



Office
of Water

Water Sharing Plan Tweed River Area Unregulated and Alluvial Water Sources

Background document



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

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

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Introduction

Water sharing plans are being progressively developed for rivers and groundwater systems across NSW following the introduction of the *Water Management Act 2000 (WMA 2000)*. These plans protect the health of the State's rivers and groundwater while also providing water users with greater security by way of perpetual access licences, equitable conditions, and increased opportunities to trade water through the separation of land and water rights. More than 90 per cent of the water extracted in NSW is now covered by the *WMA 2000*.

In recent years water sharing plans for the State's unregulated rivers and groundwater systems have been completed using a 'macro' or broader-scale river catchment or aquifer system approach. Unregulated rivers are typically those which do not have their flows regulated by major state-administered dams. Most water users on unregulated rivers rely on natural flows for their water supply.

Each macro plan covers a large river basin rather than a single sub-catchment, or in the case of groundwater systems, a particular type of aquifer (e.g. fractured rock). The principles, objectives and management arrangements remain the same as for the plans developed for a smaller area or water source.

The Water Sharing Plan for the *Tweed River Area Unregulated and Alluvial Water Sources 2010* covers 31 water sources that are grouped into three extraction management units (EMU) (refer to Appendix 4). The key focus of the water sharing plan is the:

- 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 Water Sharing Plan for the *Tweed River Area Unregulated and Alluvial Water Sources* (water sharing plan or plan) and outlines:

- the purpose of the statutory plan
- the intended outcomes of the plan
- a description of the plan area
- the process of plan development
- the use of adaptive management
- the activities associated with implementation of the plan.

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

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

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

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

Purpose of the plan

Why are water sharing plans being prepared?

To provide security and certainty for the environment and water users

Expansion of water extractions 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 placed pressure on the health and biological diversity of the State's rivers and aquifers.

Under the *WMA 2000*, the sharing of water must protect the water source and its dependent ecosystems and must protect basic landholder rights. Next, amongst licensed water users, priority is then given to water utilities and licensed stock and domestic use, ahead of commercial purposes such as irrigation and industry. Water sharing plans provide a legal basis for sharing water between the environment and consumptive purposes.

On commencement of the plan, access licences held under the *Water Act 1912* are converted to perpetual access licences – meaning they do not have to be renewed – under the *WMA 2000* and land and water rights are separated. This facilitates the trade of access licences and can encourage more efficient use of water resources. It also allows new industries to develop as water can move to its highest value use.

The plan specifies the water sharing arrangements for the next 10 years and any future changes are then subject to the compensation provisions of the *WMA 2000*.

To facilitate water trading

Commencement of the plan marks the separation of land and water rights, providing enhanced opportunity for a broader water market.

Water sharing plans set the rules by which irrigation licences can be traded. It is expected that over time, there will be an enhanced water market, where licences will be traded both permanently and temporarily.

Why a macro approach to water planning?

Macro water sharing plans are plans which apply to a number of water sources across catchments or different types of aquifers. In July 2004, 31 water sharing plans commenced in NSW, bringing these water sources and some 80 per cent of the water extracted in NSW under the management and licensing provisions of the *WMA 2000*.

The macro planning process is designed to develop broader-scale water sharing plans covering most of the remaining water sources in the State. Each macro plan covers a large river basin (not a single sub-catchment), or in the case of groundwater systems, cover a particular type of aquifer (e.g. fractured rock) across the State. These river basin or aquifer macro plans will generally apply to catchments or aquifers where there is less intensive water extraction.

The macro water sharing plans currently being prepared for groundwater aquifer systems across the State include coastal sand, fractured rock and porous rock aquifers. While these are separate plans, there will be instances where the surface and groundwater plans must consider the inter-linkages of the water resources – e.g. in alluvial groundwater systems where stream flow and groundwater are often closely linked. The plan has therefore considered the licensed entitlement for the highly connected river alluvial and floodplain aquifers within the plan area.

Macro plans are being developed through a process involving technical assessments, classification and development of water sharing rules by interagency regional panels and a state groundwater panel.

Intended outcomes of the water sharing plan

The objectives of the Tweed River Area water sharing plan are to:

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

Economic significance in the plan area

The water sharing plan recognises the economic benefits to the region that are generated by commercial users such as irrigators and industry. It sets rules so that commercial users can continue to operate productively. Thirteen of the water sources covered by the plan were classified as being of high economic significance to local communities due to their dependence on commercial extraction (see Table 1).

Table 1: Water sources with a high level of economic significance

Water source	Description (relative to overall catchment)
Burringbar River	High value of production from irrigation
Christies Creek	Medium value of production from irrigation and high value of tourism and recreation
Clothiers Creek	Medium value of production from irrigation and high value of tourism and recreation
Cobaki Broadwater	High value of tourism and recreation
Crystal Creek	Medium value of production from irrigation and high value of tourism and recreation
Cudgen Lake	High value of production (fruit, vegetables etc) from irrigation
Dunbible Creek	Medium value of production from irrigation and relatively high economic dependence
Dungay Creek	High value of production from irrigation
Duroby Creek	High value of production from irrigation
Hopping Dicks Creek	High economic dependence of the local community on water extracted for irrigation and medium value of production from irrigation
Mid Tweed River	High value of production from irrigation
Piggabeen Creek	Relatively high economic dependence of local community
Sheens Creek	High value of production from irrigation
Terranora Broadwater	High value of production (fruit) from irrigation

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 in the unregulated rivers within the water sharing plan are protected from extraction. Even though the total annual volume of water extracted is relatively low compared to average annual flows, most of the demand for water from unregulated systems usually occurs at those times when stream flow is low. Whilst there is only limited research on the importance of protecting very low flows, there is a body of evidence that suggests low flows are essential for maintaining water quality, allowing passage over riffles for fish and other fauna to pools used for drought refuge, weir pool connectivity for spawning, 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 potential to impact on stream ecosystems without appropriate management.

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.

Two water sources were identified as having high instream values (see Table 2). For Byrill Creek, water trading into the water source will not be permitted, while for the Mid Tweed River water trading into the water source will only be permitted from upstream water sources so that there is no overall increase in water 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 6 details the threatened species considered when assessing the water source values (note this only included species that are likely to be sensitive to extraction).

Table 2: Water sources with a high instream value (based on initial assessment)

Water source	Description of instream value
Byrill Creek	<ul style="list-style-type: none"> ▪ 8 threatened frog species ▪ 3 threatened bird species ▪ 1 other threatened fauna species ▪ minimal disturbance to in stream condition ▪ high diversity ▪ high recreation value ▪ significant area of national park
Mid Tweed River	<ul style="list-style-type: none"> ▪ 7 threatened frog species ▪ 5 threatened bird species ▪ high diversity ▪ significant area of national park

The majority of water sources in the plan area have an existing 'cease-to-pump' condition of 'No visible flow', while irrigators in the Lower Oxley cease to pump at the 98th percentile and in the Mid Tweed, the 95th percentile. For surface water licences within the Mooball Creek and Tweed Estuary water sources there has been no existing 'cease-to-pump' condition applicable to low flow periods, while in some water sources, only a proportion of licences were subject to restrictive access rules.

In addition, access licences for groundwater extraction have focused on annual limits rather than daily management.

When the plan commences, surface water licences in all water sources will be subject to 'cease-to-pump' rules (excluding licences held by local water utilities and for food safety and essential dairy care; basic landholder rights will also be excluded). From year six of the plan these rules will also apply to any users extracting from the alluvial aquifer via a groundwater access licence located within 40 metres 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 the aquifer can have on river flows.

Description of the plan area

The Tweed River Area water sharing plan, which comprises the Tweed River catchment and the adjoining smaller coastal catchments of Cudgen, Cudgera and Mooball Creeks, contains 31 water sources that are grouped into three extraction management units (EMU) (refer to 'Appendix 4: Water sharing plan area map' for details of water source and EMU boundaries). The plan area includes the major towns of Tweed Heads and Murwillumbah and the coastal villages of Kingscliff, Hastings Point and Pottsville. Bordered by Queensland to its north, it is the most northerly of the NSW catchments and is located wholly within the Tweed Shire encompassing an area of approximately 1,325 km².

The Tweed catchment is bounded by a caldera escarpment (or volcanic rim), comprising the MacPherson Range (NSW – Qld Border) to the north, which generally exceeds 900 m altitude, the Tweed Range to the west and the Nightcap and Burringbar Ranges in the south and south-east. A large portion of these elevated areas are protected as part of the Border Ranges, Mount Warning, and Nightcap national parks which, as part of the Tweed Volcano Group, in turn part of the Central Eastern Rainforest Reserves of Australia, are a group of nature reserves given world heritage status. Additionally, in the Tweed catchment the Upper Rous River, Hopping Dicks Creek, Brays Creek and Upper Oxley River have been identified as possessing wilderness values (Metzler and Scott, 1988) while Cudgen Lake, Terranora Broadwater, Cobaki Broadwater, Mooball Creek, Clothiers Creek and the Tweed Estuary contain land protected under State Environmental Planning Policy 14 (Coastal wetlands), providing habitat for a high diversity of wet flora and fauna species.

Upstream of Murwillumbah, the Tweed and Oxley rivers drain the rugged and compact caldera that encircles Mt Warning, which was previously the main volcanic vent. Below Murwillumbah, the Tweed River weaves across an extensive floodplain and is joined by the Rous River, which drains the moderately dissected mid north areas of the catchment, at Tumbulgum. The shallow tidal broadwaters at Terranora and Cobaki, which are fed by Bilambil, Duroby, Piggabeen and Cobaki Creeks, join the river near its mouth via the Terranora Inlet before the river discharges to the ocean at Point Danger, immediately south of the NSW-Queensland border.

Tidal influence penetrates up the Tweed River to the Bray Park Weir approximately 5 km upstream of Murwillumbah and dominates the river levels except during flood events. The major infrastructure that impacts on flows in the Tweed River system are Clarrie Hall Dam (16,000 ML) and the Bray Park Weir (approx. 520 ML). Extraction primarily for town water supply occurs from the Bray Park Weir pool which is supplied by both the Tweed and Oxley Rivers. Releases are made from Clarrie Hall Dam to top up the Bray Park Weir pool.

The small coastal catchments of Cudgen, Cudgera and Mooball Creeks, situated south of the Tweed River mouth are typical of many small coastal estuarine creeks along the northern NSW coast in that they flow northwards behind a coastal sand barrier. They have dynamic, generally constricted entrances that largely control their tidal and morphological characteristics. As a result

these catchments can be subject to a wide range of water levels and discharges, together with a variable salinity caused by the mixing of ocean water with freshwater runoff from the land.

Climate and streamflows

The Tweed catchment experiences a warm temperate climate, often termed 'humid subtropical', with a pronounced summer/autumn wet season and a winter/spring dry season.

The caldera and proximity to the sea both have significant impacts on the climatic variability across the catchment. On average the Tweed records 12 rain days per month, with February and March having the highest and July, August and September the lowest number of rain days. This rainfall can vary from more than 2000 mm on the McPherson and Nightcap Ranges escarpments to around 1600 mm on the floodplain. This, in combination with mean daily maximum temperatures in the mid to high twenties can lead to relatively high humidity within the catchment, although altitude and sea breezes can lower this. The highest mean maximum daily temperature recorded at Murwillumbah is 29.6° C in January, while the coldest mean minimum temperature is 8.3° C in July.

The Tweed is located near the southern limit of cyclonic activity on the east coast of Australia, with the cyclone season extending from December to mid April. The Bureau of Meteorology estimates that an average of one cyclone in every two cyclone seasons is likely to affect the area. Gale force winds and torrential rains associated with these cyclones, or tropical depressions formed after cyclones, may cause flooding within the catchment.

Streams in the Tweed catchment are heavily influenced by seasonal climatic variability and display a similar flow regime with some minor variations. Generally high flows occur in all water sources during the periods from January through to July with peak flows typically occurring during January to March. During the period from August through to mid/late November when only very low flows occur, some variation between basins is exhibited.

Land use history

The Tweed River water sharing plan area is located within the traditional lands of the Bundjalung Aboriginal Nation, which extends from the Logan River in Queensland in the north to as far south as the Clarence River. This land and its waterways, together with its diverse plants and animals, sustained all facets of Aboriginal life and culture by providing food and medicine and a focus for recreational, ceremonial, and spiritual activity. They are also associated with the dreaming stories and cultural learning that is still passed on today.

In 1770 Captain James Cook identified and named two of Tweed Shire's most prominent features, Mount Warning (Aboriginal name Wollumbin) and Point Danger (Aboriginal name Pooningbah). In 1823 John Oxley became the first European to see the Tweed Valley where, after exploring seven miles upstream of the Tweed River, he entered into his journal:

'A deep rich valley clothed with magnificent trees, the beautiful uniformity of which was only interrupted by the turns and windings of the river, which here and there appeared like small lakes. The background was Mt. Warning. The view was altogether beautiful beyond description. The scenery here exceeded anything I have previously seen in Australia.'

The area was settled by timber-getters around 1844 after red cedar (*Toona Ciliata*) had become scarce around Sydney. In 1871 the first school opened and by the 1890s the river port of Tumbulgum was the centre of population. The focus moved to Murwillumbah when the first Local Government municipality was declared in 1902. The Tweed Shire, which amalgamated the Municipality of Murwillumbah and Shire of Tweed, was declared in 1947.

Over the last 150 years Tweed Shire has developed a viable agricultural industry based on its highly productive alluvial flats, basalt derived uplands, sub-tropical climate and high rainfall. Sugar, dairy farming and horticulture (tropical fruit and vegetable crops) are the main types of agricultural production on the Tweed's rich basaltic soils, while beef production and timber production are predominant in those areas of lower fertility soils of sandstone and shale origin. These industries have had a major impact on the landscape's natural attributes. However, a major portion of the upper Tweed Catchment still remains under forest cover, protected either as national park or state forest.

Banana and dairy industries have declined since the 1950's resulting in less intensive agricultural land management practices. In the 1960s and 70s sand mining occurred extensively along the coastal dune system. Dredging of the river and the broadwaters has also occurred since the early century for navigation and more recently, for commercial sand and gravel extraction. Over the same time tourism, particularly on the coast and hinterland, has become a major industry.

For almost two centuries, human settlements and agricultural pursuits have expanded across the Tweed landscape. Today in excess of 85,000 people live in Tweed Shire, primarily in the major urban areas of Tweed Heads, South Tweed, Murwillumbah and Kingscliff but also scattered through a range of rural communities and villages. The last 20 years have seen significant growth, with the population increasing on average by approximately 2 per cent per year, due largely to migration by southern retirees and sea changers drawn to the area by the temperate climate and relaxed lifestyle.

The Far North Coast Regional Strategy (Dept of Planning, 2006) has identified that Tweed Heads, as a regional centre, and Murwillumbah, as a major town will continue to be the focus for the future provision of services, employment and housing. With expected population growth rates amongst the highest in the state, this expansion within and adjacent to existing centres will be supplemented by increasing urban development along Tweed's coastline between Kingscliff and Wooyung.

Industry

Productive agriculture remains a significant sector in the Tweed Shire accounting for 36 per cent of land use with sugar production (6,000 Ha) the single most important industry and one well suited to the floodplain. However, when measured in terms of output value, agriculture provides a small and declining component.

In 2004/5, total production of goods and services in the Tweed region was valued at over \$3.1 billion. Service industries, such as property and business services, retail trade, construction, and health and community services, dominate and account for almost 88 per cent of the total gross output for the region. Manufacturing, of which food processing is the largest at 1.2 per cent, contributes over 5 per cent, whilst primary industries contribute only 3 per cent.

Tourism and retirement industries have increased in recent years and are now a significant part of the local economy. Proximity to the Gold Coast Airport and the port of Brisbane, as well as to the opportunities offered by the rapidly developing markets of South East Queensland will ensure that the Tweed will continue to play an integral part in the future growth of the Far North Coast region of NSW.

Water entitlement and use

The total annual volume of surface water licensed for extraction (at February 2009) within the area covered by the water sharing plan is 35,207 ML per year compared to an annual average flow of approximately 365,000 ML for the Tweed River at Brays Park Weir (Integrated Water Supply

Options for North East NSW and South East Queensland – Snowy Mountains Engineering Corporation, 2007).

In addition, there is 780 ML per year of authorised groundwater extraction from the ‘upriver’ alluvial aquifers and the ‘coastal floodplain’ alluvial aquifers within the plan area. This volume has been included in the plan due to the significant degree of connectivity of these aquifers with their parent streams.

The licensed extraction is separated into three extraction management units (EMU). For the Tweed River Catchment Extraction EMU, the total volume of surface water licensed for extraction is 33,197 ML, including up to 27,567 ML (about 83 per cent) for town water supply from the Mid Tweed water source for Tweed Heads and Murwillumbah (current annual usage is approximately 11,000 ML), while the total volume of ground water licensed for extraction is 295 ML. In the case of the Burringbar River Catchment EMU, the total annual volume of surface water licensed for extraction from the EMU is 1,278 ML, of which approximately 771 ML (or 60 per cent) is extracted for irrigation purposes within the Burringbar River Water Source, while the total volume of ground water licensed for extraction is 245 ML. The Clothiers Creek Catchment EMU has a total annual surface water volume of approximately 732 ML licensed for extraction, with 597 ML (or 82 per cent) extracted from the Cudgen Lake water source mainly for irrigation on the agricultural areas on the Cudgen plateau, while the total volume of ground water licensed for extraction is 240 ML.

Plan development process

Project groups

State interagency panel (formerly the project control group)

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

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

The interagency regional panel

The water sharing plan rules were initially developed by the north coast interagency regional panel. This is an inter-agency group consisting of representatives from DECCW, including the Office of Water and the Northern Rivers CMA (as an observer), as well as from I&I NSW. Appendix 1 lists the names of the north coast interagency regional panel representatives and their areas of expertise. The panel also had access to other staff from their respective agencies to provide specific technical and scientific information. The key roles of the panel are to:

- establish the hydrological units or water sources (refer to Appendix 4)
- assign economic, social and environmental values and undertake risk and value assessments to classify each water source
- review the suitability of existing licence conditions under the *Water Act 1912*

- make recommendations on the water access and trading rules for each water source
- assist the CMA with the public consultation on the proposed rules
- review submissions from targeted consultation and public exhibition and make changes, where necessary to the water sharing rules.

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

The policy context

There are a number of policies and initiatives that impact on and direct the development of water sharing plans. Water sharing plans are required to be guided by the River Flow Objectives. 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 for the unregulated rivers within the water sharing plan area aim to:

- protect natural low flows
- protect natural water levels in pools of creeks, rivers and wetlands during periods of no flow
- protect a proportion of moderate flows, 'freshes' and high flows
- maintain or rehabilitate estuarine processes and habitats
- maintain groundwater within natural levels, and variability, critical to surface flows or ecosystems.

The rules in the plan were developed based on these objectives (refer to Appendix 5 for a more detailed analysis).

The macro plans are also consistent with the National Water Initiative which has a number of relevant requirements for water planning in Clauses 23, 25, 35 to 40, 52, 78, 79 and Schedule E (refer to <http://www.nwc.gov.au/www/html/117-national-water-initiative.asp> for details). This intergovernmental agreement contains provisions on water planning including:

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

The macro plans also comply with the NSW Natural Resource Commission (NRC) state-wide standards and contribute to the relevant state-wide targets such as targets 5 and 6 (see www.nrc.nsw.gov.au for details) which is a requirement of the state plan, priority E4 (see www.nsw.gov.au/stateplan for details). The NRC was established in 2003 to provide the NSW Government with independent advice on natural resource management issues. To achieve this it has developed and recommended a standard for quality natural resource management and 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 plans against this standard and its associated targets.

Table 3: Contribution of the Tweed River Area Water Sharing Plan to the relevant NRC state-wide targets

Relevant state-wide target	Contribution by Tweed River Area Water Sharing Plan
By 2015 there is an improvement in the condition of riverine ecosystems	<ul style="list-style-type: none"> – sets a defined share of water for riverine ecosystems – protection of very low flows – trading rules to maintain or reduce entitlement in high value streams – adaptive management, giving the ability to adjust rules once information becomes available or at end of plan period
By 2015 there is an improvement in the condition of important wetlands, and the extent of those wetlands is maintained	<ul style="list-style-type: none"> – trading rules to maintain or reduce entitlement in high conservation value coastal water sources – protection of very low flows
By 2015 there is an improvement in the condition of estuaries and coastal lake ecosystems	<ul style="list-style-type: none"> – trading rules developed for tidal pool areas and water sources adjoining tidal areas with recognition of estuarine sensitivity and based on the environmental requirements of estuaries – commence to pump rules introduced to protect first flush to estuaries – system operation rules to support fish ladder operation
By 2015 there is an increase in the recovery of threatened species populations and ecological communities	<ul style="list-style-type: none"> – some access and trading rules developed to protect water dependent threatened species where these were identified and the risk to these from extraction is high
Natural resource decisions contribute to improving or maintaining economic sustainability and social well-being	<ul style="list-style-type: none"> – plans provide a defined share to water and defined certainty of access – separation of land and water enhances trading and value of licences – establishment of perpetual and compensable water access licences provide security for business investment – water markets encourage movement of water licences to high-value uses – rules developed which consider community dependence on water extraction

This plan is consistent with and contributes to the Northern Rivers Catchment Action Plan (January 2007, Northern Rivers Catchment Management Authority). The Catchment Action Plan (CAP) has a

catchment resource condition target for the region's rivers and aquifers which is that 'By 2016, river and aquifer condition is improved'.

Similar to the state-wide targets on improvement in riverine ecosystems and ability of aquifers to support groundwater dependent ecosystems, the plan will contribute to achieving the water catchment target of the CAP by:

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

Policies specific to water sharing plans

Aboriginal community development access licences

Many of the state's rivers already have a high number of irrigation licences and are generally judged to be 'stressed', particularly during dry times when, for example, river flows are low. This effectively prevents the issuing of 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 licences¹ may be issued 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 higher flows are not just peak or flood flows but also include flows that are above the median (50th percentile) daily flow.

Since granting these Aboriginal community development licences would mean less water remains in the river to meet environmental needs, it will be necessary to limit the total volume that can be extracted for Aboriginal commercial purposes. The limit would be a proportion of the river flow, and would not exceed 500 ML/yr per water source. The government 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

Many of the coastal unregulated rivers within NSW have extreme competition for water during dry periods. Instream values can also be stressed during these low flow periods, wildlife becomes concentrated and water quality can deteriorate. 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 water extraction from the low flow regime into the relatively higher flow regime, over time, streams may be de-stressed and river conditions may improve. An incentive is however required as low flow extraction is cheap, convenient and more reliable – water users simply pump

¹ The *WMA 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.

the water when it's available subject to access conditions which are met more often. To utilise higher flows, it would generally be necessary to construct 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 water sharing plan is to allow those licensees that convert to higher flows to be granted additional volumes of water. In the plan it is proposed that for every 1 unit of a normal unregulated river access licence entitlement surrendered, 2.5 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 on 70 per cent of days.

Given that the purpose of the higher 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 for availability in specified water sources only if the following criteria are met:

- 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 no highly sensitive estuary (for example an intermittently closed and open lake or lagoon – or ICOLL) or other identified high flow sensitive feature such as a wetland within the EMU
- 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.

Through this process, conversions are capped at the extraction management unit by either an increase of 20 per cent of the existing annual entitlement, or by the converted licences being able to extract 10 per cent of the daily 30th percentile high flow converted to an annual limit, whichever is the lesser.

Further assessment would be required before permitting additional conversions (up to a maximum of the converted licences being able to extract 30 per cent of the 30th percentile high flow converted to an annual limit), to ensure the process remains within a sustainable framework.

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

- trades within water source trades will generally be permissible
- cease and commence-to-pump levels at the new location will generally be the 30th percentile flow

Classification method

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 on extraction.

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 (in the peak demand month) relative to low flows (i.e. flow that is exceeded 80 per cent of the time)
- 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 instream values and basic landholder rights
- NSW Government policy.

A large range of reference material was used in addition to the specialist knowledge of interagency regional panel members and technical support staff within agencies. The reference material is listed in Appendix 2.

The classification process 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 panels. The 'value' matrix was used to develop trading rules and the 'risk' matrix was used to develop the water access rules. Where necessary, the panels 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 3.

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 the local knowledge of panel members to check whether the final classifications were realistic. Amendments to both the classifications and the management rules by the interagency regional panel were based on local and technical knowledge of the water sources. Further, the approach did not include some information which was added later by the interagency regional panel, such as extraction for town water supplies and the economic values of water extraction, that were not considered in the initial classification process.

For full details about the classification method, see the document *'Macro water sharing plans – the approach for unregulated rivers. A report to assist community consultation'* which is available at www.water.nsw.gov.au

Aboriginal values

Aboriginal cultural values could be affected by water extraction from rivers. Most of the information about flow-related Aboriginal values resides with indigenous communities.

The initial consultation sessions have provided some insights into Aboriginal cultural values associated with unregulated rivers. Aboriginal communities have indicated that water sharing rules should protect natural instream 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.

For more information see the website at www.water.nsw.gov.au.

Exceptions to the generic classification approach

As outlined above, a major role of the interagency regional panel was to use the local knowledge of panel members to check whether the final classifications were realistic. Table 4 lists the changes to classifications made by the panel.

Table 4: Refined classifications based on interagency regional panel knowledge (refer to Appendix 3)

Water source	Change to classification	Justification
Dunbible	Relative Economic Significance of Irrigation from High to medium	<ul style="list-style-type: none"> agricultural dependence data estimated
Smiths Creek	Relative Economic Significance of Irrigation from High to medium	<ul style="list-style-type: none"> agricultural dependence data estimated

Other considerations

Estuaries

Estuarine values can be threatened by water extraction both upstream of, and within, the estuary. Some estuaries are highly sensitive to freshwater inflows, whilst others are quite resilient to changed inflows. The size and shape of estuaries vary and this, combined with the amount of freshwater inflows, determines the estuaries' overall sensitivity to freshwater extraction. Where possible, extractions will be limited in estuaries found to be highly sensitive to freshwater inflows.

An analysis was undertaken by an expert panel to determine how sensitive each of the state's estuaries is to changes to freshwater inflows. Table 5 summarises the inflow sensitivities for the estuaries within the water sharing plan area.

Table 5: Inflow sensitivities for the estuaries within the Tweed River Area Water Sharing Plan

Name	Inflow sensitivity – low flows	Inflow sensitivity – high flows
Cobaki Broadwater	Low	Low
Cudgen Lake	High	High
Mooball Creek	Medium	Medium
Terranora Broadwater	Low	Low
Tweed Estuary	Low	Low

Water interception activities

Changed land-use activities can intercept significant quantities of water. Examples of activities that can impact on water quantity include an increased farm dam capacity or the development of significant areas of new forestry plantations in a catchment. Under the National Water Initiative, significant interception activities should be accounted for in the diversion limit.

Farm dams currently require an access licence only when:

- they are located on a 3rd-order (or greater) river, irrespective of the dam capacity or purpose
- they exceed the maximum harvestable right dam capacity (MHRDC) for the property, which enables the capture of 10 per cent of the mean annual runoff from the property
- they are on a permanent (spring fed) 1st or 2nd order stream

The provisions relating to harvestable rights are unaffected by any of the rules identified in the macro water sharing plan. The volume of existing licensed farm dams was considered in determining the hydrologic stress rating and resultant access rules.

While there are significant areas of native vegetation, especially on the ranges bounding the Tweed catchment, these are protected as national parks and nature reserves. Some areas, especially a significant part of Byrrill Creek Water Source, have been identified as suitable for future hardwood plantation. However, it is likely that any such plantations will be developed over a lengthy time span and therefore it is unlikely that they will have a significant impact on river flow at the water source or catchment level.

Plantation developments are controlled in NSW under the Plantations and Reafforestation Act 1999 and will be monitored in the Tweed's catchments and subsequently assessed to determine if water access licences are required for any new plantations under any future planning framework.

The Tweed River catchment is therefore considered an area in which there will be no significant growth in water interception activities anticipated within the life of the water sharing plan.

Surface water – groundwater interactions

Groundwater and surface waters are inextricably linked, however the actual connections between surface and groundwater can vary significantly between systems. For example, surface waters recharging alluvial aquifers may emerge again at a discharge point in the river within hours. In contrast water recharging aquifers of the Great Artesian Basin, may not discharge for tens of thousands of years. The connection characteristics need to be considered in linking surface water and groundwater planning, because in some cases, the same resource is being accessed.

For the purposes of water sharing planning, aquifer types have been grouped into 4 basic categories:

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

The level of connectivity, the relative level of impact and the timing of connection have been considered in developing both the unregulated river and the associated groundwater sharing plans

for the Tweed River area. One of the key factors in determining the sustainable yield for various aquifers is the downstream values in any highly connected streams.

The aquifer types and groundwater sources that occur within the boundaries of the water sharing plan area 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).

Table 6: Connectivity between aquifer types and surface water

Aquifer type	Water sources	Level of connection between surface and groundwater	Level of impact on instream values	Estimated travel time between groundwater and unregulated river
Coastal sands	Tweed coastal sands	Significant (tidal section only)	Low due to connection with saline water	Days to months
Up-river alluvial	All unregulated rivers	Significant	High due to impact on base flows	Day to months
Coastal floodplain alluvial	Tweed coastal floodplain	Low-moderate (tidal section only)	Low since not major contributor and low level of connection	Season
Fractured rock	New England fold belt	Low-moderate	Low since not major contributor	Years to decades

Alluvial aquifers

Alluvial aquifers can have a significant connection to their parent streams, depending on the type of alluvial material. For example, where alluvial aquifers are found in upriver situations and are made from coarse material such as sands and gravels, groundwater and surface waters interact significantly. However, in the lower catchment areas closer to the coast, where alluvial materials tend to be finer, there is generally only moderate connection between groundwater and the river.

The tidal limit is a useful boundary which has been used to define the boundary between the upriver and coastal alluvial systems in the plan area. For the Tweed River, the tidal limit occurs at Bray Park Weir approximately 5 km upstream of Murwillumbah, which also forms a boundary between the Tweed Estuary and Mid Tweed River Water Sources.

Therefore, the alluvial aquifers in the plan have been grouped into two categories:

- the shallow 'upriver' alluvial aquifers – these are characterised by coarse materials and relatively short travel times between ground and surface waters. These aquifers are considered to be 'highly connected' to their parent streams. The water sharing rules for the upriver alluvial aquifers are covered in the plan.
- the coastal floodplain alluvial aquifers – these tend to have relatively fine materials, often interspersed with silt and clay layers, with only a small amount of inter-change between the surface and groundwater systems. Since these aquifers are only moderately connected to their parent streams it is not necessary to fully integrate the surface water and groundwater sharing rules for these systems. The objective of these rules will be to protect the aquifer against saltwater intrusion and minimise any risk of groundwater extraction on estuary values.

The proposed water sharing rules for the highly connected upriver alluvial systems will be based on the following principles:

- Manage to a single 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 exemptions such as Aboriginal commercial 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 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 40 metres 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.
- Prohibit new bores within 40 metres of 1st and 2nd order streams unless
 - they are drilled into the underlying non alluvial parent material, and the slotted intervals of the production bore commence deeper than 30 metres, and
 - the applicant can demonstrate that the bore will have minimal impact on base flows in the stream.
- Apply the standard local impact rules for alluvial groundwater and the standard provisions for newly identified groundwater dependent ecosystems.

Groundwater dependent ecosystems

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

The water sharing plan includes water sharing rules for the highly connected alluvial groundwater. An initial assessment has been undertaken to determine whether there are any significant GDEs reliant on the alluvial groundwater. Possible GDEs in alluvial groundwater include:

- cave systems
- wetlands
- endangered ecological communities.

Caves

Caves ecosystems are below the ground surface and at groundwater discharge areas and as such tend to be totally dependent on groundwater. Groundwater dependent cave ecosystems are typically associated with limestone and support an abundant variety of fauna such as crustacea and macro-invertebrates. Entire families of creatures are known to exist in these systems, some of which have been extinct from the surface for millennia. These caves are rich in biodiversity and it is important to ensure that groundwater extraction doesn't impact on that biodiversity.

The initial assessment found no caves in the plan area that are considered to be highly dependent on groundwater.

Wetlands

Groundwater dependent wetland ecosystems are typically areas where the water table is at the surface, or periodically at the surface. While the degree of groundwater dependency is variable, groundwater plays a critical role in wetlands found on alluvial floodplains. Many wetlands are extremely species rich with a mixture of plants and animals and are often considered to have high conservation value.

The initial assessment found no groundwater dependent wetlands on the alluvial floodplains in the plan area.

Endangered ecological communities

An endangered ecological community (EEC) is an assembly of species (plant or animal communities) occupying a particular area that is in danger of becoming extinct. These EECs are listed in schedules to the *Threatened Species Conservation Act (1995)*. In the case of plant communities, where these forests/woodlands occur on alluvial floodplains, it is possible that the vegetation relies to some extent on groundwater to sustain transpiration and growth. Groundwater extraction can effectively lower the water table, thereby having a negative impact on the vegetation community.

The initial assessment found no groundwater dependent EECs for the plan area.

Water sharing rules for groundwater dependent ecosystems

GDE identification and assessment is an ongoing process. In the event that new significant GDEs are found in the Tweed River water sharing plan area, consideration will be given to adding these during the life of the plan. In this event, new or replacement bores will not be permitted within a buffer zone around the GDE. Existing bores are not affecting by the buffer zones and are able to continue operating (i.e. within the existing conditions of their access licences).

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
- dealing rules – which control:
 - the trade of water – both transfer of access licence and 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 water sharing plan include:

- extraction limits – which set the total volume of water that can be extracted annually 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
- system operation rules – what types of rules are required for major storages.

For details about the proposed water sharing rules for each water source covered by the plan, refer to the water source report cards, available at www.water.nsw.gov.au.

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 (DPI) or aquatic ecology (DWE) were included
- extraction patterns by local water and major utilities were examined

- consideration was given to see if the estuary at the end of the system necessitated additional catchment-wide protection

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

The 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 many of the water sources in the plan area) they assessed the risks to the water source, and either:

- recommended that new gauges 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 controls where the risk to instream values was low
- proposed that water sources be managed based on flows observed at gauges nearby, but outside of, the water source on the basis of their flow correlation due to catchment proximity and homogeneous characteristics.

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

The panel recommended a staged approach to change, to limit adverse social and economic impacts. In essence, this proposes that water users be given time to adapt to new rules. Where the existing rules are different from the 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 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, the rules were reviewed to ensure that they integrate well and are practical to implement across the plan area.

In some water sources, local water users have daily and hourly pumping restrictions or other arrangements to share water between themselves during dry times. These rules are about rostering water access when flows are approaching a ‘cease-to-pump’ level to minimise the risk of hitting 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.

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 any high flow licences.

For the Tweed River Area water sharing plan, applications for Aboriginal community development licences will be considered by the NSW Office of Water in the following water sources:

- Hopping Dicks Creek
- Lower Oxley River
- Mid Rous River
- Upper Rous River
- Upper Tweed River.

High flow conversions

An assessment was also undertaken to evaluate whether there was the potential to convert a normal unregulated river licence to a specific purpose high flow licence in order to de-stress low flows and provide greater entitlement to the water user as an incentive to convert to a lower reliability entitlement. This would only be allowed where a net environmental benefit would be realised. Conversion would be at a favourable exchange rate, based on a maximum of 2.5 units of high flow entitlement granted for every 1 unit of an existing unregulated licence surrendered.

Subject to meeting a number of conditions, the water sources in the Tweed River Area water sharing plan where applications for high flow conversions will be considered by the NSW Office of Water are

- Crystal Creek
- Mid Rous River
- Pumpenbil Creek
- Upper Tweed River.

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 self imposed management rules)
- whether the highly variable nature of the water source required differing management rules.

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, and 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 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 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 four of the five estuarine water sources no rule other than "cease-to-pump" when there is no visible flow at the pump site' could be recommended due to tidal influence. For the other, Cobaki Broadwater, access is proposed to be managed based on flows at the Cobaki Creek gauge.

Table 7 outlines the changes made to the initial access and trading rules identified through the classification process by the interagency regional panel.

Table 7: Water sharing rules based on interagency regional panel Knowledge

Water source	Change to water sharing rules	Justification
Christies Creek	The indicative trading rule of trades permitted up to a limit was not recommended. No trades permitted into the water source was proposed.	The trading rules proposed by the IRP are more restrictive than those identified through the classification process as the high sensitivity of the estuary to inflows (low flows) was taken into account.
Clothiers Creek	The indicative trading rule of trades permitted up to a limit was not recommended. No trades permitted into the water source was proposed.	The trading rules proposed by the IRP are more restrictive than those identified through the classification process as the high sensitivity of the estuary to inflows (low flows) was taken into account.
Doon Doon Creek	The access rule identified through the classification process of a CTP set at the 95 th percentile was not recommended. A CTP set at no visible flow was proposed.	The IRP, when proposing the access rule, did not want to penalise irrigators for the hydrologic stress caused by the storage of water in Clarrie Hall Dam.

Consultation

The water source classifications and the interagency regional panel's recommended rules underwent targeted consultation with water users and specific interest groups² before the water sharing plan was drafted. Formal public exhibition³ of the draft plan ensured wider public consultation.

While developing the macro plans, the participating agencies identified areas where additional data was needed for making future water planning decisions. Similarly, the community gave feedback on specific issues that potentially impacted their water use and management. This local input is essential in the finalisation of the plan.

The Northern Rivers CMA managed the consultation process to ensure that all stakeholders and interested parties had an opportunity to examine and comment on the proposed water sharing rules. In particular, feedback was sought on:

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

Targeted consultation on the rules

Targeted consultation on the proposed rules for the plan began in late 2005 (refer to Table 8). The objectives of this consultation were:

- to provide background as to why the macro plans were being developed, how they were developed, what rules were proposed in the various areas, and how stakeholders could provide feedback
- to 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.

² 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.

³ Public exhibition is the formal exhibition of the plan where the Minister invites submissions on the plan and in particular will seek comment on a range of key issues.

Table 8: Key groups consulted

Date	Group	Location
November 2005	Representatives from key interest group including water uses, industry, environmental and Aboriginal organisations,	Murwillumbah
February 2006	Tweed Shire Council – regarding town water supply	Murwillumbah
March 2006	Licence holders and general public	Murwillumbah
April 2006	Aboriginal Community Support Officers (CMA) and representatives from Aboriginal communities	Lismore
August 2008	Tweed Shire Council – town water supply licence conditions	Murwillumbah
January 2009	Tweed Shire Council, DPI Fisheries and DWE – regarding environmental flow requirements at Bray Park Weir and Clarrie Hall Dam	Murwillumbah

The Northern Rivers CMA encouraged stakeholders to submit their comments in writing. Fourteen submissions were received as a result of the targeted consultation in the Tweed area.

Refining water sharing rules as a result of targeted consultation or new information

The interagency regional panel reviewed both the submissions and the associated matters that were raised at the meetings and, as a result, made some changes to the initial rules. During this review process, if updated flow data and water use data became available, it was incorporated into the assessment process. Table 9 outlines the changes to the proposed rules as a result of this consultative process or the inclusion of new data.

Table 9: Changes to water sharing rules as a result of targeted consultation

Water source	Change to water sharing rules	Justification
Burringbar River (Burringbar River and Crabbes Creek Management Zones)	Trading rule has been changed from 'no net gain' to 'not permitted'.	Due to the presence of the stuttering barred frog and the lack of hydrological connection (freshwater) between water sources within the EMU, the IRP has proposed no trading into the water source.
Christies Creek	Trading rule has been changed from 'no net gain' to 'not permitted'.	The IRP has proposed a more stringent trading rule due to the high sensitivity of the estuary to inflows (low flows) and the lack of hydrological connection (freshwater) between water sources within the EMU.
Clothiers Creek	Trading rule has been changed from 'not permitted into' to 'permitted only from Cudgen Lake water source'.	The IRP has proposed that trades between Cudgen Lake and Clothiers Creek water sources be permitted to allow irrigators more flexibility. The proposed trading rules should not have any negative impact on the highly sensitive estuary and the amount of extraction is capped at the current level of entitlement.
Cudgen Lake	Trading rule has been changed from 'not permitted into' to 'permitted only from Cudgen Lake water source'.	The IRP has proposed that trades between Cudgen Lake and Clothiers Creek water sources be permitted to allow irrigators more flexibility. The proposed trading rules should not have any negative impact on the highly sensitive estuary and the amount of extraction is capped at the current level of entitlement.
Cudgera Creek	Trading rule has been changed from 'no net gain' to 'not permitted'.	A more stringent rule is proposed by the IRP due to the lack of hydrological connection (freshwater) between water sources within the EMU.

Water source	Change to water sharing rules	Justification
Doon Doon Creek	<p>Access rule has been changed from a CTP set at the '95th percentile' to a CTP set at 'no visible flow'.</p> <p>Trading rule has been changed from 'trade in encouraged, up to a limit' to 'not permitted'.</p>	<p>When setting the access rule the IRP decided to propose a less stringent rule so as not to penalise irrigators for the hydrologic stress caused by the storage of water in Clarrie Hall Dam.</p> <p>Given the hydrological impact of Clarrie Hall Dam, a more stringent trading rule than that identified through the classification process is proposed.</p>
Dunbible Creek	Trading rule has been changed from 'trade in encouraged' to 'no net gain'.	The IRP has proposed that trades in will only be permitted if there is no net increase in entitlement, as the amount of existing entitlement has reached the allowable limit.
Hopping Dicks Creek	<p>Relative economic significance of Irrigation has been changed from Medium to High.</p> <p>Access rule has been changed from a CTP set at no visible flow to a CTP set at the 98th percentile (years 1-5) and 95th percentile (years 6-10).</p>	<p>In line with comments raised in a submission, the IRP agreed that the economic dependence rating should be changed to high instead of medium. While this did not change the indicative access rule of no visible flow, the regional panel decided that this could not be adopted due to uncertainty regarding the water source's hydrological data.</p> <p>The IRP has proposed a default access rule which is consistent and equitable with the proposed access rule for the downstream water source (Lower Oxley River), until a better understanding of the water source's hydrology is available.</p>
Nobbys Creek	Trading rule has been changed from 'trade in encouraged' to 'no net gain'.	The IRP has proposed that trades in will only be permitted if there is no net increase in entitlement as the amount of existing entitlement has reached the allowable limit.
Mooball Creek	Trading rule has been changed from 'no net gain' to 'not permitted'.	The IRP has proposed a more stringent trading rule due to the high sensitivity of the estuary to inflows (low flows) and the lack of hydrological connection (freshwater) between water sources within the EMU.
Sheens Creek	Trading rule has been changed from 'no net gain' to 'not permitted'.	The IRP has proposed a more stringent trading rule due to the high sensitivity of the estuary to inflows (low flows) and the lack of hydrological connection (freshwater) between water sources within the EMU.
Tweed Estuary	<p>Trading rule for the Rous Tidal Pool Management Zone has been changed to allow trading from the tidal pool in combination with amendments to the water source boundary.</p> <p>Trading will be permitted into the Tweed Estuary Management Zone.</p>	<p>In response to a submission, the water source boundary was adjusted to include all the tidal pool users in the one management zone. This should provide more trading opportunities for irrigators in the tidal pool.</p> <p>The IRP has proposed a trading rule of 'no net gain' for the Rous Tidal Pool Management Zone after it was determined that the amount of existing entitlement has reached the allowable limit. This is consistent with the rule for the upstream water source.</p> <p>The IRP agreed not to cap the volume of entitlement that could be traded into the Tweed Estuary Management Zone as it will be self limiting due to the restricted opportunities for further water development (i.e. future extraction can only be from the small non-tidal tributaries or, as is largely the existing situation, from dams).</p>

Public exhibition of the rules

Public exhibition of the proposed rules for the Tweed River Area Water Sharing Plan was held between 31 August and 9 December 2009. 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
- to formally consult with a broad range of stakeholders to explain the proposed water sharing rules
- to seek feedback from stakeholders and the general community about the proposed water sharing rules.

Four submissions were received as a result of the public exhibition of the plan. These were reviewed by the interagency regional panel which recommended changes be made to the environmental flow from Clarrie Hall Dam and the exemption of town water supply works from the prohibition clause affecting Byrrill Creek and Mid Tweed water sources. In response to the suggested 12 hour window for pumping restrictions, the panel recommended that a 10 hour window from 7pm to 5 am was sufficient.

Adaptive management

Adaptive management is an important part of a water sharing plan. Adaptive management refers to the process of ongoing data collection, monitoring, evaluation and review during the life of the water sharing plan that enables either plan amendment or remaking of a plan after 10 years. Adaptive management is a requirement of both the *WMA 2000* and the National Water Initiative.

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

Monitoring

The water sharing plan includes a number of performance indicators that will be monitored over the 10 year life of the plan.

The NSW Office of Water is currently developing a monitoring evaluation reporting (MER) framework. This framework will be developed in collaboration with key stakeholders and will be consistent with the MER needs of the Natural Resource Commission and the National Water Commission. The intention is that the framework can be applied to existing water sharing plans, macro water sharing plans to enable the development of a specific MER plan.

It is not practicable to monitor all issues in all water sources. The performance indicators identify that monitoring will be undertaken for specific issues in key water sources. A risk based approach will be used to identify specific issues and high risk water sources where detailed MER needs to occur.

Implementation documents may be established that set out the means by which the objectives of this plan are to be achieved. The monitoring of the performance indicators will be detailed in the implementation program.

Plan review

The Natural Resources Commission will undertake a review of this water sharing plan prior to any decision to extend its term or to make a new plan.

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

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

Implementation

Implementation programs

An implementation program may be established that sets out the means by which the objectives of this water sharing plan are to be achieved. The process for monitoring the performance indicators will be outlined in the implementation program. An annual review of the implementation program will be conducted to determine whether the program is being effective in implementing the water sharing provisions. The results of this review will be included in the Annual Report.

Monitoring water extractions

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

To provide water extraction estimates, measurement of extractions may be via meters or other monitoring devices fitted to approved works, or via alternative monitoring systems.

In relation to monitoring devices, different types of devices will be required depending on the nature of the water supply work installation, the size of the work, and the effect that the operation of the work may have on the water source and other water users.

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

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

Compliance

The NSW Office of Water will undertake compliance activities as necessary to enforce the provisions of the water sharing plan once it is implemented. Some reliance is placed on local water users to identify inappropriate or unlawful behaviour and report this to the Office of Water. Reports may be made by calling 1800 633 362 or emailing watercompliance@water.nsw.gov.au.

Appendices

Appendix 1: North Coast interagency regional panel – membership and expertise

Name	Agency	Role	Expertise
Interagency regional panel			
Dave Miller	NSW Office of Water	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.
Support staff			
Tim Rabbidge	NSW Office of Water	Plan coordinator	Strategic land use planning, natural resource policy development, environmental assessment and planning, water sharing plan development.
Brett McCulloch	NSW Office of Water	Technical support (licensing)	Licensing officer, local knowledge of water users, WUAs, local access arrangements and reference points.
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, water sharing plan 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	NSW Office of Water	Macro plan coordinator	Water policy and planning, water sharing plan development and implementation, facilitation and project management.
Neil Dufty		Independent facilitator	Qualified educator and earth scientist, experienced facilitator in NRM planning, former chair of water management committees.

Appendix 2: Reference material used by the north coast interagency regional panel

NSW Office of Water data sets

Licensing Administrator System (LAS) – state-wide database holding the licence details including volume of entitlement, location details and stream orders.

Hydsys – Hydsys is a state-wide database that holds all flow record data. Flow records are available for most water sources in the Northern Rivers area.

Regional Groundwater Monitoring Network – the Office of 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 (PDD) 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 DPI.

Threatened species (other) – Data supplied by DECC.

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

National Parks and Wildlife (DECC) state-wide atlas – State-wide flora and fauna database.

NSW Environmental Protection Authority, 1999, *Water Quality and River Flow Interim Environmental Objectives, Tweed River Catchment*, NSW Government.

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

NSW Fisheries (DPI) 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.

Boulton, A., Smolders, K., Turner, B. and Bell, D. (2003), *Land-use, drought, and river condition in the Bellinger and Nambucca catchments, northern NSW Final Report*, Ecosystem Management and Botany, University of New England Armidale NSW.

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

National Heritage Trust (2002), *Australian Catchment, River and Estuary Assessment 2002, Volumes 1 and 2*, National Land and Water resources Audit, Canberra.

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

NSW DPI Agriculture web site <http://www.agric.nsw.gov.au/reader/budget>.

Pierson W. L., Bishop K., Van Senden D., Horton P. R., Adamantilis C. A., 2002, *Environmental Water Requirements to Maintain Estuarine Processes*, Environmental Flows Initiative Technical Report Number 3, National Heritage Trust, Canberra.

Roy P. S. *et al.* (2001), *Structure and Function of South-eastern Australian Estuaries*, Estuarine, Coastal and Shelf Science 53, pp.351-384.

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

Tweed Economic Development Corporation, *Tweed and Northern Rivers Regional Economic Model, Tweed Shire Summary 2004/5*.

Tweed Shire Council, (2004), *Tweed 4/24 Strategic Plan*.

Graham, B., (2001), Tweed Volcanic Region.

Other Key References cited (indicative only):

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

HRC, (2003), *Independent Inquiry into North Coast Rivers Final Report*, Healthy Rivers Commission, Sydney.

Appendix 3: Final classification summary

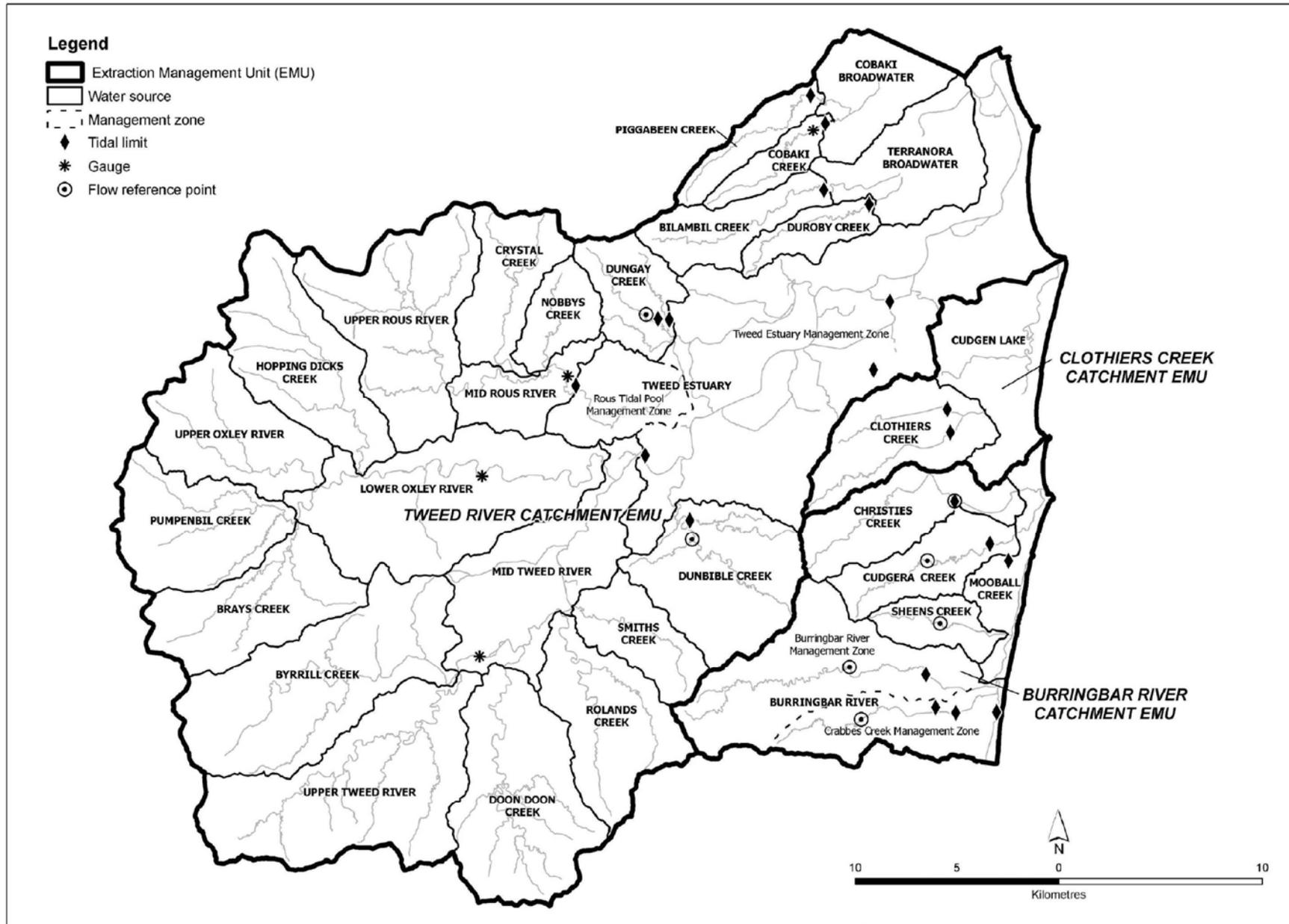
Value matrix

High instream values	a Byrrill	b Mid Tweed	c
Medium instream values	d Brays Doon Doon Dunbible Hopping Dicks Rolands Smiths Upper Oxley Upper Rous	e Bilambil Christies Lower Oxley	f Clothiers Crystal Cudgera Dungay Pumpenbil Upper Tweed
Low instream values	g	h	i Burringbar Cobaki Creek Duroby Mid Rous Nobbys Piggabeen Sheens
	Low hydrologic stress or hydrologic risk	Medium hydrologic stress or hydrologic risk	High hydrologic stress or hydrologic risk

Risk matrix

High risk to instream values	A	B	C
Medium risk to Instream Values	D	E Pumpenbil Upper Tweed	F Clothiers Crystal Dungay
Low risk to instream values	G Doon Doon Rolands	H Bilambil Brays Byrrill Cobaki Creek Cudgera Duroby Lower Oxley Mid Rous Nobbys Upper Oxley Upper Rous	I Burringbar Christies Dunbible Hopping Dicks Mid Tweed Piggabeen Sheens Smiths
	Low dependence on extraction	Medium dependence on extraction	High dependence on extraction

Appendix 4: Water sharing plan area map



Appendix 5: 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 salt water intrusion.

Classification	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
Mainly forested	BILAMBIL CREEK, BYRRILL CREEK, CRYSTAL CREEK, DUNGAY CREEK, HOPPING DICKS CREEK, LOWER OXLEY RIVER, MID TWEED RIVER, ROLANDS CREEK, SMITHS CREEK, UPPER ROUS RIVER	FULL	FULL	HIGH	FULL	N/A	FULL	HIGH	FULL	FULL	N/A	N/A	PARTIAL
Uncontrolled streams	BRAYS CREEK, BURRINGBAR RIVER, CHRISTIES CREEK, CLOTHIERS CREEK, COBAKI CREEK, CUDGERA CREEK, DUNBIBLE CREEK, DUROBY CREEK, MID ROUS RIVER, NOBBYS CREEK, PIGGABEEN CREEK, PUMPENBIL CREEK, SHEENS CREEK	FULL	FULL	FULL	FULL	N/A	FULL	LOW	HIGH	FULL	N/A	N/A	PARTIAL
Affected by urban development	COBAKI BROADWATER TERRANORA BROADWATER, TWEED ESTUARY, UPPER OXLEY RIVER, UPPER TWEED RIVER	LOW	LOW	LOW	HIGH	LOW	FULL	FULL	FULL	FULL	N/A	N/A	HIGH
Town water supply	DOON DOON CREEK	FULL	FULL	LOW	N/A	N/A	PARTIAL	PARTIAL	N/A	N/A	PARTIAL	FULL	LOW
Estuaries	CUDGEN LAKE, MOOBALL CREEK	PARTIAL	N/A	N/A	FULL	LOW	FULL	HIGH	FULL	FULL	N/A	N/A	FULL

Appendix 6: 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 or expected to occur in each water source.

	Bilambil Creek	Brays Creek	Burringbar River	Byrrill Creek	Christies Creek	Clothiers Creek	Cobaki Broadwater	Cobaki Creek	Crystal Creek	Cudgen Lake	Cudgera Creek	Doon Doon Creek	Dunbible Creek	Dungay Creek	Duroby Creek	Hopping Dicks Creek	Lower Oxley River	Mid Rous River	Mid Tweed River	Mooball Creek	Nobbys Creek	Piggabeen Creek	Pumpenbil Creek	Rolands Creek	Sheens Creek	Smiths Creek	Terranora Broadwater	Tweed Estuary	Upper Oxley River	Upper Rous River	Upper Tweed River
Fish Species																															
Oxylean pygmy perch			✓		✓	✓	✓			✓	✓			✓	✓					✓					✓		✓	✓			
Frog Species																															
Booroolong frog**														✓																	
Fleay's barred frog**		✓	✓	✓	✓				✓			✓	✓			✓	✓		✓				✓	✓		✓		✓	✓	✓	
Giant barred frog**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Glandular frog**				✓										✓																	
Green and golden bell frog**						✓	✓			✓																					
Green-thighed frog**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Loveridge's frog**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Mountain frog**																							✓								
Olongburra frog**			✓		✓	✓	✓			✓	✓									✓							✓	✓			
Peppered frog**																															
Pouched frog**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Stuttering frog**		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Wallum froglet**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Birds
Australasian bittern				✓																											
Beach stone-curlew							✓												✓	✓							✓	✓			
Black bittern**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Black-necked stork**	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Blue-billed duck																			✓												
Collared kingfisher							✓			✓										✓							✓	✓			
Comb-crested jacana	✓											✓	✓						✓				✓				✓	✓			✓
Great knot										✓																	✓	✓			
Greater sand plover							✓																			✓	✓				
Lesser sand plover																				✓						✓	✓				
Magpie goose							✓			✓																✓	✓		✓		
Mangrove honeyeater**	✓		✓		✓	✓	✓			✓	✓									✓						✓	✓				
Osprey**	✓		✓		✓	✓	✓	✓		✓	✓		✓	✓	✓					✓		✓			✓		✓	✓			
Painted snipe			✓																												
Sanderling																				✓										✓	
Other Fauna																															
Large-footed myotis				✓	✓					✓				✓			✓							✓	✓			✓			

Disclaimer

The 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.