information that will become available during the life of the Plan.

### Benefits for water users

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

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

The Plan recognises the economic benefits to the region that are generated by commercial users such as irrigators and industry. It sets rules so that commercial users can continue to operate productively.

### Environmental considerations

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

Most of the flows within the area covered by the Plan are protected from extraction. Total surface water entitlement within the catchment is approximately 103,428 ML compared to an annual average flow of 1,920,000 ML for the Richmond River.

### 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. Research suggests that 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 Plan imposes new access restrictions on days when flows are low. This is achieved by establishing 'cease to pump' rules that describe when water must not be extracted, depending on the amount of flow in the river on any given day.

Ten unregulated water sources were identified as having high instream values (see Table 1). For these water sources, trading into the water source will not be permitted except for the Kyogle Area and Coraki Area where trading into the water source will only be permitted from upstream water sources so there is no overall increase in extraction in that part of the river. Where the instream values are at high risk from extraction, the cease to pump 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).

A number of water sources within the Plan area currently have an existing cease to pump condition. These range from the 92nd percentile to no visible flow at the pump site. In some

water sources there has been no previous history of a cease to pump condition during low flow periods. These are mainly in water sources with few or no users. Those water sources with a significant number of users and limited water during low flows were also subject to a limit on daily extraction hours prior to the implementation of a cease to pump condition. Access licences for groundwater extraction have been subject to annual limits rather than daily management.

**Table 1: Water sources with a high in-stream value (based on initial assessment)**

Water source	Description of in-stream value
Bangalow Area	15 threatened species and high diversity
Broadwater Area	22 threatened species, high diversity, high recreation value and significant area of National Park
Coopers Creek	20 threatened species, high diversity and high recreation value
Coraki Area	18 threatened species, high diversity and high recreation value
Evans River	19 threatened species, minimal disturbance to in-stream condition, high recreation value and significant area of National Park
Gradys Creek	12 threatened species, high diversity, minimal disturbance to in-stream condition and significant area of National Park
Kyogle Area	18 threatened species, high diversity and significant area of National Park
Lennox Area	28 threatened species and significant area of National Park
Terania Creek	16 threatened species, high diversity and significant area of National Park
Toonumbar Area	9 threatened species, minimal disturbance to in-stream condition, significant area of National Park
Upper Richmond River	14 threatened species, high diversity, minimal disturbance to in-stream condition and significant area of National Park

When the Plan commences, surface water licences in all unregulated water sources will be subject to cease to pump rules (excluding licences held by local water utilities, licensed stock and domestic users, and licences used for food safety and essential dairy care). For the licensed stock and domestic users, the State Interagency Panel in November 2008 decided to provide an exemption from the cease to pump rules for the first three years of the Plan. This period has now expired and so the the cease to pump rules now also apply to that category of licence. From year six of the Plan these rules will also apply to any users extracting from any alluvial via a work located within 40 m of the high bank of a river. This recognises the high degree of connectivity between the alluvial aquifer and river flows and the potential impact that pumping from an aquifer can have on flows.

In instances where the existing cease to pump rule under the *Water Act 1912* is based on a higher flow rate than the rule proposed by the Plan, the existing cease to pump rule will take precedence.

### Regulated water source

Like the unregulated system, the total volume of water currently extracted from the Richmond Regulated system is a small proportion of the total annual flows (1.5 per cent). When the Plan commences, water will be managed in the regulated system to provide for the environment by trying to mimic natural flow variability. This includes providing flushes for the most

environmentally valuable part of the system (i.e. the reach immediately downstream of the dam), setting aside a volume of water in the dam to be used for environmental management and ensuring a flow is provided at the end of the system.

## Description of the Plan area

### The Richmond catchment

The area covered by the Plan (refer Appendix 1) comprises the Richmond River catchment and the adjoining smaller coastal catchment of Evans River. In total the Plan contains 23 water sources covering an approximate area of 6,900 km<sup>2</sup>. The Plan area is located on the far north coast of NSW and includes the major towns of Lismore, Ballina, Casino, and Kyogle. The north-eastern part of the Richmond River catchment is partly bounded by the Nightcap Ranges, the northern part is bounded by the Border Ranges, and the Richmond Ranges form the western and south-western boundary of the catchment. The eastern part of the catchment is defined by a very large coastal floodplain, which extends between Evans Head and Cape Byron. The Richmond River enters the Pacific Ocean at Ballina.

The Richmond River catchment is made up of three main arms – the Richmond River, the Wilsons River and Bungawalbyn Creek. Sixty per cent of the water comes from the Wilsons River. The Richmond tidal pool is at the downstream end of these three arms.

The major tributaries flowing into the Richmond River include Gradys Creek, Roseberry Creek Findon Creek, Lynches Creek and the regulated Eden Creek. The main tributaries flowing into the Wilsons River include Terania Creek, Coopers Creek, and Leycester Creek. Further south, Myrtle and Myall Creek flow into Bungawalbyn Creek which along with Shannon Brook and SandyCreek flow into the Richmond tidal pool.

The Richmond tidal pool forms the upstream extent of the Richmond River estuary which covers approximately one third of the total 19 km<sup>2</sup> of waterways. A unique feature of this estuary is the upstream extent of tidal influence, which is 90 km from the ocean mouth extending beyond Lismore on the Wilsons River and beyond Tatham on the Richmond River. The estuary winds across the very large Richmond River floodplain, which is 1,000 km<sup>2</sup> in area; approximating 15 per cent of the total catchment area.

The Evans River catchment is a small coastal catchment (62 km<sup>2</sup>) which at times receives floodwaters from the Richmond River near Woodburn and enters the ocean at the township of Evans Head. Most of the catchment is located within the Bunjulung and Broadwater National Parks and is primarily unmodified with only 30 per cent of vegetation cleared.

Major instream structures within the Richmond River catchment include: Toonumbar Dam (11,000 ML) currently used for irrigation purposes; Rocky Creek Dam (14,000 ML), Emmigrant Creek Dam, two weirs at Casino and one at Kyogle all used for town water supply purposes; and Mullumbimby Power Station weir on the upper Wilsons River. The Richmond River floodplain has been extensively modified with a network of drains, floodgates, levees and other structures to assist in draining floodwaters and wetlands for agricultural and urban landuse.

A 50 km length of river within the Richmond River catchment is regulated through releases from Toonumbar Dam. These releases flow into Iron Pot Creek, which then becomes Eden Creek. The junction of Eden Creek and the Richmond River marks the downstream end of the regulated system. The storage capacity of the dam is 11,000 ML and in most years the dam fills to capacity. The catchment area for the dam is 98 km<sup>2</sup> and includes contributions from the unregulated section of Eden Creek, Doubtful Creek and other small tributaries.

The Richmond River catchment and surrounding region is recognised as having extremely high terrestrial and marine biodiversity with many species endemic to the region. It supports species and habitats of local to international significance and forms crucial links between significant conservation areas. This richness in biodiversity is due to the climatic and geographic conditions of the area, which allows for the presence of both tropical and temperate species. In

the lower part of the catchment, most of the original vegetation has been removed however a significant proportion of the upland areas remain forested.

### Land use history

Prior to European settlement in the mid-1800s the Bunjulong people occupied the Richmond River area but were displaced from their ancestral lands with European settlement and associated land use changed throughout the catchment. The entire catchment was covered with a range of forest types including the Big Scrub, which was Australia's largest subtropical rainforest covering more than 10 per cent of the catchment.

European settlement took place around the 1840s when timber getters arrived in search of cabinet timbers, in particular Red Cedar. The timber industry was the mainstay of the economy however as the timber industry dwindled, agricultural industries developed, namely beef, dairying, and crops. As a result of land use development through the timber and agricultural industries, a significant proportion of the vegetation was cleared, in particular, almost all of the lowland vegetation including the Big Scrub.

The catchment's high rainfall and moderate temperatures are particularly suited to dairying, which flourished during the first part of the 20th century. Around the 1950s, the dairy industry started declining and farmers diversified into other industries including sugar cane on the floodplain.

Today there is a large range of agricultural industries across the Richmond River catchment with a significant recent growth in horticultural industries including fruit and nut production, vegetables, turf and nurseries. The inland areas however, still tend to support the more traditional industries of cattle grazing, timber production and dairying (albeit to a lesser extent). Sugar cane is the major land use on the coastal floodplain. Accompanying this increase in and diversification of agricultural industries, has been the growth of irrigated agriculture throughout the catchment.

Clearing has also made way for urban development which is now scattered across the catchment. Today in excess of 100,000 people live in the Richmond River catchment, primarily in the major urban areas of Lismore, Ballina, Kyogle and Casino but also in numerous rural villages throughout the catchment.

There are areas within the catchment that remain vegetated and some of which are protected as National Park, State Forest or smaller Nature Reserve. These protected areas cover 13,000 ha of the catchment and are located primarily in the upland areas and along the coastal fringe. In the very north of the catchment, the Border Ranges National Park and other smaller parks and nature reserves make up the Tweed Volcano Group of the central eastern rainforest reserves (Australia) World Heritage Area. Along the coastal strip, numerous wetlands are protected under the State Environment Planning Policy 14 (SEPP 14) for Coastal Wetlands.

The north coast of NSW and its water resources including the Richmond River catchment are currently under pressure from a rapidly increasing population and a burgeoning tourism industry. This has pressured both state and local governments to develop planning strategies for the future development of this area and in particular the water resources required to sustain this increase in demand.

## Rainfall

The Richmond River catchment experiences a subtropical climate characterised by hot humid summers and mild winters. Rainfall throughout the catchment ranges from 1,650 mm along the coast to less than 1,025 mm in the inland areas. More rain falls in the northern part of the catchment and in localised areas annual average rainfalls greater than 2,000 mm can occur. Although rain falls throughout the year, there is a marked wet season in summer through to early autumn. Rainfall in summer months averages twice to four times the rainfall in winter months. Continually high rainfall over these summer months can trigger flood events.

Late winter to spring is usually the driest period and is accompanied by rising evaporation rates. Dry periods with minimal rain are not uncommon and can last for several months.

December and January are generally the hottest months with mean summer temperatures ranging between 27°C in the inland valleys and 20°C at higher altitudes. Winter temperatures rarely fall below 7°C on the coastal strip, whereas frosts can occur inland on low lying flats, particularly during the coldest months of July and August.

Thunderstorms are common in the summer months. On average, the Richmond River catchment along with other north coast catchments are affected by cyclonic rain depressions once every couple of years. These events bring intense rainfall periods and/or very strong winds resulting in heavy seas, severe coastal erosion and localised or sometimes catchment wide flooding. These events usually occur between December and mid-April.

## Stream flows

The average annual discharge from the Richmond River is 1,920,000 ML. This annual discharge fluctuates significantly from as little as 15 per cent to as much as 233 per cent of the annual average discharge. This range illustrates the significant variability in flows between wet and dry years.

Variability in stream flows also occurs between seasons and across the catchment. In the wetter months (summer to early autumn) flow can be six times greater than the dryer months (late winter to spring). Those streams located in the north and north eastern part of the catchment where rainfalls are higher, exhibit markedly higher flows than those in the western and southwestern part of the catchment which experiences lower rainfall. The ratio of runoff to rainfall is approximately 18 per cent which is slightly above average for coastal rivers.

Flooding is a regular event throughout the Richmond River catchment and is often associated with the cyclonic rain depressions that bring intense rainfalls to the region.

There are currently 11 gauging stations across the Richmond River catchment, which monitor stream flows on a daily basis. These are located in the Gradys Creek, Kyogle Area, Richmond Regulated, Bangalow Area, Leycester Creek, Coopers Creek, Shannon Brook, and Myrtle Creek Water Sources. There are also historic records of daily flows at gauging stations throughout the catchment which have been discontinued.

Records from both the current and discontinued gauging stations provide a history of flows throughout the Richmond River catchment and have been used in the development of the Plan.

## Historical droughts

Some extended periods of drought have been recorded for the region where for example at Coraki, 18 droughts have been recorded since 1896, each of which lasted between six to 24 months. These include the severe drought of 1902 and 2002/03. In terms of impact on water resources and its extraction, the drought in 2002/03 is thought to have been the worst on record.

## Groundwater

The Richmond River catchment is made up of several groundwater sources including the aquifers of the New England Fractured Rocks, the porous rocks of the Clarence Morton Basin, the North Coast Fractured Rocks, the unconsolidated alluvial aquifers and the Richmond Coastal Sands.

Aside from the basalt aquifer of the Alstonville Plateau, the unconsolidated alluvial aquifers are a major source of groundwater in the Richmond River catchment. The alluvial aquifers make up the large coastal floodplain and also the smaller floodplains deposited along most major and minor streams.

Although the Richmond River catchment contains by far the most alluvium of the north coast valleys, there has been relatively little development of this groundwater system. This is due to the relatively low yields of these alluvial aquifers. Bores upstream of Casino usually yield <10 litres per second whereas south of Casino, notably around Bungawalbyn Creek, bores in the alluvial aquifers can yield in excess of 20 litres per second.

## Richmond tidal pool

The Richmond tidal pool is a large body of water between the salt water tidal zone and the freshwater flowing river. The tidal pool remains fresh except during extreme drought conditions despite being subject to tidal fluctuations. The Richmond tidal pool is one of the largest tidal pools on the east coast of Australia. Inflows are mainly provided by the Richmond River, the Wilsons River and to a much lesser extent Bungawalbyn Creek.

The extent of the tidal pool is delineated at the upstream end by the limit of tidal fluctuations. On the Richmond River arm, the tidal pool extends almost as far upstream as Casino and on the Wilsons River arm to just upstream of Lismore. There is also a small arm of the tidal pool which extends into Bungawalbyn Creek.

The downstream extent of the tidal pool is determined by the location of the saltwater/freshwater interface, which generally lies between Woodburn and the junction of the Richmond River and Bungawalbyn Creek. It is downstream of this point that salinity levels tend to increase periodically due to salt water intrusion during dry periods, thus preventing regular extraction for agriculture. The downstream extent of the tidal pool does migrate however, as the interface moves upstream during dry times and downstream during floods.

Inflows into the tidal pool can vary significantly both between seasons and with flood and drought events. Inflows from the Richmond River average 1,615 ML/day but can fall to 0 ML/day, and those from the Wilsons River average 499 ML/day and can fall to 3 ML/day.

Although there is some upstream migration of the saltwater/freshwater interface during dryer times, the tidal pool water remains fresh enough for regular agricultural use most of the time.

Very little is known about long term salinity variations within the Richmond tidal pool. Intermittent salinity monitoring commenced in 2001 with a more thorough monitoring program initiated during the 2002/03 drought. Richmond County Council currently undertakes weekly salinity monitoring with readings taken at a number of locations.

The seven year monitoring record shows that the average salinity of the water at Coraki is 0.13 parts per thousand (ppt) and at Woodburn is 1.4 ppt (excludes extreme readings from the 2002/03 drought). Salinities at these locations range between 0.05–3.51 ppt at Coraki and 0.04 – >10.5 ppt at Woodburn; with the higher figures recorded just prior to the 2002/03 drought breaking. Although only short, this data set does include an extreme drought event and a few dry and wet periods, which allows for some understanding of the nature of the tidal pool under different climatic conditions.

During the 2002/03 drought, flows throughout the Richmond River catchment including those into the tidal pool, were very low. During this extreme drought, the saltwater/freshwater interface migrated a significant distance upstream causing increases in salinity within the tidal pool. Table 2 illustrates the nature of increases in salinity at various locations throughout the tidal pool during the last few months of the drought.

As concerns grew about the impact on the town water supply at the top of the tidal pool from increased salinity during the 2002/03 drought, the then Department of Land and Water Conservation developed triggers for restricting and suspending irrigation from the tidal pool. These were developed in consultation with the water users in the tidal pool.

**Table 2: Salinity levels in the Richmond tidal pool during the 2002/2003 drought**

Date	Salinity levels at locations within the tidal pool (ppt)						Inflows to tidal pools (ML/day)	
	Woodburn	Junction with Bungawalbyn Creek	Coraki	Develin Lane (Wilson Arm)	McInnes Lane (Wilson Arm)	Codrington Lane (Richmond Arm)	Richmond River at Casino	Wilson River at Eltham
06/02/02	3.2		0.13				25.0	69
05/03/02	3.52		0.13				101.0	152
03/04/02	2.56		0.32				198.0	243
15/05/02	0.25		0.12				84.0	373
12/06/02	0.25		0.12				105.0	363
17/07/02	0.15		0.07				32.0	156
07/08/02	0.34		0.12				19.0	75
04/09/02	0.2		0.08				51.0	129
02/10/02	4.1		0.12				3.0	55
30/10/02	5.0	0.92	0.16				6.0	67
06/11/02	10.5	2.95	0.34	0.15			15.0	29
07/12/02		5.35	1.92	0.53		0.19	4.0	15
04/01/03	Stopped monitoring high levels	6.11	2.56	0.84	0.18	0.26	26.0	37
02/01/03			3.51	1.58	0.27	0.33	0.1	10

The triggers were based on salinity levels at specific locations within each arm of the tidal pool upstream of the Richmond River/Wilsons River junction:

Richmond River Arm	Pumping restrictions – 0.2 ppt salinity at Codrington Lane Cease to pump – 0.2 ppt salinity at Tatham Bridge
Wilson's River Arm	Pumping restrictions – 0.2 ppt salinity at Develin Lane Cease to pump – 0.2 ppt salinity at McInnes Lane

Table 2 indicates that the salinity trigger for pumping restrictions were reached in both arms around the beginning of December, with the cease to pump trigger reached in the Wilson's River Arm around the beginning of January. The cease to pump trigger level in the Richmond River Arm was reached just prior to the drought breaking, which was mid-February.

A number of very dry periods have occurred since the 2002/03 drought and although the minimum inflows were comparable during these periods, the salinity levels at Woodburn and Coraki were markedly lower than the levels reached during the 2002/03 drought. For example during the 2004 drought flows during spring declined to 13 ML/day at the Casino gauge and to 10 ML/day at the Eltham gauge. However, salinity levels at Coraki were 0.4 ppt and at Woodburn 9.6 ppt. Again in 2007 flow levels during spring were 12 ML/day at the Casino gauge and 24 ML/day at the Eltham gauge and salinity levels at Coraki were 0.4 ppt and at Woodburn 7.6 ppt.

Evidence suggests that during dry periods the tidal pool exhibits a buffering capacity where the rate of upstream migration of the saltwater/freshwater interface is relatively slow. However, based on evidence from the 2002/03 drought, it seems that during a prolonged drought the buffering capacity starts to diminish and the interface then migrates upstream at a more rapid rate. Based on evidence from other tidal pools such as the Hunter River, it is thought that this buffering capacity is a result of groundwater inflows. During a prolonged drought when groundwater inflows start dwindling and inflows from the catchment are minimal, the salt/water freshwater interface moves upstream more rapidly.

Little is known about the impact of salinity increases on ecosystem health within a tidal pool. A pilot study was completed in 1999 looking at the potential ecological impacts of extracting freshwater from the Richmond River tidal pool (Pierson *et al* 1999). This study was based on modelling salt distributions within the estuary based on 50 years of modelled flow data and a generalised water extraction rate. In addition, Muschal 2006 undertook a study in the Hunter River catchment looking at the risk to aquatic biota from elevated salinity. The results of these studies recommended salinity limits for estuary ecosystems which were used to assist in the development of water sharing rules for water users in the Richmond tidal pool.

### Entitlement and use

There are approximately 2,345 water licences in the area covered by the Plan, totalling 97,407 ML of entitlement. This is approximately five per cent of the average annual flow. The majority of these licences are for irrigation, with a significant proportion also used for town water supply. There has been an embargo on granting new surface water licences in both the unregulated and regulated systems of the Richmond River catchment since 1995. Alluvial aquifers were embargoed in 2008.

The Plan assumes full development of all entitlement in setting the extraction limits as shown in Table 3.

Water is also extracted from watercourses within the Richmond River catchment through Basic Landholder Rights (not requiring a licence).

**Table 3: Total entitlement and number of licences for each water resource**

Water resource	Entitlement (ML)	Number of licences
Unregulated River	87,451	1,194
Groundwater Alluvial	4,151	624
Regulated River	10,330	68
•general security	10,203	61
•high security	127	7

### Water use in the unregulated water sources

The majority of the unregulated surface water licences are located:

- along the Richmond River including the major upstream tributaries
- in the Bangalow Area (Wilsons River) and Terania Creek Water Sources
- in the Richmond River tidal pool upstream of Coraki along both arms (Richmond and Wilsons Rivers)
- in the Alstonville and Tuckean Area Water Sources (Alstonville Plateau).

The southern and southwestern part of the Plan area contains considerably fewer licences due to the lower rainfalls and the physical nature of the area.

Nine of the 21 unregulated water sources covered by the Plan were classified as being of high economic significance to local communities due to their dependence on commercial water extraction (see Table 4).

**Table 4: Water sources with a high level of economic significance**

Water source	Description (relative to overall catchment)
Alstonville Area	High value of production from irrigation (nurseries, orchards, pasture and vegetables) and relatively high economic dependence on water extraction.
Bangalow Area	High value of production from irrigation (nurseries, orchards, irrigated and vegetables) and relatively high economic dependence on water extraction.
Coopers Creek	High economic dependence of the local community on water extracted for irrigation and medium value of production from irrigation (pasture).
Gradys Creek	High economic dependence of the local community on water extracted for irrigation and medium value of production from irrigation (pasture).
Kyogle Area	High value of production from irrigation (orchards, irrigated, turf, and vegetables) and relatively high economic dependence on water extraction.
Terania Creek	High economic dependence of the local community on water extracted for irrigation and medium value of production from irrigation (orchards and pasture).
Tuckean Area	High value of production from irrigation (nurseries, orchards and pasture) and relatively high economic dependence on water extraction
Upper Richmond River	High economic dependence of the local community on water extracted for irrigation and medium value of production from irrigation (orchards and pasture).
Wyrallah Area	High value of production from irrigation (orchards and pasture) and relatively high economic dependence on water extraction.
Coraki Area	High value of production from irrigation (orchards and pasture) and relatively high economic dependence on water extraction.

Water extraction in the Richmond River catchment is used for a range of agricultural purposes including irrigated pastures for dairy and to a lesser extent beef and horticulture. The well drained soils on the Alstonville Plateau and in the area around Nimbin and Bangalow support a diverse range of horticultural industries. These include macadamias, avocados, stone fruits, custard apples, nurseries and blueberries. Some new expanding horticultural crops include pecan nuts, coffee and bushfoods. A substantial dairy industry is located along the downstream alluvial flats of the Richmond River and Wilsons River and a well-developed beef industry is established around Casino and Kyogle. Sugar cane is the dominant crop on the estuarine flats of the floodplain between Ballina and Coraki.

A significant irrigation industry has grown over the last 50 years utilising the reliable water resource of the Richmond tidal pool. There are currently over 150 licences located within the Richmond tidal pool which make up nearly 25 per cent of the total entitlement for the Richmond unregulated system.

Detailed water use is not available in the unregulated rivers because there is not yet broad scale metering in these water sources. NSW is exploring this issue through the Water Use Monitoring Program.

These figures do not include those extractions from the tidal pool that are currently not licensed under the *Water Act 1912*. Under the 1912 Act, there is some ambiguity as to whether works within the 'tidal pool zone' require a licence. However, under the *Water Management Act 2000*, which commences when a water sharing plan is gazetted, all works located in the tidal pool will need to be licensed. Therefore DPI Water has developed a tidal pool licensing regulation and is currently identifying unlicensed works, determining the associated history of use and establishing whether a licence should be granted under that regulation in the Richmond tidal pool.

### **Water extraction in the alluvial water sources**

The alluvial groundwater licences are located mainly in the alluvium along the main trunk of the Richmond River (Kyogle Area Water Source) and on the Richmond Floodplain in the Coraki Area and Wyrallah Area Water Sources. Approximately 60 per cent of all alluvial aquifer licences are located in the upriver alluvium with 40 per cent located in the downstream floodplain alluvium (i.e. that part of the floodplain adjacent to the estuary), which constitutes the Richmond Floodplain. Like the surface water licences, the south and south western part of the Richmond River catchment has the least number of alluvial aquifer licences. In 2008 an embargo was placed on the granting of new access licences in the alluvial aquifers in the Richmond River catchment.

Of the total entitlement, 47 per cent is for stock and domestic purposes, 34 per cent for irrigation purposes and 18 per cent for industrial purposes. The per cent of entitlement for stock and domestic use is similar in the two alluvial types. However, the per cent of entitlement for irrigation use is higher in the coastal floodplain alluvial aquifers compared to the upriver alluvial aquifers.

Detailed water use data is not available for the alluvial aquifers because there is not yet broad scale metering in these aquifers. NSW is exploring this issue through the Water Use Monitoring Program.

### **Water extraction in the Richmond Regulated Water Source**

Toonumbar Dam was constructed on Iron Pot Creek in 1972 to provide a regular supply of water for irrigation and is currently operated by Water NSW. The dam has a capacity of 11,000 ML and although it is fed by a relatively small catchment area (98 km<sup>2</sup>); on average it is full 40-50 per cent of the time. A significant proportion of the upstream catchment is vegetated and there are currently no surface water licences within this area.

The current level of surface water entitlement is 10,330 ML, which is held between 68 licence holders. The entitlement is made up of 132 ML of high security access and 10,198 ML general security access. The total entitlement makes up around seven per cent of the annual average flow of this system, which is approximately 139,000 ML/year.

There is broad scale metering in the regulated water source, which indicates the current usage rates are well below full development with annual usage typically ranging between 1,000 and 2,000 ML/year with usage peaking over 2,880 ML during 2002/03 because of the drought. The primary use of this water is for pasture irrigation on dairy farms. With this low level of usage, the current reliability of this regulated system is very high.

The majority of the licences are located in the reach below the confluence of Iron Pot Creek with Eden Creek with 40 of the 68 licence holders located in this area and accounting for 7,314 ML of the total 10,330 ML of entitlement. The regulated system experiences considerable losses to groundwater which are in the order of 4,000–5,000 ML per year accounting for around 40 per cent of dam capacity. The regulated system is currently managed such that there is always a visible flow at the location of the most downstream licence holder, which is close to the downstream limit of the regulated system. This management rule is based on ensuring that the needs of Basic Landholders Rights are met within the regulated system.

### Water extraction from cane drains

Associated with the growth of the sugar cane industry on the Richmond floodplain has been the construction of an extensive network of 'cane drains'. These drains were constructed to remove excess water from the floodplain to maximise sugar cane production, which grows best in well drained soils. In addition to facilitating drainage, water held in these drains is also utilised during dry times to establish new cane crops.

Under *the Water Act 1912* this type of water extraction has not been licensed. In 2001 the then Department of Land and Water Conservation advised the cane industry that as an interim measure, extraction of water from cane drains could occur under Basic Landholder Rights until such time that a Water Sharing Plan was prepared. The Plan for the Richmond Area provides for water extraction from cane drains to be brought under the *Water Management Act 2000*.

### Local water utility requirements

A number of town water supplies ranging from large storages to small direct river extractions are located within the Richmond River catchment. These supplies are administered through various authorities with Rous Water supplying water to the largest number of households. Rocky Creek Dam (capacity 14,000 ML), Emmigrant Creek Dam (capacity 820 ML), the Wilsons River and groundwater from the Alstonville Plateau constitute the regional water supply managed by Rous Water (Table 5). These supplies provide for towns including Lismore, Ballina, Byron Bay, Ocean Shores, Brunswick Heads, Coraki, Broadwater, Alstonville, Lennox Head, Bangalow and Woodburn.

The townships of both Casino and Kyogle extract their water directly from the Richmond River. Wardell is supplied from Marom Creek, Nimbin supplied from Mulgum Creek and Mullumbimby from the Wilsons River (Table 5).

**Table 5: Town water supplies, location and entitlement**

<b>Water supply</b>	<b>Water source</b>	<b>Surface water licence entitlement ML/annum</b>	<b>Per cent of total entitlement in water source</b>
Rocky Creek Dam (Rous)	Terania Creek	12,358	80%
Emmigrant Creek Dam (Rous)	Alstonville Area	2,620	33%
WilsonRiver Tidal Pool (Rous)	Wyrallah Area	5,400	44%
Richmond River – Kyogle	Kyogle Area	564	4%
Richmond River – Casino	Kyogle Area	3427	25%
Mulgum Creek – Nimbin	Terania Creek	133	<1%
UpperWilsonRiver	Bangalow Area	545	8%
Marom Creek – Wardell	Tuckean Area	440	7%

Table 5 indicates that extractions for town water supplies can be a considerable proportion of the total entitlement within a water source e.g. Rocky Creek Dam. In other water sources town water supplies comprise a small proportion of the total entitlement. In some water sources competition for water during low flows can become an issue between agricultural users and the local water utility. In these cases, water utilities can access very low flows, when other users are suspended.

The ongoing increase in population in the Richmond River catchment is placing pressure on town water supplies. This growth, together with the experience gained from the 2002/03 drought, has led to local water utilities investigating options for securing additional water supplies within the Richmond River catchment.

## Policy and planning context

A number of national, state and regional plans and policies guide the development of water sharing plans in NSW including:

- National Water Initiative
- *Water Management Act 2000*
- *Access Licence Dealing Principles Order 2004*
- Natural Resource Commission state-wide targets
- Catchment Action Plans
- NSW water planning policies and other considerations

In 1997, the NSW Government undertook a public process of developing water quality and river flow objectives for NSW unregulated river catchments. The relevant river flow objectives are shown in Appendix 4. The rules in the Plan were developed based on these objectives.

### National Water Initiative

The National Water Initiative (NWI) was signed by the Council of Australian Governments (COAG) in June 2004. Through the NWI, governments across Australia, including NSW, have agreed on actions to achieve a more cohesive national approach to managing, measuring, planning, pricing and trading water. The NWI recognises the continuing need to increase the productivity and efficiency of Australia's water use, whilst servicing rural and urban communities, and ensuring the health of river and groundwater systems.

The NWI sets out guidelines, outcomes and timelines for water plans and planning processes. Until 2014 the NWI was implemented and monitored by the National Water Commission, an independent statutory body responsible for providing advice to COAG on national water issues. The Commission was responsible for undertaking a biennial assessment of each state's progress with implementing the NWI.

The role of the National Water Commission ceased in December 2014 and its water management functions are in the process of being transferred to other agencies. Assessment of progress in the implementation of the NWI will be transferred to the Productivity Commission along with monitoring the effectiveness of the implementation of the Murray–Darling Basin Plan and associated Basin State water resource plans.

### Water Management Act 2000

The *Water Management Act 2000* (WMA 2000) is based on the concept of ecologically sustainable development i.e. managing current development so that it will not threaten the availability of resources for future generations. The WMA 2000 recognises the need to allocate water for the environmental health of our rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water access from land title.

Water sharing plans are the main tool through which the WMA 2000 achieves its objective. The major changes required to water management have meant that the WMA 2000 has been progressively implemented, and the *Water Act 1912* progressively phased out as water sharing plans commence.

The most recent version of the [WMA 2000](http://www.legislation.nsw.gov.au/) is available from the NSW Government legislation website, <http://www.legislation.nsw.gov.au/>

### Access Licence Dealing Principles

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The *Access Licence Dealing Principles Order 2004* (hereafter referred to as the Dealing Principles) draws on the objects and water management principles of the WMA 2000 and provides state-wide guidance and rules for applications to undertake water dealings including trade.

The Dealing Principles specify that dealings must consider:

- Impacts on other water users
- Impacts on the water source
- Impacts on indigenous, cultural, heritage and spiritual matters
- Maximising social and economic benefits

The Dealing Principles specify rules for different types of dealings such as; conversion to a new category, subdivision, consolidation, assignment of rights or allocation, changing water sources, amending extraction components and interstate dealings. They specify requirements that must be met for a dealing to be permitted and the conditions under which a dealing is prohibited.

Water sharing plans must be consistent with the Dealing Principles. Water sharing plans can also put additional restrictions in place such as restricting trade into a particular area due to environmental values or hydrologic stress.

### **Natural Resources Commission**

The macro water sharing plans also comply with the NSW Natural Resources Commission (NRC) statewide standards and contribute to the relevant statewide targets such as Targets 5 and 6 (see [www.nrc.nsw.gov.au](http://www.nrc.nsw.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 state-wide 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 water sharing plans against this Standard and its associated targets.

### **Catchment Action Plan**

Catchment action plans are statutory, non-regulatory plans that were previously prepared by the state's catchment management authorities under the *Catchment Management Authorities Act 2003* (now repealed). In January 2014 the NSW Government established Local Land Services (LLS) and transferred the functions of catchment management authorities into this new organisation. North Coast Local Land Services will be responsible for continuing the delivery of natural resource management programs within the Richmond valley, including catchment management plans.

**Table 6: Contribution of the Richmond River Area water sharing plan to NRC statewide targets**

Relevant statewide target	Contribution by Richmond WSP
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 help 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).	<ul style="list-style-type: none"> <li>• Sets a defined share of water for riverine ecosystems.</li> <li>• Protection of very low flows.</li> <li>• Trading rules to maintain or reduce entitlement in high value streams.</li> <li>• Adaptive management, giving the ability to adjust rules once information becomes available or at the end of plan period.</li> </ul>
By 2015 there is an improvement in the ability of groundwater systems to support their groundwater dependent ecosystems and designated beneficial uses (Target 6).	<ul style="list-style-type: none"> <li>• Sets distance rules to GDEs for new bores.</li> <li>• Extractions from alluvial aquifers managed using connected surface water rules.</li> <li>• Trading rules designed to protect groundwater sources.</li> <li>• Local area impact management rules.</li> </ul>
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained (Target 8).	<ul style="list-style-type: none"> <li>• Trading rules to maintain or reduce entitlement in high conservation value coastal water sources.</li> <li>• Protection of very low flows.</li> </ul>
By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems (Target 9).	<ul style="list-style-type: none"> <li>• Trading and access rules developed for tidal pool areas and water sources adjoining tidal areas with recognition of estuarine sensitivity and based on environmental requirements of the estuaries.</li> </ul>
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being (Target 12).	<ul style="list-style-type: none"> <li>• Plans provide a defined share to water and defined certainty of access.</li> <li>• Separation of land and water enhances trading and value of licences.</li> <li>• Establishment of perpetual and compensable water access licences provide security for business investment.</li> <li>• Water markets encourage movement of water licences to high value uses.</li> <li>• Rules developed which consider community dependence on water extraction.</li> </ul>

## Water sharing policy and other considerations

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

### Aboriginal values

Aboriginal cultural values may be affected by water extraction from aquifers and surface waters. Most of the information about flow-related Aboriginal values resides with the Indigenous communities.

The initial consultation sessions provided some insights into Aboriginal cultural values associated with unregulated rivers. Aboriginal communities have 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 entitlement 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 proposed provisions of the Plan.

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

Further input was sought from the Aboriginal community during the public exhibition period. For more information, see the fact sheet 'Macro water sharing plans. Information for Aboriginal water users', which is available on the DPI Water website [www.water.nsw.gov.au](http://www.water.nsw.gov.au)

### Protecting key environmental assets

The Richmond River catchment contains a significant number of threatened flora and fauna species, some of which are sensitive to water extraction (listed in Appendix 2). All of these species were considered when assessing the in-stream values of the water sources. A Recovery Plan has been developed for each of the threatened fish species present in the Richmond River catchment, the Eastern Freshwater Cod and the Oxleyan Pygmy Perch. These Recovery Plans have been prepared to assist the recovery of the species through identifying a range of strategies. The Recovery Plan for the Eastern Freshwater Cod specifically states that the Water Sharing Plans need to be consistent with the objectives and recommendations of the Recovery Plan. This required the Interagency Regional Panel to assess the flow requirements of the Eastern Freshwater Cod and where necessary assess and modify practices which contribute to reduced streamflow.

The Eastern Freshwater Cod is a large, predatory, freshwater fish native to only the Richmond and Clarence Rivers in northern New South Wales, where they were once abundant. Due to over harvesting and habitat degradation, the natural population of this fish in the Richmond River catchment has been destroyed and the current small population is a result of significant restocking efforts. Those water sources that have been identified by Industry and Investment NSW as key areas for the Eastern Freshwater Cod in the Richmond River catchment are Gradys Creek, Bangalow Area, Kyogle Area and Upper Richmond River Water Sources.

The Eastern Freshwater Cod tends to inhabit large bedrock controlled pools and travels between them; particularly during the breeding season. However, little is known about the flow requirements needed for the passage of the Eastern Freshwater Cod. Industry and Investment NSW and DPI Water are currently undertaking research on the nature of Cod movement within the Clarence Catchment. The Interagency Regional Panel has considered preliminary results from this research during the development of the Plan.

### Protecting 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. GDEs can include cave systems, springs, wetlands and groundwater dependent endangered ecological communities (EECs).

An initial assessment has been undertaken to determine whether there are any significant GDEs reliant on the alluvial groundwater. The only GDE identified in this initial assessment was a wetland located at the downstream end of the Tuckean Area Water Source. 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.

This identified wetland, known as the Tuckean Swamp, is a large estuarine back-swamp within the Richmond Floodplain. The swamp has been highly modified with the construction of drains and a tidal barrage, which among other things have lowered the shallow water table. Part of the Tuckean Swamp is now protected as a Nature Reserve.

### Protecting estuary health

Streamflow 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 NOW and DECCW (environmental water) to determine how sensitive each of the state's estuaries is to changes in freshwater inflows (DWE, 2008). The method was checked by staff from Industry and Investment NSW (Fisheries) and DECCW (Environmental Water Management). 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.

Table 7 summarises the inflow sensitivities for the estuaries within the Plan area.

Table 7: Inflow sensitivities for estuaries of the Richmond River Area

Name of estuary	Inflow sensitivity – Low flows	Inflow sensitivity – High flows
Lennox Area	Medium	Medium
Richmond River	Medium	Medium
Evans River	Medium	Medium

### 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 NOW. BLR include water for domestic and stock purposes extracted from a water source fronting a landholder's property or from any aquifer underlying the land, harvestable rights and for native title rights.

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

Furthermore, the access 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 Plan. NOW 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.

### Water interception activities

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

Farm dams require an access licence only when:

- they are located on a third-order (or greater) river, irrespective of the dam capacity or purpose
- if they exceed the maximum harvestable right dam capacity for the property, which is a capacity that enables the landholder the ability to capture 10 per cent of the mean annual runoff from their property; or
- if they are on a permanent (spring fed) first and second order stream.

The volume of existing licensed farm dams was considered in determining the hydrologic stress rating and resultant access rules.

Unlicensed extraction from farm dams is permitted as a Harvestable Right. The full activation of Harvestable Rights within the area of the Plan is considered highly unlikely, therefore the Plan allows for an estimate of the current activation of basic landholder rights within the extraction limit. The current activation of harvestable rights is therefore implicitly, rather than explicitly, included within this estimate. The provisions relating to Harvestable Rights are unaffected by any of the rules identified in the Plan. However the uptake of Harvestable Rights will be monitored to determine if at any stage total unlicensed dam capacity has increased to a level considered significant in terms of interception and to inform the implementation of the NWI.

While there are significant areas of native vegetation in the Richmond River catchment, particularly in the upper parts, much of this is protected as National Parks and Nature Reserves. A small portion of the catchment is currently under timber plantations, however there is potential for this area to increase over time. Plantation developments are controlled in NSW under the *Plantations and Reafforestation Act 1999* and may be assessed in the Richmond River catchment to determine if water access licences are required for any new plantations under any future planning framework.

The Richmond River catchment is currently considered an area in which there will be no significant growth in water interception activities anticipated within the life of the Plan.

### **Development of future town water supplies**

With the continued increase in population within the Richmond River catchment together with the significant drought events experienced over the last decade, local water utilities are currently investigating ways to increase their bulk water supplies. Rous Water is currently considering developing a new dam, Dunoon Dam, on Rocky Creek below the current dam. The practicality of this proposal is being investigated through a Future Water Supply Strategy.

The Integrated Water Cycle Management Strategies developed by both Richmond Valley and Kyogle Councils identified the need for each council to source alternate sources to enhance their existing supplies. Options being considered include groundwater, offstream storage, accessing water from Toonumbar Dam and water reuse.

Any town water supply augmentations within the Plan area must be undertaken within the bounds of the Plan. At a minimum, a local water utility will need to meet conditions specified in the Plan to ensure enough water is flowing to protect the environment in accordance with the Plan. Furthermore, a new significant Dam would likely require assessment under process established by Part 3A of the *Environmental Planning and Assessment Act 1979*.

### **Aboriginal Community Development access licences (unregulated)**

Many of the 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 irrigation licences on these 'stressed' rivers. However in some of the 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 these high flows.

In these coastal catchments, Aboriginal Community Development licences<sup>2</sup> may be granted which allow water to be pumped from rivers during the higher flows, and stored in farm dams or tanks, to be used as needed. It is important to note that for the purposes of issuing these licences, higher flows are not just peak or flood flows but also include flows that are greater than those that are exceeded 50 per cent of the time (the top half of the flow regime).

Since granting Aboriginal Community Development licences would mean less water remains in the river at these higher flows to meet other users' and environmental needs, it will be necessary to limit the total volume that can be extracted for Aboriginal commercial purposes. The limit would be a proportion of the river flow, and would not exceed 500 ML/year per water source. The Plan does not propose to limit the volume assigned to each individual Aboriginal Community Development licence, only the total volume per water source.

### **High flow conversion (unregulated water sources)**

Many of the coastal unregulated rivers within NSW have extreme competition for water during dry periods. In-stream values can be stressed during these low flow periods, wildlife becomes concentrated in particular locations and water quality can deteriorate through eutrophication.

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<sup>2</sup> The *Water Management Act 2000* currently makes provision for Aboriginal 'Commercial'. 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.

Therefore, there is merit in developing incentives that aim to move extraction out of the low flows and into the higher flows, as an attempt to improve environmental conditions and reduce competition.

By moving extraction from periods of low flow to periods of relatively higher flow, over time streams may de-stress and river conditions improve. An incentive is however required as low flow extraction is cheap and convenient and more reliable – water users simply pump the water when it's available subject to access conditions which are met more often relative to high flow licences. To utilise higher flows, it would generally be necessary to construct an on-farm water storage. Water could then be pumped during periods of higher flow and stored for use at a later time. This is a much more expensive approach to irrigation but can provide enhanced security for water users.

An incentive proposed by the Plan is to allow those licences that convert to higher flows to be granted additional volumes of water. In the Plan it is proposed that for every one unit of a normal unregulated river access licence entitlement surrendered, five units of higher flow access licence entitlement will be granted. The high flow access commences at the 30th percentile which is the flow that is exceeded 30 per cent of days.

Given that the purpose of the high flow conversions is to 'de-stress' low flows in coastal river systems, a detailed assessment was undertaken to ensure that there is an overall environmental benefit achieved.

The conversion has been recommended in specified water sources only if the following criteria are met:

- The water source is classified as having important in-stream values at high risk from extraction or in water sources having high hydrological stress.
- There are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment.
- There is no highly sensitive estuary or other identified high flow sensitive feature such as a wetland within the Extraction Management Unit.
- There is no existing high flow stress (i.e. significant extraction already in the high flow periods).
- The conversion would not significantly impact on tidal pool users or Town Water Supplies.

In addition, while trading of higher flow entitlements is possible, the Plan proposes that it will be constrained as follows:

- Trading within the water source will generally be permissible.
- Cease and commence to pump levels at the new location will always be the 30<sup>th</sup> percentile flow.

## Developing the Plan

### Scope of the Plan

The Plan covers three discrete water resources. Incorporating all of these into the one Plan recognises their interaction and allows for the development of water sharing rules that are linked and are equitable within and between these resources.

These three discrete resources include:

1. The unregulated rivers – these cover most of the rivers in the Richmond River catchment and all of the Evans River catchment. Although located in the catchment, the unregulated Coopers Creek Water Source is excluded from the Plan as it is already covered within a water sharing plan, which commenced in July 2004. The two plans will operate in parallel
2. The Richmond Regulated Water Source
3. The groundwater in the alluvial aquifer.

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

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

1. Porous rock aquifers found in rock formations such as sandstone or limestone. Groundwater occurs within the pore space in the rock matrix.
2. Fractured rock aquifers found in rock formations such as granite or basalt. Groundwater in these rocks occurs mainly within the fractures and joints.
3. Coastal sand aquifers, where groundwater is contained in the pore spaces in the unconsolidated sand sediments.
4. Alluvial aquifers, where groundwater is contained in the pore spaces in the unconsolidated floodplain material.

The aquifer types and groundwater sources that occur within the boundaries of the Plan and their connectivity characteristics are given in Table 6. It is based on principles and recommendations in *Towards a National Framework for Managing the Impacts of Groundwater and Surface Water Interaction in Australia* by Sinclair Knight Merz (2006).

The aquifers of the New England Fold Belt fractured rocks, the porous rocks of the Clarence Morton Basin and the North Coast Fractured Rocks are managed through the Water Sharing Plan for the North Coast Fractured and Porous Rock 2016. The Richmond Coastal Sand aquifers are managed through the Water Sharing Plan for the North Coast Coastal Sands 2016. When developing the Plan, the level of connectivity, the relative level of impact and the timing of connection between the surface water and alluvial aquifers have been considered (Table 8). This included delineating between the upriver alluvial aquifers, which are characterised by coarse material such as sands and gravels and show relatively short travel times between ground and surface waters, and the downstream alluvials (Richmond coastal floodplain alluvial aquifers) which are comprised of finer materials and show a weaker connectivity than the upstream alluvial aquifers between ground and surface waters.

The boundary between the upriver and coastal floodplain alluvial systems in the Plan area was identified based on soil landscape mapping, where the boundary was delineated by a change in hydraulic connectivity based on soil type and geomorphology.

Table 8: Connectivity between aquifer types and surface water

Aquifer type	Ground water sources	Level of connection between surface and groundwater	Level of impact on in-stream values	Estimated travel time between groundwater and unregulated river
Coastal sands	Richmond Coastal Sands	Significant (tidal section only)	Low due to connection with saline water	Days to months
Up-river Alluvial	Unregulated rivers and the Richmond Regulated	Significant	High due to impact on base flows	Day to months
Fractured rock	New England Fold Belt North Coast Fractured Rocks	Low – Moderate	Low since not major contributor	Years to decades
Porous Rock	Clarence Morton Basin	Low – Moderate	Low since not major contributor	Years to decades

### Water management units

Water sharing plans have a hierarchy of planning units. The Richmond water sharing plan falls within the **North Coast Water Management Area**. All water sharing plans have a gazetted map of the area for which that particular plan has been developed.

**The Extraction Management Unit (EMU)** is the highest level in the hierarchy of planning units and may consist of one or several sub-catchments ('water sources' – see the *WMA2000* for definition). An EMU is specified for the purpose of establishing a geographic area over which the long-term average annual extraction limit applies. This Plan contains three EMUs including:

- the Richmond River– all unregulated surface water and alluvial groundwater in the Richmond River catchment
- the Evans River Catchment – all unregulated surface water and alluvial groundwater in the Evans River Catchment
- the Richmond Regulated – all surface water in the regulated system.

The daily access rules apply at the **Water Source** level, which is the next level down in the hierarchy of planning units. The Richmond River EMU is divided into 22 water sources, the Evans River EMU has one water source; and the Richmond Regulated EMU is one water source. Their spatial extent is shown in Appendix 1.

A **Water Management Zone** represents a portion of a water source and is the level at which more refined implementation of access or trading rules are applied. Six water sources have been sub-divided into water management zones:

1. Kyogle Area Water Source – Upper and Lower Kyogle Area Management Zones.
2. Coraki Area Water Source – Non Tidal and Tidal Pool Management Zones.
3. Wyrallah Area Water Source – Non Tidal and Tidal Pool Management Zones.
4. Alstonville Area – Alstonville and Alstonville Drains Management Zones.
5. Tuckean Area –Tuckean and Tuckean Drains Management Zones
6. Richmond Regulated Water Source – Zone 1 and Zone 2 Management Zones.

### The State Interagency Panel

The State Interagency Panel has overall responsibility for the statewide strategic direction of water sharing planning, to make certain that adequate resources are available and to ensure that the varying policy and statutory requirements of the relevant NSW Government agencies are met. The State Interagency Panel 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 Panel is chaired by DPI Water and comprises representatives from DPI Water, Office of Environment and Heritage, and agriculture, fisheries and aquaculture specialists from the Department of Primary Industries. There are also three representatives from Local Land Services (formerly Catchment Management Authorities). DPI Water is responsible for overall project management.

### The Interagency Regional Panel

The Plan was prepared by the North Coast Interagency Regional Panel, which consisted of representatives from the former NSW Office of Water, Industry and Investment NSW, the former Department of Environment, Climate Change and Water (DECCW) and the former Northern Rivers Catchment Management Authority (who acted as an observer). Appendix 3 lists the names of the North Coast Interagency Regional Panel representatives and their areas of expertise. The Interagency Regional Panel also had access to other staff from their respective agencies to provide specific technical and scientific information. The key roles of the Interagency Regional Panel were to:

- establish the hydrological units or water sources (refer to Appendix 1)
- assign economic, social and environmental values and undertake risk and value assessments to classify each unregulated water source
- review water access conditions imposed on users through announcements/orders under the *Water Act 1912* during low flow conditions
- make recommendations on the water access and trading rules for each water source
- undertake public consultation on the proposed rules
- review submissions from targeted consultation and public exhibition and make changes, where necessary to the draft water sharing rules.

An Independent Facilitator was engaged to chair the meetings and guide the decision-making process. The Interagency Regional Panel used a consensus decision-making approach. Where agencies had concerns relating to particular issues, those issues were highlighted during consultation to seek specific comment on those issues from the stakeholders. The Independent Facilitator was not involved in the later Interagency Regional Panel meetings which were

focused on reviewing feedback from the public consultation and other additional information as part of the clarification and finalisation of the Plan provisions.

Interagency Regional Panels work under the guidance of the State Interagency Panel described above.

The North Coast Interagency Regional was reconvened in 2013 to review the Coopers Creek water sharing plan and make recommendations on water sharing rules as part of the replacement process.

### **Classification of unregulated water sources**

The classification of water sources was the first step in developing water sharing rules in the unregulated water sources. The Interagency Regional Panel 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 instream values against community dependence. The matrices for the Richmond water sharing plan are included in Appendix 6. For full details about the classification method, refer to the document ‘*Macro water sharing plans: The approach for unregulated rivers. Report to assist community consultation*’ which is available on the DPI Water website [www.water.nsw.gov.au](http://www.water.nsw.gov.au)

This classification method took into account:

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

Specifically the classification process involved assessment of factors, including:

- instream values, for example, threatened fish that are likely to be affected by extraction
- the risk to these instream 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 flows
- the extraction value, which is a qualitative assessment of the economic value of the agriculture which relies on 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
- the current best estimate of the amount of water extracted under basic landholder rights and for town water supplies
- whether the existing water sharing rules are adequate to manage the risk of extraction to in-stream values and basic landholder rights
- NSW Government policy.

The tidal pool was also classified using the same method where: for the ‘value matrix’ estuary value was used instead of instream value and low flow sensitivity x hydrologic stress represented hydrologic stress in the tidal pool; and for the ‘risk matrix’ risk to estuary value and community dependence on extraction were used.

A large range of reference material was used in addition to the general knowledge of the Interagency Regional Panel members and technical support staff within agencies. The reference material is listed in Appendix 5.

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 both matrix classifications for each water source to expedite the development of the water sharing plans by the Interagency Regional Panel. The ‘value’ matrix was used to develop trading rules and the ‘risk’ matrix was used to develop the water access rules. Where necessary, the Interagency Regional Panel refined these indicative rules to reflect local circumstances. The final classifications determined by the Interagency Regional Panel for all water sources (both value and risk matrices) have been summarised in Appendix 6.

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 Interagency Regional Panel was to use their local knowledge to check 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 approach did not include some information (e.g. extraction for town water supplies, estuary sensitivity) which was considered later by the Interagency Regional Panel. Refinements of classifications for specific water sources are listed in Table 9.

**Table 9: Refined classifications based on Interagency Regional Panel knowledge (refer to Appendix 6)**

<b>Water source</b>	<b>Change to classification</b>	<b>Justification</b>
Myall Creek	Risk classification changed from D – G	Panel revised the in-stream risk from medium to low due to only a few licences present and a very low extraction volume.
Kyogle Area	Risk classification changed from F – C	Panel revised the in-stream risk from medium to high due to the presence of a significant number of licences and a high extraction volume.

## Water sharing rules

Water sharing rules that the classification process focused on consist of:

- access rules – which determine at what flow levels extraction is allowed to commence/cease
- dealing rules – which control:
  - the trade of water – both permanent transfer of access licence entitlements and temporary assignment of water allocation between access licences
  - change of water sources
  - the location for extraction.

Other management rules that were considered in the development of the Plan include:

- extraction limits – which set the total volume of water that can be extracted on a long-term average annual basis from the water source or water management zone
- rules for granting new entitlement – what types of access licences may be granted
- rules for granting works approvals – what types of set back conditions are required
- rules for the protection of a specific environmental asset e.g. the Eastern Freshwater Cod.

## Rules for alluvial aquifers

The proposed water sharing rules for the alluvial aquifers are based on the following principles:

- Manage to a combined long-term average annual extraction limit for the unregulated surface water and alluvial groundwater. This would be based on the sum of existing unregulated and alluvial groundwater entitlement, plus a basic landholder rights estimate, plus an allowance for exemptions such as water for Aboriginal Community Development or town water purposes (where these apply).
- Manage growth in use through a common set of available water determinations for both surface and groundwater users.
- Permit within water source licence conversion between licence categories, assignment or allocation of account water from surface to groundwater licences but not the reverse (i.e. one way only).
- Manage the trade of alluvial groundwater licences with the same trading rules as the adjoining surface water. In effect, this would prohibit trading into areas identified as having high instream values, or are characterised as having high hydrological stress. Trade, where permitted between water sources, would only be from a river alluvial area to another river alluvial area.
- Manage existing bores located within 40m of an unregulated river to surface water daily access rules (from year six of the Plan), except access licences for stock and domestic, local water utility or food safety or essential dairy care purposes. These are not subject to access rule constraints.
- 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 or when:
  - they are drilled into the underlying non-alluvial material, and the slotted intervals of the production bore commence deeper than 30 m, or
  - the applicant can demonstrate that the bore will have minimal impact on base flows in the stream.

- Apply the standard local impact rules for alluvial groundwater and standard provisions for identified Groundwater Dependent Ecosystems (GDEs).

### Water sharing rules for groundwater dependent ecosystems

The Plan sets out a schedule of high priority (high conservation value) groundwater dependent ecosystems (GDEs). Their location is mapped and proposed distance rules will cover new or replacement bores which will not be permitted within a buffer zone around the GDE. Existing bores will not be affected by the proposed buffer zones and are able to continue operating (i.e. within the existing conditions of their access licences). The GDE schedule may be updated throughout the life of the Plan. Updating of the schedule is considered to be an amendment to the Plan, and as such would require the concurrence of the Minister for the Environment and the Minister for Land and Water.

### Developing the access and dealings rules

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

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

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

The Interagency Regional Panel also considered the ability to effectively manage and monitor flow in a water source. For example, where there is no flow gauging station (as is the case in several water sources) they assessed the risks to the water source, and if a cease to pump greater than visible flow is required, then either:

- Recommended that a new gauge be installed as part of the Hydrometric Network Expansion Project for high risk or highly stressed water sources.
- Looked at alternatives such as the installation of 'staff' gauges as part of the Hydrometric Network Expansion Project (which measure river height but not flow) or the use of visible flow control where the risk to instream values was low.
- Proposed that the water source be managed based on flows observed at gauges nearby, but outside of, the water source on the basis that their flows could be correlated due to climatic similarity and homogeneous catchment characteristics, such as area and/or topography.

They also considered any known specific requirements of threatened species in relation to key reproductive needs, migration or other particular ecological activities.

The Interagency Regional Panel recommended a staged approach to change, to limit adverse social and economic impacts. In essence, this proposed that water users be given time to adapt to new rules. Where the existing rules are different from the Interagency Regional Panel's recommended rules, the degree of immediate change (and hence the effect on extractors) was limited to the next higher level of rule in the first instance, unless a higher level of protection could be achieved with minimal socio-economic impact. The Interagency Regional Panel then determined a timeframe and the further steps required to achieve the recommended rules during the life of the Plan (also refer to 'Adaptive Management').

Once the proposed water sharing rules were determined, a check was undertaken to ensure that the rules are consistent in their application and practical to implement across the catchment.

In some water sources, local water users already have daily and hourly pumping restrictions or other arrangements to share water between themselves during dry times. These rules are associated with rostering water access when flows are approaching a cease to pump level to minimise the risk of the river flows at the flow reference point dropping to the cease to pump and thus requiring all licence holders to cease pumping simultaneously. While these have often been very effective in sharing water between licence holders, they have not been enforceable via licence conditions. During targeted consultation, there was support by water users to continue using these arrangements in the majority of water sources where they were in existence, and as a result these arrangements were incorporated into the access rules of the Plan where possible.

### Exceptions to the generic rule approach

In reviewing the indicative rules proposed for each water source, the Interagency Regional Panel used their local knowledge to refine access and trading rules where appropriate. Any amendments made were based on factors such as:

- availability of infrastructure (e.g. river gauges)
- availability of management systems (e.g. ability to manage the rules)
- existing management rules (e.g. existing licence conditions or Water Users' Association rostering rules which distribute low flow access amongst licensed users)
- whether the heterogeneity of flow regimes within different areas of a water source required differing management rules for those sub-areas.

It was recognised that local interpretation of the indicative water sharing rules was very important. For example, the rule of 'no pumping from pools when a pool drops to a specified height' was regarded as inappropriate in these systems due to small pool sizes and the numerous numbers of pools. Furthermore, it was not consistent with the River Flow Objectives (pools need to be maintained for drought refuge). In these instances, the Interagency Regional Panel adopted a rule of 'no pumping from pools where there is no visible inflow and outflow'.

In water sources where the existing cease to pump rule under the *Water Act 1912* was more stringent than the indicative rule, the existing access rule was generally adopted, on the basis that no change to current operations should mean no adverse social or economic impact and some licences have been issued under the *Water Act 1912* on the basis that they access higher flows. In these circumstances the Interagency Regional Panel acknowledged that many of the rules had been negotiated by water users or stipulated as outcomes of Rural Land Board hearings, and had been in place for a period of time and seemed to be adequately protecting values while providing certainty for water users.

For several water sources, no rule other than a cease to pump when there is no visible flow in the vicinity of the pump site could be recommended due to the absence of a gauging station within or nearby to the water source and the recognition that installing a station in these water sources was not a priority. However, in many cases a 'visible flow' approximates the level that the indicative rule was trying to achieve.

Table 10 outlines the changes made to the initial access and trading rules identified through the classification process by the Interagency Regional Panel.

**Table 10: Refined water sharing rules based on Interagency Regional Panel knowledge**

Water source	Change to water sharing rules	Justification
Alstonville Area	<ul style="list-style-type: none"> <li>Cease to pump – from ‘no visible flow’ to ‘above no visible flow’ rule.</li> <li>Trading – from ‘no net gain’ to ‘no trades in’.</li> </ul>	<ul style="list-style-type: none"> <li>Continuation of existing access arrangements under the <i>Water Act 1912</i> and presence of threatened frog species.</li> <li>Considered already hydrologically stressed, to maintain irrigator security.</li> </ul>
Broadwater Area	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no trades in.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To compensate for minimal access restrictions.</li> </ul>
Coraki Area (non-tidal)	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no net gain.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To allow for some trading without increasing stress.</li> </ul>
Double Duke Area	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no trades in.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To prevent increase in hydrologic stress in this high value area.</li> </ul>
Doubtful Creek	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow</li> <li>Trading – no net gain.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To allow for some trading without increasing hydrologic stress.</li> </ul>
EvansRiver	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no trades in.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>Limit trading due to the high value of the estuary.</li> </ul>
Gradys Creek	Cease to pump from ‘no visible flow’ to ‘95thpercentile’.	Continuation of existing access arrangements under the <i>Water Act 1912</i> .
Kyogle Area	Cease to pump – from ‘95thpercentile’ to ‘93rd percentile’ (upper zone) and ‘94th percentile’ (lower zone).	Continuation of existing access arrangements under the <i>Water Act 1912</i> .
Lennox Area	<p>No initial classification due to lack of hydrologic data.</p> <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no trades in.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To compensate for minimal access restrictions.</li> </ul>
Leycester Creek	Cease to pump - from ‘no visible flow’ to ‘92 <sup>nd</sup> percentile’.	Continuation of existing access arrangements under the <i>Water Act 1912</i> .
Myall Creek	Trading – from ‘no net gain’ to ‘no trades in’.	Limit trading due to the high value of the area.
Myrtle Creek	Trading – from ‘no net gain’ to ‘no trades in’.	Limit trading due to the high value of the area.

Water source	Change to water sharing rules	Justification
Sandy Creek	Trading – from trades in allowed 'no net gain' to 'no trades in'.	Limit trading due to the high value of the area.
Terania Creek	Cease to pump – from 'no visible flow' to '95thpercentile'.	Presence of the three threatened species of flow dependent frogs.
Toonumbar Area	Cease to pump – from '95thpercentile' to 'no visible flow'.	No other suitable reference point.
Tuckean Area	No initial classification due to lack of hydrologic data. <ul style="list-style-type: none"> <li>Cease to pump rule – 'above no visible flow' rule.</li> <li>Trading – no trades in.</li> </ul>	<ul style="list-style-type: none"> <li>Continuation of existing access arrangements under the Water Act 1912 and presence of threatened frog species.</li> <li>Considered already hydrologically stressed, to maintain irrigator security.</li> </ul>
Wyrallah Area	No initial classification due to lack of hydrologic data. <ul style="list-style-type: none"> <li>Cease to pump rule – no visible flow.</li> <li>Trading – no net gain.</li> </ul>	<ul style="list-style-type: none"> <li>No other suitable reference point.</li> <li>To allow for some trading without increasing stress.</li> </ul>

### Granting high flow conversions

Statewide guidelines recommend that high flow conversions only be adopted in specified water sources if:

- the water source is classified as having important instream values at high risk from extraction or in water sources having high hydrological stress
- there are adequate mechanisms in place to ensure the surrendered low flow is reserved for the environment
- there is a no highly sensitive estuary or other identified high flow sensitive feature such as a wetland within the EMU
- there is no significant extraction already occurring in high flow periods
- there is no significant impact on tidal pool users or town water supplies.

Subject to these guidelines, the water sources in the Plan area where applications for high flow conversions will be considered are:

- Bangalow Area
- Eden Creek
- Gradys Creek
- Kyogle Area
- Terania Creek
- Leycester Creek
- Myrtle Creek
- Shannon Brook

### Granting Aboriginal Community Development access licences

A detailed assessment was undertaken to determine where it may be appropriate to grant Aboriginal Community Development licences. It was decided that no new licences would be

granted in water sources with high instream value or in areas that could not support high flow licences. For the Plan area, applications for Aboriginal Community Development licences will be considered in the following water sources:

- Eden Creek
- Leycester Creek
- Myrtle Creek
- Alstonville Area
- Tuckean Area
- Shannon Brook

The restriction of Aboriginal Community Development licences to high flows has been raised as a general issue across all water sharing plans. DPI Water is currently working with the Aboriginal community through the Aboriginal Water Initiative to address these concerns and look at options for allowing limited access to lower flows.

### **Water sharing rules for the Richmond Regulated Water Source**

In operating Toonumbar Dam, Water NSW releases water to meet water orders plus system losses, taking into account tributary inflows. A significant amount of water is lost annually to the alluvial aquifers, as well as minor losses associated with evaporation. For operational purposes, the regulated system is currently divided into two reaches: from the dam wall down to the junction with Eden Creek; and from the junction with Eden Creek to the junction with the Richmond River.

#### **Developing the rules**

The development of the water sharing rules for the Richmond Regulated Water Source was based on the consideration of similar criteria to those assessed for the unregulated water sources.

These criteria included all the policy and other considerations as detailed previously in this document including, key environmental assets, basic landholder rights, water interception activities, development of future town water supplies, plus the following:

- The amount of water licensed for extraction and the total entitlements for general and high security access licences.
- The current level of extraction and the associated uses.
- The social and economic value of extraction and impacts of restricting extraction.
- The instream values.
- Interaction with the alluvial aquifers.
- Hydrological characteristics (groundwater and surface water) of the regulated water source and its tributaries.
- The hydrological impact of river regulation on the system.
- The current operational rules.

The water sharing rules that were considered by the Interagency Regional Panel for the regulated surface water included:

- access rules – which determine when extraction is allowed and what is provided for the environment

- dealing rules – which control the trade of water within the regulated water source – both permanent transfer of access licence entitlements and temporary assignment of water allocation between access licences and changing the location for extraction
- environmental flow rules – including end of system flows and an environmental contingency allowance
- extraction limits – the total volume of water that can be extracted on a long-term average annual basis from the water source
- granting new entitlement – what types of access licences may be granted
- granting works approvals – what types of set back conditions are required
- conversion of general security licences to high security
- system operation rules for the dam
- carry over of unused allocation.

For details about the water sharing rules for this water source, refer to the *Richmond Regulated Water Source Rules Summary*, available at [www.water.nsw.gov.au](http://www.water.nsw.gov.au).

## Consultation

The classifications and the Interagency Regional Panel's recommended rules underwent targeted consultation with water users and specific interest groups<sup>3</sup> before the Plan was drafted. The draft Plan then underwent formal public exhibition<sup>4</sup> to ensure wider public consultation.

While developing the Plan, the participating agencies 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 was essential in the finalisation of the Plan.

The former Northern Rivers CMA managed the consultation process, and ensured that all stakeholders and interested parties had an opportunity to examine and comment on the proposed water sharing rules.

### Targeted consultation on the draft rules

Targeted consultation on the proposed rules for the draft Plan began in late 2005 and finished in early 2008 (Table 11).

The objectives of this consultation were:

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

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<sup>3</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>4</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.

**Table 11: Key groups consulted as part of the targeted consultation**

Date	Group	Location
10th December 2005	Richmond River tidal pool water users.	Coraki
29th November 2005	Representatives from key interest group including water uses, industry, environmental and Aboriginal organisations.	Lismore
8th February 2006	Town Water Supply – Tweed, Richmond Valley, Ballina, Rous Water, Byron, Kyogle and Lismore Councils.	Ballina
2nd March 2006	Licence holders and general public.	Lismore Town Hall
3rd March 2006	Licence holders and general public	Kyogle Community Hall
11th April 2006	Aboriginal Community Support Officers (CMA) and representatives from Aboriginal communities.	Lismore
14th February 2008	Richmond Regulated River Water Users.	Toonumbar Dam

Stakeholders were encouraged to submit their comments in writing and a total of 34 submissions were received as a result of the targeted consultation. These were reviewed by the Interagency Regional Panel and changes were made to water sharing rules where appropriate.

### Refining the water sharing rules after targeted consultation

The Interagency Regional Panel 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.

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

Water source	Change to water sharing rules	Justification
Leycester Creek	Trading – from ‘no trades in’ to ‘no net gain’.	A change in classification (and therefore indicative water sharing rules) as a result of updated usage data.
Coraki Area (Upper Richmond, Lower Richmond and Bungawalbyn Creek Tidal Pool Management Zones)	Cease to Pump – from 12 ML/day @ Casino gauge to 1ppt salinity at Coraki. Trading – from ‘trading allowed between tidal water sources with tidal pool management zones’ to ‘trades only from upstream water sources’.	Considerable water user support for a salinity trigger. Additional data available for developing a trigger based on ecosystem health rather than quality of drinking water. Concern about lack of trading opportunity, so allowed for trades in whilst not increasing hydrological stress.
Wyrallah Area (Tidal Pool Management Zone)	Cease to Pump – from 6 ML/day @ Eltham gauge to 1ppt salinity at Coraki. Trading – from ‘trading allowed between tidal water sources with tidal pool management zones’ to ‘trades only from upstream water sources’.	Considerable water user support for a salinity trigger. Additional data available for developing a trigger based on ecosystem health rather than quality of drinking water. Concern about lack of trading opportunity so allowed for trades in whilst not increasing hydrological stress.

## Public exhibition of draft rules

Public exhibition of the proposed rules for the Plan was held between 9<sup>th</sup> November 2009 and 29<sup>th</sup> January 2010. The objectives of this consultation were:

- to provide background to stakeholders as to why the macro plans are being developed, how they are developed, what rules are proposed in the various areas and how stakeholders can provide feedback; and
- to formally consult with a broad range of stakeholders to explain the proposed water sharing rules; and
- to seek feedback from stakeholders and the general community about the proposed water sharing rules.

A total of forty one submissions were received as a result of the public exhibition of the Plan. These were reviewed by the Interagency Regional Panel. Table 13 outlines changes made to the draft rules as a result of the public exhibition process.

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

Water source	Change to water sharing rules	Justification
Alstonville Area	Cease to Pump – lowered from 2 to 0.5 ML/day at gauge to be established on Houghlahans Creek.	As Houghlahans Creek is smallest tributary concern that level is too high and not representative. Lowered level to just above no visible flow.
	Cease to Pump exemption - access licences currently on Maguires Creek below the sewage treatment plant are not subject to cease to pump rules only while effluent continues to be discharged from the treatment plant.	Water always available in Maguires Creek due to discharges from treatment plant.
Coraki Area (Tidal Pool Management Zone)	Cease to Pump – increase in salinity trigger level from 1 to 2 parts per thousand.	Concerns cease to pump will have significant socio economic impact on industries. Trigger levels set at salinity station which is located at downstream end of tidal pool.
Wyrallah Area (Tidal Pool Management Zone)	Pumping Restrictions – trigger changed from stream inflow levels in each arm to a salinity trigger for whole tidal pool. 10 hours restrictions triggered when salinity levels between 1 and 2 parts per thousand.	Support for the whole tidal pool to be subject to the same pumping restrictions based on a salinity trigger.
	Trading – treat tidal pool as one entity and allow trading into from all upstream water sources. Trading downstream into tidal pool was only allowed into the respective downstream arm of the tidal pool.	Concern about lack of trading opportunity and support for treating tidal pool as one entity. This does not increase hydrological stress

Water source	Change to water sharing rules	Justification
Terania Creek	Cease to Pump – lowered from 13 to 8.5 ML/day. Implementation has been staged with cease to pump in years 1-5 set at 6 ML/day.	New levels from updated hydrological data. Staging of rule designed to provide time for adjustment and minimise impact.
	If after year 5 cease to pump considered to be having a significant economic impact will be amended.	Concerns cease to pump will have a significant socioeconomic impact on industries in water source.
	Pumping Restrictions – trigger level reduced from 17 to 15 ML/day and number of pumping hours increased from 6 to 8 hours/day.	New levels from updated hydrological data. Increase in hours to reduce socioeconomic impact of pumping restrictions.
	High Flow Conversion – now permitted in the water source.	Considerable interest in accessing high flow conversion. Criteria revisited and decided that location of dam meant low impact on high flows within water source.
	Flow Reference Point – gauging station to be established in the water source.	Concerns about operating off gauge in neighbouring catchment. Identified as high priority catchment for gauge placement.
Richmond Regulated	Access to Uncontrolled Flows – now permitted with access rules based on the rules currently implemented by State Water	An alternative water supply so may help to minimise any socioeconomic impact of the ECA. Increases incidence of dam spilling which provides more water for the high value part of the water source.
	Environmental Contingency Allowance – a review to be undertaken by year 5 to determine the environmental assets and critical events it should be used for. Review will determine if ECA continues to be set aside. If no review occurs after year 5 of plan no ECA is set aside.	Concern that ECA would reduce dam security and cause socioeconomic impact. Review to confirm that ECA is warranted and determine its use. ECA won't continue if no review is undertaken to ensure it doesn't cause unjustified economic impacts.
	Licence Conversion – not permitted. Will be reviewed once 80% of entitlement is activated	Supply from dam is very reliable so conversions to increase security currently warranted. Will be reviewed if demand on dam increases significantly
Pumping Restrictions	Access licence holders who have been accredited under the Efficient Water Use Accreditation Scheme are not subject to pumping restrictions.	Access licence holders with low volume output efficient irrigation systems were subject to greater impact from the pumping restrictions.
High Flow Conversions	Conversion ratio increased from 1:3 to 1:5.	Ratio was not high enough given the expenses associated with capturing and storing high flows.

## Replacement of the Coopers Creek WSP (2004)

The Coopers Creek Water Sharing Plan was one of the first water sharing plans to be developed as part of the NSW Government's water reforms, and commenced in 2004. Water sharing plans must be extended or replaced after 10 years. Coopers Creek was extended until June 2016 to allow adequate time for the replacement process to be undertaken.

The Coopers Creek water source is located within the Richmond catchment. The WSP for the Richmond River was developed using the macro approach and commenced in late 2010. As part of the replacement process, the Coopers Creek water source was merged into the Richmond water sharing plan, allowing all surface water sources within the Richmond catchment to be covered under a single water sharing plan.

### Amendments to the Coopers Creek WSP prior to replacement

There have been two amendments to the Coopers Creek water sharing plan, once in 2009 and another in 2011. The background to the amendments, and the changes made have been outlined below to explain the development of water sharing rules in the water source.

#### Amendment One (February 2009)

The 2004 Plan established a water sharing regime that provided water for the environment and water for extractive purposes such as irrigation. An important consideration for the Plan was to provide water for the endangered Eastern Freshwater Cod.

The Plan was challenged in the Land and Environment Court by the Coopers Creek Water Users Group who was concerned that the cease to pump conditions in the Plan were overly stringent and had the potential to seriously impact the viability of their businesses. The major concern was the cease to pump (CTP) rule during spring, which was 20 ML/d for the first five years of the plan. After year five the CTP then increased to 31 ML/d. This CTP was established to allow for the movement of the Eastern Freshwater Cod which is a threatened species.

Negotiations between Coopers Creek WUG and government agencies involved in making the plan (then DNR, DEC and DPI) were undertaken in 2005. The matter was subsequently settled out of court. Implementation of the settlement required a number of amendments be made to the Plan which were finalised in February 2009, as follows:

- The Coopers Creek water source be divided into the following two zones, allowing zone specific access rules to be set:
  - Upper Coopers Creek – above the junction of Bennys Creek and Coopers Creek.
  - Lower Coopers Creek – downstream of Bennys Creek to the end of the water source.
- For years 1-5 of the Plan, in the Lower Coopers Creek zone licence holders will need to cease to pump when flows are at or less than 14 ML/day for all months of the year. This replaced the more stringent 20 ML/day cease to pump rule that currently applies during the months of July, August and September (developed to protect passage for the Eastern Freshwater Cod).
- For years 1-5 a "first flush" rule be established so that licence holders in both zones are not permitted to extract water for a period of 48 hours after the end of system flows rise from flows at or less than 14 ML/day to 31 ML/day or greater within a 24 hour period. This first flush rule was designed to assist the movement of the Eastern Freshwater Cod.

- After year 5 of the Plan, a “first flush” rule be established so that licence holders are not permitted to extract water for a period of 48 hours after the end of system flows rise from flows at or less than 17 ML/day to 31 ML/day or greater within a 24 hour period.
- The Total Daily Extraction Limits (TDELs) that are currently specified in the Plan would need to split between the two zones. However, TDELs will only be implemented if there is significant activation of sleeper licences during the life of this Plan.

### Amendment two (March 2011)

New information about the hydrology and habitat value of Coopers Creek and the biology of the Eastern Freshwater Cod suggested that the current water sharing rules are not meeting the Plan’s objectives, and may be having unintended social and economic impacts. It was determined it would be in the public interest for the Department of Water and Energy (DWE) to initiate a review of the Plan. The review was undertaken by an Interagency Review Panel.

The new information included:

- New hydrological modelling – which showed original flow duration information used in making the plan significantly over estimated flows.
- A water usage survey – undertaken in 2008 which generated a clearer understanding of the number of users, pattern of usage and maximum volumes traditionally extracted.
- A fish survey – found no cod in Coopers Creek however there is good evidence that there is a small remnant population (they appear to be of an age that suggests they were part of the 98/99 stocking program). This may indicate that the Eastern Freshwater Cod may have not been reproducing since they were stocked into the system.
- A report prepared by DWE ‘Stream rehabilitation requirements for the support of Eastern freshwater cod’ – Concluded the lower Coopers Creek zone has only marginal habitat at best with a highly degraded riparian zone. The Upper Coopers Creek zone has some excellent habitat, with healthy riparian zone and deep stable pools. A number of instream barriers such as road crossings were found to be a significant hindrance to the movement of the cod. The report flagged that very little is known about the species, its lifecycle and movement patterns. Further research to be undertaken in the Clarence valley should provide valuable information which will help determine what rules are appropriate in areas where the Eastern Freshwater Cod is known to occur.
- A report prepared by DWE ‘Assessment of Fish passage and low flow habitat protection – Coopers Creek, NSW’

The new information was reviewed by an Interagency Panel and proposed changes to the Plan were placed on public exhibition. The Interagency Panel considered the comments received from water users and as a result the following amendments were made to the plan.

- A new CTP of 12.5 ML/day at Ewing Bridge stream gauge which will provide approximately 14 ML/day at the end of system and will ensure pools and low flow riffles are protected from extraction.
- If the CTP is having a significant economic impact on water users the CTP can be amended on a long-term basis. The amendment provision allows the CTP to vary on this long-term basis, after consultation with the Coopers Creek Water Users Group. However, the CTP it must not be set below 8.5 ML/day at the Ewing Bridge gauge.
- The higher seasonal CTP rule for July, August and September was removed. The Panel decided that this rule provides little if any benefits for the Cod, but has the potential to have a real impact on commercial water users.

- The reference point in the WSP was changed from the end of system to the stream gauge at Ewing Bridge, as this is a much easier point from which to manage extractions and inform users of their real-time pumping access.
- An amendment provision allowed a new environmental flow rule to be considered if new information shows that the protection of higher flows will facilitate the movement of Cod. Prior to implementing this environmental flow rule, a socio-economic impact assessment would be required.
- The 'first flush' rule was amended to align with the new cease to pump rule. The new rule prohibited *extraction for 48 hours if the gauge level goes from below 12.5 ML/day to above 31 ML/day in a 24 hour period*. The trade of licences was prohibited between the Upper and Lower Management Zones, and from the tributaries to the main trunk of Coopers Creek. These rules were designed to protect instream values, including Cod habitat, from the pressures of additional extraction and recognised that further degradation due to increased stress from extraction is undesirable.
- It was proposed to allow high flow conversions in Coopers Creek. As an encouragement for consumptive users to move out of lower flows and into the less reliable higher flows, a conversion factor of 1 to 3 was offered.
- The following objectives were added to the WSP:
  - Protect very low flows for fundamental ecosystem health and pools for drought refuge.
  - Provide flows that facilitate passage of the Eastern Freshwater Cod.
  - Recognise and support existing industry via trading rules, and access rules that provide opportunities for continued access

### The Plan replacement process

Public submissions regarding the Coopers Creek water sharing plan were called for in 2012. These submissions and additional information were collated and reviewed in 2013. A report was submitted to the Minister recommending these plans be replaced, highlighting a number of issues that should be reviewed as part of the replacement process. The North Coast IRP was reconvened to consider the issues raised and make recommendations on proposed changes to the water sharing rules.

Changes to rules in the Coopers Creek water source focussed on:

- Reviewing daily flow sharing provisions
- Reviewing trading rules
- Standardising clauses to make them consistent with the latest water sharing plans and legislative framework
- Incorporating policy developments since 2004

### Access rules

The Coopers Creek water source was assessed using the macro method to determine if the existing water sharing rules were appropriate and in line with the current planning framework. Coopers Creek water source has been classified as having high instream value, high hydrological stress, high risk and high community dependence. Based on the 'macro approach' the indicative rule for the CTP is the 95<sup>th</sup> percentile. The neighbouring water source of Terania Creek, has the same classification and has an access rule based on the 95<sup>th</sup> percentile. The existing cease to pump in Coopers Creek was based on the 93<sup>rd</sup> percentile, which is a more stringent rule.

The Coopers Creek Water Users Group were concerned about the inconsistency between water sources and considered they were unfairly disadvantaged, as a result of being one of the first water sharing plans to be developed. They believed that it was appropriate to set the CTP at the 95<sup>th</sup> percentile, using updated flow data.

The IRP acknowledged that without specific information to support a more stringent CTP, it is difficult to justify retaining the current rule. They agreed to recommend a CTP rule based on the 95<sup>th</sup> percentile to be consistent with neighbouring water sources and the macro planning method. Updated flow data indicates that the 95<sup>th</sup> percentile equates to 9ML/day at the Ewing Bridge gauge.

The IRP also recommended removing an existing amendment provision which allowed the CTP rule to be reduced (but no lower than 8.5ML/day) if the rule was having significant economic impact on water users. This provision was no longer warranted given the proposed CTP rule is 9ML/day.

### **Amendment provision - Eastern Freshwater Cod**

The IRP agreed to adopt the amendment provision in the current Richmond water sharing plan which allows an environmental flow rule to be established in specified water sources, if new information on the flow requirements on the Eastern Freshwater Cod becomes available. This will ensure consistency with other water sources in the Richmond water sharing plan area.

### **Pumping Restrictions**

Pumping restrictions have been implemented in several water sources in the Plan area. Pumping restrictions help manage extraction as water levels drop towards the CTP trigger, ensuring flows are shared between water users and the environment. The IRP considered pumping restrictions were appropriate given the significant number of licences and the high in-stream value of the Coopers Creek water source.

The proposed pumping restrictions were based on a maximum of 10 hours per day when flows are less than or equal to 16ML/day. Comment was sought from water users on the most appropriate pumping window.

### **Trading**

The IRP reviewed the existing trading rules and agreed that restricting trading from the upper zone to the lower zone was overly stringent. Therefore they proposed trading from the upper zone to the lower zone be permitted. No further changes were made to the trading rules.

### **High Flow Conversion**

High flow conversions were previously permitted in Coopers Creek based on a conversion factor of 1 to 3 with a limit of up to 3000 unit shares in total for the high flow licences. Water users have indicated they are unlikely to convert their licence due to there being no suitable sites for dams and the large amount of investment required. High flow conversions have therefore not been recommended for the water source.

### **Highly connected alluvial aquifers**

The first round of water sharing plans (2004) did not include alluvial aquifers. 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. As such the surface water and groundwater associated with the alluvial aquifers will be managed as a single resource, with linked access and trading rules.

Based on current groundwater planning principles, default groundwater rules have been developed by the State Interagency Groundwater Panel. These default rules were considered and endorsed by the IRP during the development of the Richmond water sharing plan. To ensure groundwater within the Richmond catchment is managed consistently, these rules have been adopted for the Coopers Creek alluvial aquifers.

### **Total Daily Extraction Limits**

The Richmond River water sharing plan does not establish Total Daily Extraction Limits (TDELs), but allows these to be established through an amendment provision if necessary. For the Coopers Creek water source, this more general amendment provision has replaced the existing provision which allowed TDELs to be established if there was significant activation of sleeper licences in the Coopers Creek water source.

### **Applications for specific purpose licences**

The Coopers Creek water sharing plan previously allowed for the granting of new domestic and stock access licences. Under the Richmond water sharing plan applications for domestic licences are permitted, but applications for stock licences will not be accepted. To achieve consistency with all other Richmond unregulated water sources the provisions allowing applications for stock licences have been removed.

### **Minor changes to the Richmond water sharing plan**

The Richmond water sharing plan was amended to incorporate the Coopers Creek water source. During the re-drafting process DPI Water made some changes to the Richmond water sharing plan to correct some drafting errors and bring the plan into the current format for recent water sharing plans across the State. These changes will have minimal or no impact on water users in the Plan area and are summarised below.

### **Access rules for the alluvial sediments**

Most local water utility access licence holders (licence number must be listed in Schedule 3 of the Plan) and all domestic and stock “domestic only” access licence holders are exempt from the access rules (cease-to-pump rules) for the alluvial sediments. If the access licence holder does not fall into one of these categories then the access rules for taking water from the alluvial sediments for local water utility access licence holders and domestic and stock access licence holders will commence in year 6 of the Plan (the same year that access rules will commence for aquifer access licence holders).

### **Granting or amending water supply work approvals for in-river dams**

Water supply work approvals will not be permitted to be granted or amended for an in-river dam on a third order or higher stream in the Bangalow Area Water Source, Broadwater Area Water Source, Coopers Creek Water Source, Coraki Area Water Source, Evans River Water Source, Kyogle Area Water Source, Lennox Area Water Source, Terania Creek Water Source, Toonumbar Area Water Source and Upper Richmond Water Source. This is consistent with the State-wide position to prohibit in-river dams in third order or higher streams for water sources with high instream values.

### **Mandatory conditions**

Some amendments have been made to clarify the mandatory conditions. These amendments include exempting holders of a metered water supply work with a data logger from needing to maintain a Logbook (a meter must meet the parameters of this definition to be exempt). Licensing staff also identified that under the current Richmond water sharing plan, all water supply work approval holders must have metering equipment installed. This has been amended so that the correct metering requirements apply to licence holders taking from the regulated river and the unregulated and alluvial water sources.

## **Consultation for the Plan amendments**

The Interagency Regional Panel's recommended rules underwent targeted consultation with water users before the Plan was drafted. The draft Plan then underwent formal public exhibition to ensure wider public consultation.

### **Public exhibition of the draft rules**

The re-drafted Richmond water sharing plan was placed on public exhibition from the 19 January to the 27 February 2015. The objectives of this consultation were:

- to inform stakeholders and the general community about minor changes to the Richmond water sharing plan
- to seek feedback from Coopers Creek licence holders and the community about the proposed changes to water sharing rules.

Meetings were held on the 4 February 2015 at the Corndale Hall to discuss the proposed changes with the Coopers Creek Water Users Group and other licence holders. Two submissions were received as a result of the public exhibition and these were reviewed by the Interagency Regional Panel.

### **Changes to water sharing rules as a result of public exhibition**

Water users generally accepted the flow threshold of 16ML/day as a trigger for pumping restrictions, however were concerned about the impact of limiting pumping to 10 hrs/day. Key concerns included:

- Rye grass requires a minimum of 12 hours for optimal watering during July – December.
- Reducing the pumping window to 10 hours per day would result in sub-optimal water or halve the area that can be irrigated. Both amount to a significant impact on production and profit margins.

In response to the issues raised by water users the pumping window was changed to 12 hours per day, between the hours of 8pm and 8am.

## Adaptive management

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

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

## Monitoring of plan performance

DPI Water has developed a Monitoring, Evaluation and Reporting Framework in collaboration with key stakeholders. The framework conforms to NSW and Commonwealth government guidelines for monitoring, evaluation and reporting, and demonstrates an adaptive management approach to water planning required under the principles of the WMA 2000.

The evaluation framework aims to inform the community of the outcomes of water sharing plans, and to collate the results of various legislatively required evaluations and relevant knowledge to inform the review of the water sharing plans. The framework will assess the inputs, outputs and outcomes of the water sharing plans and their operations.

The assessment will consider:

- the process of plan development (appropriateness),
- the performance of the plan during operation (efficiency), and
- the socio-economic, environmental and cultural outcomes of the plan (effectiveness).

The main strategies in place to assist in evaluating water sharing plans include:

- assessment of performance indicators (using an Environmental Flows Monitoring and Modelling program),
- an audit of plans, and
- review of each plan at the end of its ten year term.

## Performance indicators

Part 2 of the water sharing plan includes a number of standard performance indicators that will be monitored over the life of the water sharing plan. It is not practical 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.

In order to assess performance indicators, DPI Water has established an environmental flows monitoring and modelling program which is designed to make the results of environmental flow studies more transferable between water sources and to develop more generic relationships between flow, hydraulics and ecological responses. This will enable a more efficient and effective evidence based approach to support monitoring and evaluation of water sharing plans in NSW.

## Audit

The WMA 2000 requires that water sharing plans be audited regularly, at intervals of not more than five years, to determine whether the provisions of the plan are being implemented. Under

section 44 of the Act the Minister for Lands and Water must appoint an Audit Panel to undertake this review.

The Audit Panel reflects the membership of the State Interagency Panel for Water Sharing and comprises representatives from DPI Water, OEH, DPI and LLS. Representatives from the NSW Natural Resources Commission and NSW Fisheries are invited to participate in the audit process as observers.

Reflecting the requirements of the WMA 2000 the focus of the audit is on the extent to which the provisions in the plan have been implemented. The audit does not attempt to assess the outcomes or effectiveness of the plan in achieving its objectives (this is considered by DPI Water through its monitoring and evaluation process).

When conducting an audit the panel will review a range of analysis and material provided by DPI Water to:

- identify patterns of implementation activities across water source types, across plans and types of water sharing plan provisions,
- identify actions required to address instances of partial and non-implementation,
- develop broad recommendations for improving the implementation of existing plans and the robustness of new plans, and
- identify opportunities for linking the audit findings with other related processes, particularly the review of catchment action plan targets.

### Plan review

At the end of the water sharing plan's 10 year life the Minister may, under Section 43A of the WMA 2000 and on recommendation by the Natural Resource Commission, extend a water sharing plan for another 10 years or replace the plan. An extension does not allow for any changes to the water sharing plan. If any changes are proposed, then a replacement water sharing plan needs to be prepared.

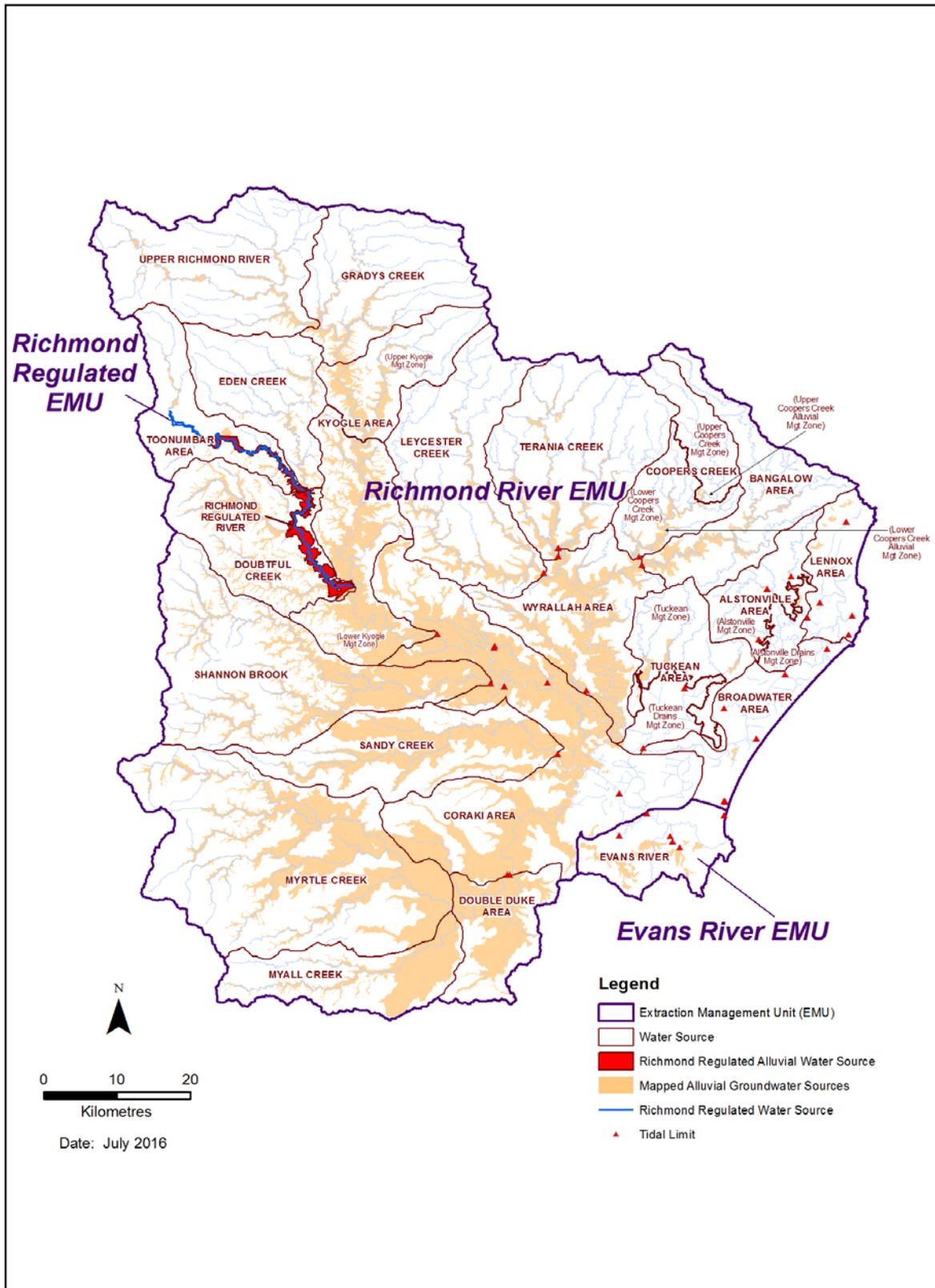
The WMA 2000 requires that when deciding whether to extend or replace an existing plan, the Minister must consider:

- the most recent audit of water sharing plans conducted under section 44, and
- a report from the NRC prepared within the previous five years, on the extent to which the water sharing plan has contributed to relevant state-wide natural resource management standards and targets of the relevant LLS catchment action plan.

Under the WMA 2000 a water sharing plan may be extended for 12 months past the expiry date of the plan to allow for a replacement plan to be prepared.

## Appendices

### Appendix 1: Water sharing plan area map



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

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

	Alstonville Area	Bangalow Area	Broadwater Area	Coopers Creek	Coraki Area	Double Duke Area	Doubtful Creek	Eden Creek	Evans River	Grady's Creek	Kyogle Area	Lennox Area	Leycester Area	Myall Creek	Myrtle Creek	Upper Richmond River	Sandy Creek	Shannon Brook	Terania Creek	Tuckean Area	Toonambar Area	Wyrallah Area
<b>Fish</b>																						
Oxleyan Pygmy Perch	E		K		K	E			K			E		E	E		E	E		E		E
Eastern Freshwater Cod	E	K	E	K	E	E	E	E	E	K	K	E	E	E	E	K	E	E	E	E	E	K
<b>Frogs</b>																						
Fleay's Barred Frog**		E		E			E	E		K	E	E				K			K		K	
Giant Barred Frog**	E	E	E	K	E	K	E	E	K	E	K	E	E	E	K	E	E	E	K	E	K	K
Green and Golden Bell Frog**	E		E						E			K								E		
Green-thighed Frog**		E		E	E	K	E	E	E	K	K	E	E	K	K	E	K	E	K	E	E	
Loveridge's Frog**		E		K						K	K		K			K			K			
Mountain Frog**										K	K					E						

	Alstonville Area	Bangalow Area	Broadwater Area	Coopers Creek	Coraki Area	Double Duke Area	Doubtful Creek	Eden Creek	Evans River	Grady's Creek	Kyogle Area	Lennox Area	Leycester Area	Myall Creek	Myrtle Creek	Upper Richmond River	Sandy Creek	Shannon Brook	Terania Creek	Tuckean Area	Toonumbar Area	Wyrallah Area
Olongburra Frog**	E		K	K	K				K			K				E				E		
Pouched Frog**	E	K	E	K			E			K	K	E	K					E	K	K		
Stuttering Frog**		K		K			E	E		E	E		E		E	E		E	E		E	
Wallum Froglet**	E	E	K	E	K	K	E	E	K	E	E	K	E	E	E	E	E	E	E	E	E	E
<b>Birds</b>																						
Australasian Bittern			K	K	K				K			K										
Beach Stone-curlew			K						K			K										
Black Bittern**	K	K	K	K	E	K	E	E	E	K	K	K										
Black-necked Stork**	K	K	K	K	K	K	K		K		K	K										
Blue-billed Duck					k						K											
Brolga	K		K		K	K			K			K										
Collared Kingfisher			K						K			K										
Comb-crested Jacana			K	K	K	K	K	K	K	K	K	K										
Freckled Duck				K	K						K	K										
Great Knot			K									K										
Greater Sand Plover			K									K										
Lesser Sand Plover			K						K			K										
Magpie Goose	K				K	K					K	K										
Mangrove Honeyeater**	E		E									K										
Osprey**	K	E	K	K	E	E			K			K										
Painted Snipe					K							K										

	Alstonville Area	Bangalow Area	Broadwater Area	Coopers Creek	Coraki Area	Double Duke Area	Doubtful Creek	Eden Creek	Evans River	Gradys Creek	Kyogle Area	Lennox Area	Leycester Area	Myall Creek	Myrtle Creek	Upper Richmond River	Sandy Creek	Shannon Brook	Terania Creek	Tuckean Area	Toonumbar Area	Wyrallah Area
Sanderling			K									K										
Terek Sandpiper	K		K									K										
<b>Other Fauna</b>																						
Large-footed Myotis		K		K		K			K	K		K										
<b>Wet Flora Species</b>																						
<i>Austromyrtus fragrantissima</i>			K	K	K						K	K										
Ball Nut	K	K	K	K																		
<i>Cassia brewsteri</i> var. <i>markiana</i>																						
<i>Cyperus aquatilis</i>																						
<i>Diploglottis campbellii</i>	K			K								K										
<i>Phaius australis</i>			K						K			K										
<i>Phyllanthus microcladus</i>		K																				
Thorny Pea		K		K	K				K		K											

**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: North Coast Interagency Regional Panel

Members of the Interagency Regional Panel used to develop the Richmond water sharing plan (2010)

Name	Agency	Role	Expertise
<b>Interagency Regional Panel</b>			
Dave Miller	NOW	Agency Representative	Water planning/administration/policy.Geomorphology. Riparian management. Stream ecology/restoration.
John Williams	I&I NSW	Agency Representative	Regional experience in water reform programs, water quality problems especially acid drainage, coastal agricultural industries, catchment management and interagency coordination.
Adam Smith	DECCW	Agency Representative	Regional input to water reforms, catchment plans and investments, biodiversity and threatened species management planning.
Ian Simpson	NRCMA	CMA Observer	Catchment management, program development and implementation, project management, soil conservation, land management and riparian restoration. Community liaison and engagement.
<b>Support staff</b>			
Richard Swinton	I&I NSW	Technical Support/Alternate Representative	Resource management, water policy development, farm systems and enterprises, farm management and economics, irrigation systems and management, extension and communications, water sharing plan development and implementation.
Marcus Riches	I&I NSW	Technical Support	Fisheries management and conservation issues, threatened species, biological/environmental research, local knowledge of flow behaviour of catchments, WSP development and implementation.
Roland Bow	DECCW	Technical Support/Alternate Representative	Technical and management expertise in research, aquaculture, commercial fisheries, compliance and conservation, fisheries management and aquaculture.
Peter Lloyd Jones	DECCW	Technical Support/Alternate Representative	Measuring ecological response of environmental flows, regional input and delivery of water reforms/ water sharing plan development, input into State water policy development.
Nicky Smith	NOW	Plan Coordinator	Water policy and planning, WSP development and implementation, facilitation and project management.
Julie Lovell	NOW	Plan support	Classification process, access and trading rules.Plan coordination.
Brett McCulloch	NOW	Technical Support (licensing)	Licensing officer, local knowledge of water users, WUAs, local access arrangements and reference points.
Neil Dufty		Independent Facilitator	Qualified educator and earth scientist, experienced facilitator in NRM planning, former chair of water management committees.

**Members of the Interagency Regional Panel used to review the Coopers Creek water sharing plan (2014)**

<b>Name</b>	<b>Agency</b>	<b>Role</b>	<b>Expertise</b>
<b>Interagency Regional Panel</b>			
Dave Miller	DPI Water	Agency Representative	Water planning and policy, geomorphology, riparian management, stream ecology/restoration.
Marcus Riches	DPI Fisheries	Agency Representative	Regional experience in NRM management, catchment planning, fisheries management and interagency coordination.
Peter Lloyd Jones	Office of Environment and Heritage	Agency Representative	Measuring ecological response of environmental flows, regional input and delivery of water reforms/ water sharing plan development, input into State water policy development.
Rik Whithead	DPI Agriculture	Agency Representative	Regional experience in NRM management, coastal agricultural industries, catchment management and interagency coordination.
<b>Support staff</b>			
Julie Lovell	DPI Water	Plan Coordinator	Water policy and planning, WSP development, project management and stakeholder liaison.
Peter Hackett	DPI Water	Technical Support (licensing)	Licensing officer, local knowledge of water users, WUAs, local access arrangements and reference points.

## Appendix 4: Contribution to the river flow objectives

Levels of assessed contribution:

FULL – contributes to objective in full.

HIGH – while not fully contributing to objective is considered a good level of contribution.

PARTIAL – goes some way to contributing to the objective.

LOW – only small degree of contribution to the objective.

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

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

Water source	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Alstonville Area	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Bangalow Area	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Broadwater Area	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	FULL
Coraki Area – non tidal	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	HIGH
Coraki – tidal	n/a	n/a	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	HIGH
Doubtful Creek	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Double Duke	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Eden Creek	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Evans River	FULL	FULL	FULL	FULL	n/a	FULL		HIGH	n/a	n/a	n/a	FULL
Gradys Creek	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL

Water source	Protect pools in dry times	Protect natural low flows	Protect important rises in water levels	Maintain wetland and floodplain inundation	Mimic natural drying in temporary waterways	Maintain natural flow variability	Maintain natural rates of change in water levels	Manage groundwater for ecosystems	Minimise effects of weirs and other structures	Minimise effects of dams on water quality	Make water available for unforeseen events	Maintain or rehabilitate estuarine processes and habitats
Kyogle Creek	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Lennox Area	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	FULL
Leycester Creek	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Myall Creek	FULL	FULL	FULL	FULL	n/a	FULL	FULL	HIGH	n/a	n/a	n/a	PARTIAL
Myrtle Creek	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Richmond Regulated	n/a	HIGH	PARTIAL	PARTIAL	LOW	LOW	LOW	HIGH	PARTIAL	HIGH	PARTIAL	LOW
Sandy Creek	FULL		PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Shannon Brook	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Terania Creek	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Toonumbar Area	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Tuckean Area	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Upper Richmond River	FULL	FULL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	PARTIAL
Wyrallah Area – non tidal	FULL	PARTIAL	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	HIGH
Wyrallah Area – tidal	n/a	n/a	PARTIAL	HIGH	n/a	HIGH	PARTIAL	HIGH	n/a	n/a	n/a	HIGH

## Appendix 5: Reference material

The following is a list of reference material used by North Coast Interagency Regional Panel during the development of the Richmond water sharing plan

### DPI Water data sets

Licensing Administrator System (LAS) – DPI Water water licensing database.

Hydsys – DPI Water stream flow database. Flow records are available for most water sources in the Northern Rivers area.

Regional Groundwater Monitoring Network – DPI Water is developing a regional groundwater monitoring network to be used to monitor alluvial groundwater levels and assess stream / surface water connectivity.

Volumetric Conversion Database (VOLCON) – Used to help determine the Peak Daily Demand for each water source.

Regional Geographic Information Systems – Land use and topographic information

### Central data sets

Stressed Rivers reports – used as the basis for identifying where there are instream barriers.

Threatened species (fish) – Data supplied by Industry and Investment NSW.

Threatened species (other) – Data supplied by former DECCW.

Index of Social Disadvantage – Australian Bureau of Statistics.

Employment in Agriculture – Australian Bureau of Statistics

Roy PS *et al.* (2001) – Structure and Function of South-Eastern Australian estuaries.

### Other agency data

NPWS Wildlife Atlas – State-wide flora and fauna database.

NSW Fisheries modelled data sets (Fish Community Index, Fish Community Vulnerability).

NSW Fisheries freshwater and saltwater recreational fishing database.

### Other projects/reference material

Australian Greenhouse Office (March 2004 version). *NSW Forest Extent 1972-2002*. Australian Greenhouse Office, Canberra. Data set used to determine per cent cover and width of riparian zones.

*Ballina Shire Council State of the Environment Report 2004*.

DLWC (1999). *Richmond Catchment Stressed Rivers Report*. NSW Department of Land and Water Conservation, Sydney.

Harris, J. H. and Gehrke, P. C. (eds) (1997). *Fish and Rivers in Stress: The NSW Fish Survey*. NSW Fisheries, Cronulla, Sydney.

Muschal, M. (2006) Assessment of risk to aquatic biota from elevated salinity – A case study from the Hunter River Australia. *Journal of Environmental Management* 79, 266-278.

National Heritage Trust (2002) *Australian Catchment, River and Estuary Assessment 2002*, Volumes 1 & 2. National Land and Water Resources Audit, Canberra. Data used included aquatic biota (macroinvertebrate/AUSRIVAS) index.

Northern Rivers Catchment Management Authority (2005) *Northern Rivers Catchment Action Plan*, Grafton.

NSW DPI Agriculture web site for crop gross margins:

<http://www.agric.nsw.gov.au/reader/budget>.

NSW Agriculture (2003) NSW North Coast Irrigation Profile. Water Use Efficiency Advisory Unit.

Pierson WL, Bishop K, Van Senden D, Horton PR, Adamantilis CA.(2002). Environmental Water Requirements to Maintain Estuarine Processes..*Environmental Flows Initiative Technical Report Number 3*. National Heritage Trust, Canberra.

Richmond River County Council. *Richmond River Estuary Process Study Executive Summary*. Aquatic Biogeochemical and Ecological Research.

Richmond Valley Council *State of the Environment Reports 2004, 2005, 2006*.

RichmondValley Council 2008.*Integrated Water Cycle Management Strategy Plan*.

Roy PS *et al.* 2001.*Structure and Function of South-eastern Australian Estuaries*. Estuarine, Coastal and Shelf Science 53: 351–384.

Trewin, D. (2001), *Census of Population and Housing: Socio-Economic Indexes for Area's (SEIFA)*.Australian Bureau of Statistics, Canberra.

Cavanagh, D., Dalrymple, B. and Wood, M. *Managing Water Quality in the Richmond River Estuary*, Australia. WMB Pty Ltd (Member of the BMT Group of Companies), Brisbane, Australia. [www.rrcc.nsw.gov.au/pdf/Research/Cavanagh\\_D.pdf](http://www.rrcc.nsw.gov.au/pdf/Research/Cavanagh_D.pdf)

## Appendix 6: Final classification summary

### Value matrix

High in-stream values	<b>A</b> Toonumbar Area	<b>B</b>	<b>C</b> Bangalow Area, Gradys Creek, Kyogle Area, Upper Richmond River, Terania Creek, Coopers Creek
Medium in-stream values	<b>D</b> Myall Creek	<b>E</b>	<b>F</b> Alstonville Area, Double Duke, Leycester Creek, Myrtle Creek, Eden Creek, Sandy Creek, Shannon Brook
Low in-stream values	<b>G</b>	<b>H</b>	<b>I</b>
	Low hydrologic stress of hydrologic risk	Medium hydrologic stress of hydrologic risk	High hydrologic stress of hydrologic risk

No value classification for Broadwater Area, Evans River, Lennox Area, Doubtful Creek, Tuckean Area and the non-tidal areas in the Coraki Area and Wyrallah Area Water Sources due to lack of flow data

**Risk matrix**

High risk to instream values	<b>A</b>	<b>B</b> Leycester Creek, Myrtle Creek	<b>C</b> Bangalow Area, Upper Richmond River, Kyogle Area, Terania Creek Tidal Pool areas of the Coraki and Wyrallah Areas, Coopers Creek
Medium risk to instream values	<b>D</b>	<b>E</b> Eden Creek, SandyCreek, Shannon Brook	<b>F</b> Alstonville Area, Gradys Creek
Low risk to instream values	<b>G</b> Double Duke, Myall Creek, Toonumbar Area	<b>H</b>	<b>I</b>
	Low dependence on extraction	Medium dependence on extraction	High dependence on extraction

No value classification for Broadwater Area, Evans River, Lennox Area, Doubtful Creek, Tuckean Area and the non-tidal areas in the Coraki Area and Wyrallah Area Water Sources due to lack of flow data